SLOVENSKI STANDARD
SIST-TS CEN/TS 15718:2011

01-november-2011

Železniške naprave - Kolesne dvojice in podstavni vozički - Zahtevane lastnosti za lita kolesa

Railway applications - Wheelsets and bogies - Product requirements for cast wheels

Bahnanwendungen - Radsätze und Drehgestelle - Produktanforderungen für Gussräder

Applications ferroviaires - Essieux montés et bogies - Exigences pour roues en acier moulé

Ta slovenski standard je istoveten z: CEN/TS 15718:2011

ICS:

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

SIST-TS CEN/TS 15718:2011 **en,fr,de**

TECHNICAL SPECIFICATION

SPÉCIFICATION TECHNIQUE

TECHNISCHE SPEZIFIKATION

CEN/TS 15718

September 2011

ICS 45.040

English Version

Railway applications - Wheelsets and bogies - Product requirements for cast wheels

Applications ferroviaires - Essieux montés et bogies - Exigences pour roues en acier moulé

Bahnanwendungen - Radsätze und Drehgestelle - Produktanforderungen für Gussräder

This Technical Specification (CEN/TS) was approved by CEN on 3 January 2011 for provisional application.

The period of validity of this CEN/TS is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the CEN/TS can be converted into a European Standard.

CEN members are required to announce the existence of this CEN/TS in the same way as for an EN and to make the CEN/TS available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the CEN/TS) until the final decision about the possible conversion of the CEN/TS into an EN is reached.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, 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.

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

Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. CEN/TS 15718:2011: E

Contents

Page

Foreword

This document (CEN/TS 15718:2011) has been prepared by Technical Committee CEN/TC 256 “Railway applications”, the secretariat of which is held by DIN.

Your attention is drawn to the fact that certain elements in this document may be subject to intellectual property or similar rights. CEN and/or CENELEC cannot be held responsible for not identifying such property rights and providing a warning of their existence.

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 2008/57/CE.

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

Introduction

Prior to the publication of this Technical Specification, the only European Standard available to define quality requirements for monobloc wheels was EN 13262, which applies only to forged and rolled wheels. Forging and rolling was the only authorized process to be used by the UIC regulation that was applicable in the recent past for European countries.

Cast wheels are commonly used by AAR networks and have been introduced into Europe on some applications for freight wagons. As a reference document, this standard defines the product requirements of a monobloc cast wheel. In order for a cast wheel to maintain the same level of safety as for a forged and rolled wheel, for the product characteristics, the main content of this document is derived from EN 13262.

This standard addresses a complete definition of the product and delivery procedures for cast wheels by:

a) defining all the wheel characteristics;

NOTE 1 These are either verified during the qualification or for the delivery of the product (see Clause 3).

b) defining qualification procedures (see Annex D);

c) defining delivery conditions (see Annex E).

NOTE 2 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 E.4) or;

2) delivery procedure using quality assurance concepts (see E.4.6).

.

1 Scope

This technical standard specifies the characteristics of cast railway wheels for use on European networks.

Two steel grades, C ER7 and C ER8, are defined in this Technical Specification. For tread-braked wheels; only C ER7 is used.

This Technical Specification is applicable to cast wheels which have a chilled rim. The standard is only applicable to cast wheels that have satisfied the technical approval procedure according to CEN/TS 13979-2.

This Technical Specification applies only to wheels used in freight wagon applications for speeds up to and including 120 km/h.

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

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

EN ISO 148-1, *Metallic materials - Charpy pendulum impact test - Part 1: Test method (ISO 148-1:2009)*

EN ISO 6506-1, *Metallic materials — Brinell hardness test — Part 1: Test method (ISO 6506-1:2005)*

EN ISO 6892-1, *Metallic materials — Tensile testing. Part 1: Method of test at room temperature (ISO 6298-1:2009).*

ISO 1101, *Geometrical Product Specifications (GPS) – Geometrical tolerancing -- Tolerances of form, orientation, location and run-out.*

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

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

ISO/TR 9769[1)], *Steel and iron — Review of available methods of analysis*

ISO 14284, *Steel and iron — Sampling and preparation of samples for the determination of chemical composition*

ASTM E 399-90:1990, *Test method for plane-strain fracture toughness of metallic materials*

ASTM E1245, *Standard Practice for Determining the Inclusion or Second-Phase Constituent Content of Metals by Automatic Image Analysis*

SAE J827, *High-carbon cast-steel shot*

SAE J442, *Test strip, holder and gage for shot peening*

SAE J443, *Procedures for using standard shot peening test strip*

1) See also CEN report CR 10261:1995.

SAE J444, *Cast shot and grit size specifications for peening and cleaning*

3 Product definition

When the characteristics of the wheel vary as a result of the casting process, the test pieces shall be taken from the worst-case location. The worst-case location has to be defined during the product qualification process by means of comparative tests in different parts of the wheel (feeder head area, outside feeder head area, intermediate). These defined locations are valid for a given manufacturing process and used for the ongoing production. In the case of a process change, these locations will have to be defined again.

