
**Železniške naprave - Kolesne dvojice in osnovni vozički - Monoblok kolesa -
Postopek za tehnično odobritev - 1. del: Kovana in valjana kolesa**

Railway applications - Wheelsets and bogies - Monobloc Wheels - Technical approval
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

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Wheels - Technical approval procedure - Part 1: Forged
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Vollräder - Technische Zulassungsverfahren - Teil 1:
Geschmiedete und gewalzte Räder

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Contents

Page

European foreword.....	7
Introduction	8
1 Scope	9
2 Normative references	9
3 Terms and definitions	9
4 Parameters for the definition of the application covered.....	10
4.1 General.....	10
4.2 Geometric parameters for interchangeability	10
4.2.1 General.....	10
4.2.2 Functional requirements.....	10
4.2.3 Assembly requirements.....	10
4.2.4 Maintenance requirements.....	11
4.3 Parameters for thermomechanical assessment of tread-braked wheels.....	11
4.3.1 Geometrical requirements for tread-braked wheels.....	11
4.3.2 Drag braking or consecutive stop braking.....	12
4.3.3 Accidental drag braking incident.....	12
4.4 Mechanical assessment parameters.....	13
4.5 Acoustic assessment parameters	13
5 Description of the wheel, the design of which shall be assessed	14
6 Assessment of geometric interchangeability.....	14
7 Assessment of thermomechanical behaviour.....	14
7.1 General procedure.....	14
7.2 First stage – Braking bench test.....	14
7.2.1 Test procedure	14
7.2.2 Decision criteria	15
7.3 Second stage – Wheel fracture bench test.....	15
7.3.1 General.....	15
7.3.2 Test procedure	15
7.3.3 Decision criterion	15
7.4 Third stage – Field braking test	16
7.4.1 General.....	16
7.4.2 Test procedure	16
7.4.3 Decision criteria	16
8 Assessment of mechanical behaviour.....	17
8.1 General procedure.....	17
8.2 First stage – Calculation	17
8.2.1 Applied forces.....	17
8.2.2 Calculation procedure	19
8.2.3 Decision criteria	19
8.3 Second stage – Bench test.....	20
8.3.1 General.....	20

8.3.2	Definition of bench loading and the test procedure	20
8.3.3	Decision criteria.....	20
9	Assessment of acoustic behaviour.....	20
10	Technical approval.....	20
10.1	Technical approval scope and process	20
10.2	Technical approval documents	21
	Annexe A (informative) Drag braking values	22
A.1	Freight wagons	22
A.2	Other types of rolling stock and specific freight wagons	22
	Annexe B (normative) Assessment of thermomechanical behaviour	23
B.1	Assessment flow chart	23
B.2	Braking bench test procedure.....	23
B.2.1	Test principle	23
B.2.2	Definition of drag braking	23
B.2.3	Method for measuring decision criteria.....	24
B.2.3.1	Measuring displacement.....	24
B.2.3.2	Measuring residual stresses	24
B.2.4	Tests and measurements	25
B.2.4.1	Pre-test measurements	25
B.2.4.2	Braking tests.....	25
B.2.4.3	Measurements at the end of braking cycles.....	25
B.2.5	Anomalies	26
B.3	Wheel fracture bench testing procedure	26
B.3.1	Test principle	26
B.3.2	Creation of residual stresses in the rim of the wheel	26
B.3.3	Pre-cracked rim	26
B.3.4	Definition of drag braking test.....	28
B.3.5	Parameters for the wheel fracture bench test	28
B.3.6	Tests and measurements	29
B.3.6.1	General	29
B.3.6.2	Pre-cracked rim	29
B.3.6.3	Wheel fracture	30
B.3.7	Anomalies.....	30
B.4	Field braking test procedure	31
B.4.1	Test principle	31
B.4.2	Definition of braking	31
B.4.3	Method for measuring decision criteria.....	31

