



**SLOVENSKI STANDARD**  
**oSIST prEN 13979-1:2017**  
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**Železniške naprave - Kolesne dvojice in osnovni vozički - Monoblok kolesa -  
Postopek načrtovanja ocenjevanja - 1. del: Kovana in valjana kolesa**

Railway applications - Wheelsets and bogies - Monobloc wheels - Design assessment procedure - Part 1: Forged and rolled wheels

Bahnanwendungen - Radsätze und Drehgestelle - Vollräder - Technische Zulassungsverfahren - Teil 1: Geschmiedete und gewalzte Räder

Applications ferroviaires - Essieux montés et bogies - Roues monobloc - Procédure d'évaluation de la conception - Partie 1 : Roues forgées et laminées

**Ta slovenski standard je istoveten z: prEN 13979-1**

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## Railway applications - Wheelsets and bogies - Monobloc wheels - Design assessment procedure - Part 1: Forged and rolled wheels

Applications ferroviaires - Essieux montés et bogies - Roues monobloc - Procédure d'évaluation de la conception - Partie 1 : Roues forgées et laminées

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This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 256.

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

**CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels**

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## European foreword

This document (prEN 13979-1:2017) has been prepared by Technical Committee CEN/TC 256 “Railway applications”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 13979-1:2003+A2:2011.

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 Directive 2008/57/EC.

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

EN 13979 currently includes the following parts:

- *Railway applications – Wheelsets and bogies – Monobloc wheels – Design assessment procedure – Part 1: Forged and rolled wheels;*
- *Railway applications – Wheelsets and bogies – Monobloc wheels – Design assessment procedure – Part 2: Rolled steel wheels [CEN/TS].*

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## prEN 13979-1:2017 (E)

### Introduction

Before the entry into service of a wheel, two aspects are assessed:

- assessment of the design as described in this standard;
- assessment of the quality of the product (EN 13262).

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## 1 Scope

The aim of this European Standard is to define a method for the design assessment of a forged and rolled monobloc wheel of freight or passenger RST. This assessment is made before entry into service. This standard describes, in particular, the assessment to be performed in order to use wheels on a European network which, moreover, have quality requirements in conformity with those defined in EN 13262.

This assessment requires that the conditions of use of the wheel are defined and this standard provides a method for the definition of those conditions.

The design assessment has four different aspects:

- a geometrical aspect: to allow interchangeability of different solutions for the same application;
- a thermomechanical aspect: to manage wheel deformations and to ensure that braking will not cause wheels to break;
- a mechanical aspect: to ensure that no fatigue cracks occur in the web and that no permanent deformation occurs under exceptional loading;
- an acoustic aspect: to ensure that the solution chosen is as good as the reference wheel, for the use in question.

This standard does not cover assessment of the hub and the rim.

For wheels of powered axles or wheels with noise dampers, the requirements may be amended or supplemented.

For light vehicles and tramways, other standards or documents may be used.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 13103, *Railway applications – Wheelsets and bogies – Non-powered axles – Design guide*

EN 13104, *Railway applications – Wheelsets and bogies – Powered axles – Design guide*

EN 13262:2004+A2:2011, *Railway applications - Wheelsets and bogies - Wheels - Product requirements*

## 3 Terms and definitions

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

### 3.1

#### **technical specification**

document describing specific parameters and/or product requirements as an addition to the requirements of this standard

### 3.2

#### **diameter after last reprofiling**

nominal value defined by a  $5 \times 5$  mm nominal chamfer and the slope of the new tread profile; adapted values can be defined in the maintenance plan

**prEN 13979-1:2017 (E)****3.3****worn diameter**

theoretical minimum diameter in service: cylindrical profile from the outer side of the rim to D0 and then original new profile to the inner side of the rim

**4 Parameters for the definition of the application covered****4.1 General**

The application for which the wheel is to be assessed shall be defined by the parameters outlined below.

If the application parameters are changed for an assessed wheel, the assessment shall be reviewed.

**4.2 Parameters for geometrical interchangeability****4.2.1 General**

The application shall be defined by geometrical interchangeability parameters divided into three categories according to whether they are linked to functional, assembly or maintenance requirements.

NOTE For rolling stock wheels which have to conform to the Directive, some of the geometrical parameters are given in the rolling stock TSIs.