3.1 Chemical composition

3.1.1 Values to be achieved

The maximum percentage contents of the various elements contained within cast wheels shall be as given in Table 1.

Table 1 — Maximum content of various elements within cast wheels

Steel grade	Maximum content %										
	C	Si[c]	Mn	P[a]	S[a, b]	Cr	Cu	Mo[c]	Ni	V	Cr + Mo + Ni
CER7	0,52	0,6	0,80	0,020	0,02	0,30	0,30	0,12	0,30	0,06	0,52
CER8	0,56	0,6	0,80	0,020	0,02	0,30	0,30	0,12	0,30	0,06	0,52
NOTE For special applications, variations within the maximum limit of these values may be agreed.											
[a] A maximum content of 0,025 % may be agreed at the time of enquiry or order.											
[b] A minimum sulfur content may be agreed at the time of enquiry and at the time of order in order to safeguard against hydrogen cracking.											
[c] These values exceed those in EN 13262. It shall be ensured that use of these values does not adversely affect the metallurgical structure of the wheel.											

3.1.2 Location of the sample

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

3.1.3 Chemical analysis

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

3.2 Mechanical characteristics

3.2.1 Tensile test characteristics

3.2.1.1 Values to be achieved

Cast wheels shall have rim and web characteristics of at least the values given in Table 2.

Table 2 — Minimum tensile test values of the rim and web

Steel grade	Rim			Web	
	$R_{eH} \geq$ [a] N/mm^2	R_m N/mm^2	$A_5 \geq$ %	R_m reduction $\geq$ [b] N/mm^2	$A_5 \geq$ %
CER7	≥ 520	820/940	≥ 14	≥ 110	≥ 16
CER8	≥ 540	860/980	≥ 13	= 120	≥ 16

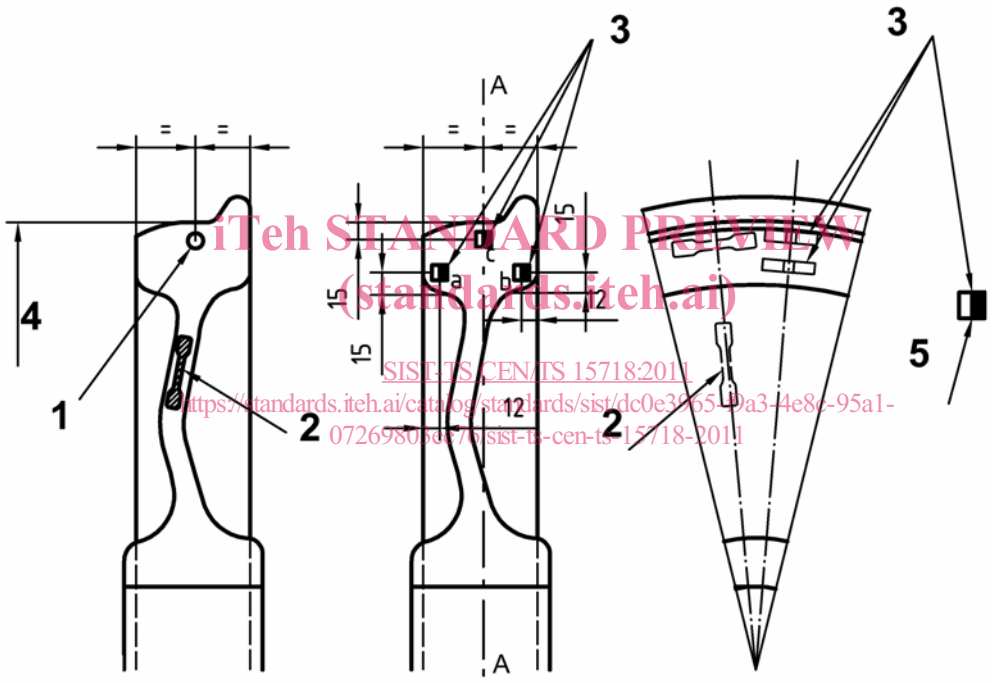
[a] If no distinctive yield strength is present, the proof stress $R_{p0,2}$ shall be determined.

[b] Reduction of tensile strength as compared to that of the rim on the same wheel.

3.2.1.2 Location of test pieces

Test pieces shall be taken from the rim and the web of the wheel, as indicated in Figure 1.

Dimensions in millimetres



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

This shall be performed in accordance with EN ISO 6892-1. The test piece diameter shall be at least 10 mm in the parallel length and the gauge length shall be 5 times the diameter.

NOTE If the wheel design prevents a sample of the stated size from being taken, a smaller sized sample may be taken after agreement between the customer and supplier.