B.4.3.1 Measuring displacement	31
B.4.3.2 Measuring residual stresses.....	32
B.4.4 Route type for testing	32
B.4.4.1 Parameters linked to the vehicle of intended application.....	32
B.4.4.2 Other parameters.....	32
B.4.4.3 Meteorological conditions	32
B.4.4.4 Parameters associated with the track.....	32
B.4.5 Tests and measurements	32
B.4.5.1 Pre-test measurements.....	32
B.4.5.2 Braking tests.....	33
B.4.5.3 Measurements at the end of the braking cycles.....	33
B.4.6 Anomalies	33
Annexe C (normative) Wheel profile diameter definition.....	34
C.1 General.....	34
C.2 Diameter after last reprofiling.....	34
C.3 Worn diameter	35
Annexe D (normative) Assessment of mechanical behaviour.....	36
D.1 Assessment flow chart.....	36
D.2 Calculation procedure in the case of exceptional load	36
D.2.1 Principle	36
D.2.2 Load.....	36
D.3 Calculation procedure for cases of fatigue load.....	37
D.3.1 Principle	37
D.3.2 Load.....	37
D.3.3 Method of calculation	37
Annexe E (informative) Fatigue loading for narrow gauge tracks (metric or close to a metre).....	39
Annexe F (informative) Fatigue loading for tilting trains.....	40
Annexe G (normative) Mechanical behaviour – Finite element calculation assessment.....	41
Annexe H (informative) Mechanical behaviour – Bench loading and test procedure.....	42
H.1 Principle of bench loading and test procedure	42
H.2 Definition of loads.....	42
H.2.1 General.....	42
H.2.2 Measurement of stresses during field tests.....	43
H.3 Fatigue bench test.....	43
H.3.1 Method 1 – Random fatigue test	43
H.3.1.1 Load matrix	43

H.3.1.2	Monitoring the bench test	44
H.3.1.3	Random fatigue test.....	44
H.3.1.4	End of test criteria	44
H.3.2	Method 2 – Single-stage fatigue test.....	44
H.3.2.1	Matrix and load spectrum.....	44
H.3.2.2	Equivalent stress.....	44
H.3.2.3	Single-stage fatigue test.....	44
H.3.2.4	Acceptance criterion.....	45
H.3.3	Examples of benches	45
Annexe I (informative)	Assessment of acoustic behaviour	46
I.1	General procedure	46
I.2	Assessment procedure.....	46
I.3	Assessment criteria.....	47
I.4	Decision criterion	47
I.5	Assessment flow chart	48
I.6	Calculation procedure.....	48
I.6.1	Preliminary comment	48
I.6.2	Calculating the wheel modal basis	49
I.6.3	Defining the reference speeds	49
I.6.4	Defining the reference combined wheel-rail roughness.....	49
I.6.5	Defining the reference track model.....	50
I.6.6	Defining the calculation parameters.....	51
I.6.7	Calculating sound power.....	52
I.6.8	Factoring the weighted spectrum into sound power.....	52
I.6.9	Calculating the acceptance criterion	53
I.6.10	Optional calculations.....	53
I.7	Field measurement procedure	53
I.7.1	General	53
I.7.2	Environmental conditions.....	54
I.7.3	Conditions for the track.....	54
I.7.4	Conditions for the train	54
I.7.4.1	Conditions for the tread	54
I.7.4.2	Composition of train	54
I.7.5	Positioning the measurement points	55
I.7.6	Measurement quantities	56
I.7.7	Test procedure	56

prEN 13979-1:2022 (E)

I.7.7.1 Measuring roughness	56
I.7.7.2 Measurements trackside	57
I.7.8 Data processing.....	57
I.7.8.1 General.....	57
I.7.8.2 Calculating combined roughness	57
I.7.8.3 Calculating a representative quantity of sound power	57
I.7.8.4 Correcting standardized sound levels vis-à-vis a reference combined roughness.....	58
I.7.8.5 Calculating the acceptance criterion.....	58
Annexe J (informative) Ultrasonic method for determining residual stresses in the rim (non-destructive method).....	59
J.1 Procedure.....	59
J.2 Measurement uncertainty	59
J.3 Calibrations	60
J.4 Verifying measurement parameters.....	60
Annexe ZA (informative) Relationship between this European Standard and the Essential Requirements of EU Directive (EU) 2016/797 aimed to be covered.....	61
Bibliography.....	63

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oSIST prEN 13979-1:2022

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European foreword

This document (prEN 13979-1:2022) 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 13979-1:2020.