**4.2.2 Functional requirements**

- the nominal tread diameter that influences the buffer height and the loading gauge;
- the maximum rim width linked to the points and crossing and the track brakes;
- the tread profile outside the conical part of the tread;
- the position of the internal surface of the rim relative to the corresponding surface of the hub;
- the conicity of the hub bore;
- the space required for disc brakes mounted on the wheel;
- the space required on the bogie frame, braking equipment and suspension equipment.

**4.2.3 Assembly requirements**

- the bore diameter;
- the hub length to ensure overhanging of the hub on the wheelseat.

**4.2.4 Maintenance requirements**

- the wear limit diameter or the last reprofiling diameter;
- the wear groove shape;
- the geometry of the area for wheel clamping on reprofiling machines;
- the position and shape of the hole and groove for displacement under oil pressure;

- the general rim shape to allow ultrasonic measurement of residual stresses in wheels braked by shoes.

### 4.3 Parameters for thermomechanical assessment of tread-braked wheels

#### 4.3.1 Drag braking

##### 4.3.1.1 General

The application shall be defined by the maximum braking energy generated by the friction of the brake shoes on the tread, and the type of brake shoes applied to the wheel (nature, dimensions and number).

##### 4.3.1.2 Freight rolling stock

When monobloc wheels are fitted to wagons that are 100 % tread braked, the parameters in Table A.1 of Annex A shall apply.

NOTE This table is the same as the table in the freight wagons TSI.

When a wagon is not 100 % tread braked, the power shall be adapted as defined in the technical specification.

For specific wagons or traffic, the power and/or application time and/or running speed values can be modified to check the thermomechanical behaviour of these wheels in the context of the requirements of the technical specification.

##### 4.3.1.3 Other types of rolling stock (powered and passenger)

Thermomechanical behaviour shall be verified for the worst braking case. This shall be done using drag braking in compliance with the parameters in Table A.2 of Annex A and/or the worst consecutive stop braking for this application.

NOTE The values of the LOC and PAS TSI Clause 4.2.4.5.4 are valid for the assessment of the braking system, not for the wheel.

The slope and/or application time and/or running speed and/or the number of consecutive stop braking and/or energy values shall be defined in the technical specification.

#### 4.3.2 Dragging brake incident

##### 4.3.2.1 General

Thermomechanical behaviour is defined by the maximum braking energy generated by friction between the brake blocks and the wheel tread that the wheel to be assessed is required to dissipate under a dragging brake incident.

##### 4.3.2.2 Freight rolling stock

If the drag braking test parameters are performed in accordance with Table A.1 of Annex A, then no additional tests are necessary. If lower values than those defined in Table A.1 are used, a wheel fracture bench test (Clause 7.3) shall be performed.

##### 4.3.2.3 Other types of rolling stock (powered and passenger)

For other types of rolling stock, a wheel fracture bench test (Clause 7.3) shall be performed.

### 4.4 Parameters for mechanical assessment

The application shall be defined by:

- a) the maximum vertical static force per wheelset;

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- b) the type of service to be provided by the vehicles that will be fitted with the wheels to be assessed:
  - 1) description of the lines: geometric quality of the tracks, curve parameters, maximum speeds, etc.;
  - 2) running times on these lines;
- c) the calculated service life of the wheel, in kilometres.

**4.5 Parameters for acoustic assessment**

The application shall be defined by all the parameters influencing the noise emitted by the wheel and not directly involved in the design of the wheel to be assessed, such as:

- the reference track on which the wheel is to run;
- the reference wheel to which the design will be compared;
- the reference rolling stock and one or more reference speeds;
- a surface roughness spectrum, representative of the operational tread condition (cast-iron tread braked or not) of the wheel under test, to be used on both the reference wheel and the new wheel.

**5 Description of the wheel to be assessed**

The documentation of the wheel to be assessed shall contain:

- a) the description of the fabrication process (forging, rolling, heat treatment, etc.);
- b) the definition of the wheel geometry (drawing);
- c) the following manufacturing parameters, if they differ from those defined in EN 13262:
  - 1) geometrical tolerances;
  - 2) surface finishes;
  - 3) steel grade;
- d) the parameters for defining the application for which the approval is requested.

At the end of this technical approval procedure and before being put into service, a wheel should be subjected to the product qualification procedure defined in EN 13262.

**6 Assessment of the geometrical interchangeability**

The wheel design shall conform to the requirements of subclause 4.2.

**7 Assessment of the thermomechanical behaviour****7.1 General procedure**

This assessment may comprise three stages. The transition from one stage to the next depends on the results obtained.

The flowchart for this assessment is shown in normative Annex B.