3.2.2 Hardness characteristics in the rim

3.2.2.1 Values to be achieved

Minimum values of Brinell hardness applicable to the whole wear zone of the rim shall be as given in Table 3. These values shall be achieved up to a maximum depth of 35 mm under the tread, even if the wear depth is higher than 35 mm. These measurements shall be taken from the points defined by B, C and D in Figure 2.

Hardness values in the rim-web transition (point A in Figure 2) shall be at least 10 points lower than the wear limit values.

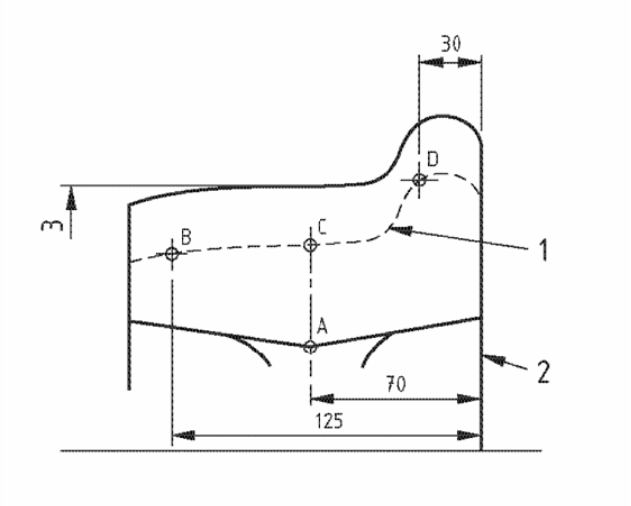
Table 3 — Minimum hardness values

Steel grade	Minimum value for Brinell hardness
CER7	235
CER8	245

3.2.2.2 Location of readings

Four readings shall be carried out on a radial section of the rim as shown in Figure 2. Where the microstructure of the wheel varies as a result of the casting process, the test locations shall occur in the worst-case areas of the wheel.

Dimensions in millimetres



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

This 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

Cast wheels shall have the average and minimum impact values as given in Table 4.

NOTE The values represent the average and minimum values for the three test specimens 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 — Average and minimum impact test characteristics

Steel grade	KU (J) at +20 °C		KV (J) at -20 °C	
	Average values	Minimum values	Average values	Minimum values
CER7	≥ 17	≥ 12	≥ 10	≥ 7
CER8	≥ 17	≥ 12	≥ 10	≥ 5

3.2.3.2 Location of the test pieces

Test pieces shall be taken from the rim of the wheel, as 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

This shall be performed in accordance with EN 10045-1.

3.2.4 Fatigue characteristics

3.2.4.1 Values to be achieved

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

Table 5 — Minimum fatigue characteristics

State of delivery of the web	$\Delta\sigma$ N/mm^2
Fully machined	450
Partially machined or as cast and shot peened	315

NOTE 1 The aim of these characteristics is to ensure that product characteristics are higher than those used for the definition of permissible stresses for the fatigue design of the web.

NOTE 2 As there are many approximations in a fatigue calculation, it is not realistic to distinguish between the two steel grades.

3.2.4.2 Specimens for fatigue test

Specimens shall consist of wheels as delivered. Their surface appearances shall be those defined in 3.7.

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.

Tests shall be monitored by measuring the radial stresses which exist in the crack initiation area.

NOTE An example of the method is given in Annex B.

3.2.5 Fracture toughness characteristics of the rim

3.2.5.1 General

This characteristic shall only be verified on tread-braked wheels (service brake or parking brake).

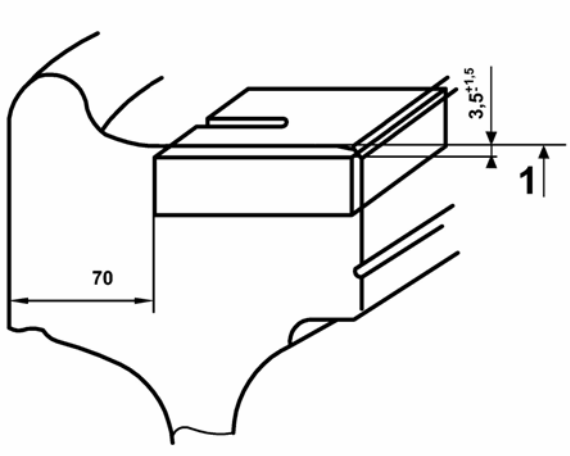
3.2.5.2 Values to be achieved

For steel grade CER7, the average value obtained from six test pieces shall be greater than or equal to 80 N/mm^2 $\sqrt{m}$ and any single value shall not be below a minimum of 70 N/mm^2 $\sqrt{m}$.

3.2.5.3 Location of test pieces

Six test pieces shall be taken from the rim as indicated in Figure 3. Where the microstructure of the wheel varies as a result of the casting process, the test locations shall be in the worst-case areas of the wheel.

Dimensions in millimetres



Key

1 nominal diameter

Figure 3 — Test pieces taken from the rim