In comparison with the previous edition, the following technical modifications have been made:

- A new link to the pre-designing state of the art methods defined by UIC (thermo-mechanical calculation);
- Some recommendations for the rim geometrical design in order to ensure sufficient material to withstand thermal loading;
- A clearer definition of the wheel homologation scope and a new definition of the process to homologate a wheel design derived from a previously homologated one (Clause 3);
- Correction of the recommended reference combined roughness spectrum representative of the different types of braking system for the acoustical assessment (Table I.1).

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

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

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Introduction

An assessment of the two following aspects is carried out before a wheel is commissioned:

- assessment of the design as described in this standard;
- assessment of the quality of the product (EN 13262:2020).

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1 Scope

The aim of this document is to define a design assessment procedure of a forged and rolled monobloc wheel. This assessment is carried out before the wheel is commissioned. This document describes, in particular, the assessment to be performed in order to use wheels on a European network which, in addition, have quality requirements in conformity with those defined in EN 13262:2020.

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

The assessment of the design covers four 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 fracture;
- a mechanical aspect: to ensure that no fatigue cracks occur in the wheel 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.

This document has been drawn up for wheels of non-powered tread-braked wheelsets and applies in full to this type of wheel. For wheels with mounted brake discs or gear unit couplings or wheels with noise dampers, the requirements can be amended or supplemented.

For urban railway vehicles, other standards or documents can be used.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 13103-1:2017, *Applications ferroviaires - Essieux montés et bogies - Partie 1: Méthode de conception des essieux-axes avec fusées extérieures*

EN 13262:2020, *Applications ferroviaires - Essieux montés et bogies - Roues - Prescriptions pour le produit*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: <http://www.electropedia.org/>
- ISO Online browsing platform: <http://www.iso.org/obp>

3.1

technical specification

document describing specific parameters and/or design assessment procedure requirements as an addition to the requirements of this document

prEN 13979-1:2022 (E)

3.2

diameter after last reprofiling

nominal value defined by a 5×5 mm nominal chamfer and the slope of the new tread profile

Note 1 to entry: Modified values can be defined, for example, in the maintenance plan or in the technical specification. See Figure C.1.

3.3

worn diameter

theoretical minimum diameter in service, and 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 a wheel is to be assessed shall be defined by the parameters set out below.

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

4.2 Geometric parameters for interchangeability

4.2.1 General

The application shall be defined by geometric parameters for interchangeability, which can be split into three categories according to whether they are related to functional requirements, assembly requirements or maintenance requirements.

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

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 switches and crossings and the track brakes;
- the tread profile outside the conical part of the tread;
- the position of the inner side of the rim relative to the corresponding side 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 the hub overhangs on the wheelseat.

4.2.4 Maintenance requirements

- the wear limit diameter or the last reprofiling diameter;
- the wear groove shape, if necessary;
- 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 tread-braked wheels.

4.3 Parameters for thermomechanical assessment of tread-braked wheels

4.3.1 Geometrical requirements for tread-braked wheels

A suitable inner diameter on the inner and outer side of the rim shall be applied in order to enable good conditions for residual stress measurement. This means that, in order to enable this measurement, the residual rim thickness, on both sides, should be larger than the ultrasonic probes used for the measurements during maintenance and homologation.

100 % tread braked freight wagons wheels with a nominal diameter of 920 mm shall be designed in order that the surface of the rim section when the wheel is fully worn has a residual area A_{rim} equal or larger than 0,23 dm².

