Contents

Page

European foreword ... 4
1 Scope ... 5
2 Normative references ... 6
3 Terms and definitions ... 6
4 Symbols ... 9
5 Rail roughness ... 9
5.1 Measuring system requirements ... 9
5.1.1 General ... 9
5.1.2 Accuracy of the output signal ... 9
5.1.3 Dimensions of the sensor ... 9
5.1.4 Tracking of the sensor ... 10
5.1.5 Sampling interval ... 10
5.1.6 Record length ... 10
5.1.7 Calibration and traceability to a national measurement standard ... 10
5.2 Data acquisition ... 10
5.2.1 General ... 10
5.2.2 Test section requirements ... 10
5.2.3 Reference surface choice ... 11
5.2.4 Data sampling ... 12
5.2.5 Preparation of the rail head surface ... 13
5.2.6 Acoustic roughness acquisition ... 13
5.3 Data processing ... 13
5.3.1 Principle ... 13
5.3.2 Spike removal technique ... 14
5.3.3 Curvature processing ... 15
5.3.4 Spectral analysis ... 16
5.3.5 Procedure for extending the wavelength range ... 17
5.3.6 Averaging process ... 17
6 Wheel roughness ... 17
6.1 Measuring system requirements ... 17
6.1.1 General ... 17
6.1.2 Accuracy of the output signal ... 17
6.1.3 Dimensions of the sensor ... 17
6.1.4 Tracking of the sensor ... 17
6.1.5 Sampling interval ... 17
6.1.6 Calibration and traceability to a national measurement standard ... 18
6.2 Data acquisition ... 18
6.2.1 General ... 18
6.2.2 Data sampling ... 18
6.2.3 Vehicle preparation ... 19
6.2.4 Acoustic roughness acquisition ... 19
6.2.5 Data quality checks ... 19
6.2.6 Localized geometric wheel features ... 20
6.3 Data processing ... 20
6.3.1 Principle ... 20

QUESTO DOCUMENTO È UNA PREVIEW. RIPRODUZIONE VIETATA

6.3.2 Spike removal technique **20**
6.3.3 Curvature processing **21**
6.3.4 Spectral analysis **21**
6.3.5 Averaging the roughness spectra **22**

7 Acceptance criteria **22**
7.1 Rail roughness **22**
7.2 Wheel roughness **22**

8 Presentation of the rail and wheel roughness spectra **22**

9 Report **23**
9.1 Rail roughness **23**
9.2 Wheel roughness **23**

Annex A (informative) **Examples of localized geometrical features on the rail** **25**

Annex B (normative) **Algorithm used to synthesize a one-third octave band spectrum from a corresponding narrow band spectrum for rail roughness** **27**

Annex C (informative) **Determination of the combined roughness (and contact filters)** **28**

Annex D (informative) **Quantification of measurement uncertainties according to ISO/IEC Guide 98-3** **29**
D.1 General **29**
D.2 Mathematical model **30**
D.3 Determination of the standard uncertainties **30**
D.4 Determination of the combined standard uncertainty **31**
D.5 Determination of the expanded uncertainty **32**

Annex E (informative) **An example of a rail roughness report sheet** **33**

Annex ZA (informative) **Relationship between this European Standard and the Essential Requirements of EU Directive 2008/57/EC aimed to be covered** **34**

Bibliography **35**

QUESTO DOCUMENTO È UN PREVIEW. RIPRODUZIONE VIETATA

European foreword

This document (EN 15610:2019) 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 November 2019, and conflicting national standards shall be withdrawn at the latest by November 2019.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 15610:2009.

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/EC.

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

The main changes with respect to the previous edition are listed below:

— The most significant technical change is the introduction of a measurement procedure for the characterization of the wheel acoustic roughness.

— Slight improvements of the section related to the characterization of the acoustic rail roughness have also been implemented.

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, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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1 Scope

1.1 This document specifies a direct measurement method for characterizing the surface roughness of the rail and wheel associated with rolling noise ("acoustic roughness"), in the form of a one-third octave band spectrum.

This document describes a method for:

a) selecting measuring positions along a track or selecting wheels of a vehicle;

b) selecting lateral positions for measurements;

c) the data acquisition procedure;

d) measurement data processing in order to estimate a set of one-third octave band roughness spectra;

e) presentation of this estimate for comparison with limits of acoustic roughness;

f) comparison with a given upper limit in terms of a one-third octave band wavelength spectrum;

g) the measuring system requirements.

1.2 It is applicable to the:

a) compliance testing of reference track sections in relation to the acceptance test for noise emitted by railway vehicles;

b) performance testing of track sections in relation to noise emitted by railway vehicles;

c) acceptance of the running surface condition only in the case where the acoustic roughness is the acceptance criterion;

d) assessment of the wheel surface condition as an input for the acoustic acceptance of brake blocks;

e) assessment of the wheel and rail roughness as input to the calculation of combined wheel rail roughness;

f) diagnosis of wheel-rail noise issues for specific tracks or wheels;

g) assessment of the wheel and rail roughness as input to rolling noise modelling;

h) assessment of the wheel and rail roughness as input to noise source separation methods.

1.3 It is not applicable to the:

a) measurement of roughness (rail roughness, wheel roughness or combined roughness) using an indirect method;

b) analysis of the effect of wheel-rail interaction, such as a "contact filter";

c) approval of rail and wheel reprofiling, including rail grinding operations, except for those where the acoustic roughness is specifically the approval criterion (and not the grinding quality criteria as provided in e.g. EN 13231-3);

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d) characterization of track and wheel geometry except where associated with noise generation.

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 61260-1:2014, *Electroacoustics – Octave-band and fractional-octave-band filters – Part 1: Specifications (IEC 61260-1:2014)*

EN ISO 266:1997, *Acoustics – Preferred frequencies (ISO 266:1997)*

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: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
acoustic roughness
r(x)
variation in the height of the running surface associated with rolling noise excitation expressed as a function of distance x along the running surface

3.2
acoustic roughness spectrum
$\tilde{r}(\lambda)$
amplitude of the acoustic roughness expressed as a function of the wavelength λ

3.3
acoustic roughness level
L_r
level expressed in decibels, given by the following formula:

$$L_r = 10 \cdot \log_{10}\left(\frac{r_{RMS}^2}{r_0^2}\right) \quad (1)$$

where

L_r is the acoustic roughness level in dB;

r_{RMS} is the root mean square roughness in µm;

r_0 is the reference roughness; r_0 = 1 µm.

Note 1 to entry This definition applies to values measured either in the form of a one-third octave band wavelength spectrum, or for a specific wavelength band.

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