For each of the three stages, the test shall be carried out on a new rim (nominal diameter) and at a diameter after last reprofiling (see Annex C).

## 7.2 First stage – Braking bench test

### 7.2.1 Test procedure

The test method and the measurements to be taken are given in normative Annex B.

For freight wagons the requirements in chapter 4.3.1.2 shall apply. For other vehicles the power to be applied during this test shall be equal to  $1,2 P_a$  ( $P_a$  is defined in 4.3). The duration of each drag braking period and the train speed are those defined in 4.3 ( $t_a$  and  $V_a$ ).

### 7.2.2 Decision criteria

Three criteria shall be met simultaneously for the wheel with the new rim and the wheel at a diameter after last reprofiling.

a) Wheel with new rim:

- 1) maximum lateral displacement of the rim during braking: + 3 / - 1 mm;
- 2) level of residual stress in the rim after cooling:
  - i)  $\sigma_{rn} \leq + \Sigma_r \text{ N/mm}^2$  as the average of three measurements;
  - ii)  $\sigma_{in} \leq + (\Sigma_r + 50) \text{ N/mm}^2$  for each measurement;
- 3) maximum lateral displacement of the rim after cooling: + 1,5 / - 0,5 mm.

b) Wheel at a diameter after last reprofiling:

- 1) maximum lateral displacement of the rim during braking: + 3 / - 1 mm;
- 2) level of residual stress in the rim after cooling:
  - i)  $\sigma_{rw} \leq + (\Sigma_r + 75) \text{ N/mm}^2$  as the average of three measurements;
  - ii)  $\sigma_{iw} \leq + (\Sigma_r + 100) \text{ N/mm}^2$  for each measurement;
- 3) maximum lateral displacement of the rim after cooling: + 1,5 / - 0,5 mm.

The value of  $\Sigma_r$  shall be defined according to the criteria of the wheel rim steel grade. For grades ER6 and ER7 of EN 13262,  $\Sigma_r = 200 \text{ N/mm}^2$ .

The lateral displacement is positive if the distance between the two inner faces of the wheel of the wheelset increases.

For wheels on rolling stock that do not have to satisfy the requirements of the interoperability directive, if the track tolerances differ from the general tolerances used in Europe, other values of lateral displacement may be defined in the technical specification.

**prEN 13979-1:2017 (E)****7.3 Second stage – Wheel fracture bench test****7.3.1 General**

This second stage shall be proceeded with if the residual stress levels measured during the first stage exceed the decision criteria, or in application of Clauses 4.3.2.2 and 4.3.2.3.

**7.3.2 Test procedure**

The test procedure is given in normative Annex B.

**7.3.3 Decision criterion**

The tested wheels shall not fracture.

**7.4 Third stage – Field braking test****7.4.1 General**

This third stage shall be proceeded with if one of the results of the first stage does not meet the decision criteria and the wheel is not rejected after the second stage.

**7.4.2 Test procedure**

The test method and the measurements to be taken are given in normative Annex B.

The power to be taken into account for this test is  $1,2 P_a$  ( $P_a$  is defined in 4.3). The duration of each drag braking and the running speed of the train are those defined in 4.3 ( $t_a$  and  $V_a$ ).

**7.4.3 Decision criteria**

Three criteria shall be met simultaneously for the wheel with the new rim and the wheel at a diameter after last reprofiling.

## a) Wheel with new rim:

- 1) maximum lateral displacement of the rim during braking: + 3 / - 1 mm;
- 2) level of residual stress in the rim after the tests and after cooling:
  - i)  $\sigma_{rn} \leq + (\Sigma_r - 50) \text{ N/mm}^2$  as the average of the three measurements;
  - ii)  $\sigma_{in} \leq + \Sigma_r \text{ N/mm}^2$  for each of the measurements;
- 3) maximum lateral displacement of the rim after cooling: + 1,5 / - 0,5 mm.

## b) Wheel at a diameter after last reprofiling:

- 1) maximum lateral displacement of the rim during braking: + 3 / - 1 mm;
- 2) level of residual stress in the rim after the tests and after cooling:
  - i)  $\sigma_{rW} \leq + \Sigma_r \text{ N/mm}^2$  as the average of the three measurements;
  - ii)  $\sigma_{iw} \leq + (\Sigma_r + 50) \text{ N/mm}^2$  for each of the measurements;
- 3) maximum lateral displacement of the rim after cooling: + 1,5 / - 0,5 mm.