The residual area is calculated as follows:

- when the inner diameter of the rim is the same both on the inner and outer side, the area to be considered is the rectangle between the outer diameter of the wear limit groove (w in EN 13262:2020) and the inner diameter of the rim (b_1 and b_2 in EN 13262:2020),
- when the inner diameter of the rim is different on the inner and outer side, the area defined above shall be completed with the triangle resulting from this difference (see Figure 2 – in this example b_1 is smaller than b_2).

This calculation is carried out referring to the nominal values of the quoted parameters.

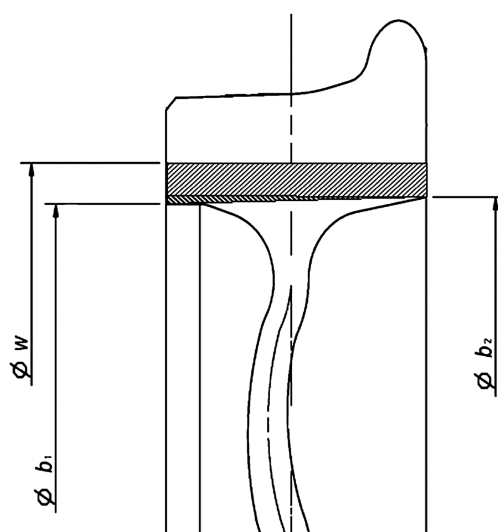


Figure 1 — Definition of the residual area (example)

prEN 13979-1:2022 (E)

4.3.2 Drag braking or consecutive stop braking**4.3.2.1 General**

The application shall be defined based on the maximum braking energy (P_a nominal braking power, t_a application time (duration of the test) and V_a average speed of the vehicle) generated by the friction of the brake shoes on the tread, as well as the type of brake shoes applied to the wheel (the type – cast iron brake shoe or composite brake shoe – dimensions and number).

The braking test with composite brake shoes covers the braking test with cast iron brake shoes. The braking test with two opposing brake shoes covers the braking test with a single brake shoe. The braking test is independent of the manufacturing origin of the brake shoes.

Non homologated composite brake shoes can be used for these tests providing that they are able to withstand the test conditions.

NOTE The non-homologated brake shoe Becorit 929-1 is widely used to perform these kind of tests

4.3.2.2 Freight wagons

When monobloc wheels fitted to a wagon are 100 % tread braked, the parameters in Table A.1 of Annex A shall apply, unless the technical specification defines them differently.

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

When a wagon is not 100 % tread braked, nominal power, P_b , 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 and in accordance with Table A.2.

4.3.2.3 Other types of rolling stock

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

This choice can be made taking into account the level of displacement and residual stresses calculated using numerical simulation for each of the braking scenarios considered.

The average slope and/or application time and/or average speed of consecutive stop braking and/or energy values shall be defined in the technical specification. Table A.2 provides examples of values.

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.

4.3.3 Accidental drag braking incident**4.3.3.1 General**

The thermomechanical behaviour shall be defined based on the maximum braking energy (P_a braking power, t_a application time (duration of the test) and V_a average speed of the vehicle) generated by the friction of the brake shoes on the tread that the wheel to be assessed shall be able to dispel when there is an accidental drag braking incident.

4.3.3.2 100 % tread-braked wheels

For freight wagons, the parameters for the accidental drag braking incident are identical to those defined for drag braking (see Table A.1).

For other types of rolling stock, the parameters for the accidental drag braking incident are identical to those of drag braking (see Table A.2) for 100 % tread braking.

4.3.3.3 Non-tread-braked wheels

For all types of rolling stock, the parameters for the drag braking incident shall be:

- a) Parameters for the accidental drag braking incident test for a 100 % tread-braked wheel (see 4.3.2.2);
- b) Or the parameters for the wheel fracture bench test (see 7.3)

4.4 Mechanical assessment parameters

The application shall be defined by:

- the maximum vertical static force per wheelset (according to EN 13103-1:2017);
- the type of route 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;
- the estimated service life of the wheel, in kilometres.

In the case of a mechanical assessment solely by means of calculation, the parameters of 8.2 shall be taken into consideration.

4.5 Acoustic assessment parameters

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:

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