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Järnvägar – Akustik – Mätning av ojämnheter på räl och hjul för utvärdering av kontaktbuller

Railway applications – Acoustics – Rail and wheel roughness measurement related to noise generation

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Europastandarden EN 15610:2019 gäller som svensk standard. Detta dokument innehåller den officiella engelska versionen av EN 15610:2019.

Denna standard ersätter SS-EN 15610:2009, utgåva 1.

The European Standard EN 15610:2019 has the status of a Swedish Standard. This document contains the official version of EN 15610:2019.

This standard supersedes the SS-EN 15610:2009, edition 1.

Upplysningar om sakinnehållet i standarden lämnas av SIS, Swedish Standards Institute, telefon 08-555 520 00. Standarder kan beställas hos SIS som även lämnar allmänna upplysningar om svensk och utländsk standard.

Information about the content of the standard is available from the Swedish Standards Institute (SIS), telephone +46 8 555 520 00. Standards may be ordered from SIS, who can also provide general information about Swedish and foreign standards.

Denna standard är framtagen av kommittén för Järnvägar, SIS/TK 254.

Har du synpunkter på innehållet i den här standarden, vill du delta i ett kommande revideringsarbete eller vara med och ta fram andra standarder inom området? Gå in på www.sis.se - där hittar du mer information.

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 15610

May 2019

ICS 17.140.30; 93.100

Supersedes EN 15610:2009

English Version

Railway applications - Acoustics - Rail and wheel roughness measurement related to noise generation

Applications ferroviaires - Acoustique - Mesurage de la rugosité des rails et des roues relative à la génération du bruit de roulement

Bahnanwendungen - Akustik - Messung der Schienen- und Radrauheit im Hinblick auf die Entstehung von Rollgeräuschen

This European Standard was approved by CEN on 21 January 2019.

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.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of 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 United Kingdom.

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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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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.

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);

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.

3.4
combined effective roughness
roughness function that excites rolling noise

Note 1 to entry: The combined effective roughness is the RMS of the rail and wheel roughness spectra. It becomes the combined effective roughness when the effect of the contact patch filter is included.

3.5
direct roughness measurement method
acoustic roughness measurement method for which the sensor measures the running surface roughness so that either the rail or the wheel roughness is measured independently of any effect of wheel-rail interaction

3.6
indirect roughness measurement method
acoustic roughness measurement method that measures a quantity that is the result of wheel-rail interaction, such as noise, rail or axle box vibration, whereby the original excitation by the combined effective wheel and rail roughness is inferred

3.7
test section
specific section of track associated with a particular set of measurements

3.8
RMS
root mean square average which is required in the standard where averaging of spectra is required

Note 1 to entry: This is defined for each spectral band as:

$$RMS = \sqrt{\frac{a_1{}^2 + a_2{}^2 + \cdots + a_N{}^2}{N}} \tag{2}$$

where:

a is a spectral amplitude; and

N is the number of spectral band value from which the average is being calculated.

Note 2 to entry: In terms of levels, this is equivalent to:

$$L_{average} = 10 \log_{10} \left(\frac{10^{L_1/10} + 10^{L_2/10} + \cdots + 10^{L_N/10}}{N} \right) \tag{3}$$

3.9
running surface
part of the wheel tread or of the rail head, along which the wheel-rail contact passes during rolling

Note 1 to entry: In the case of the rail this is the bright band of the surface of the rail head that contains all the running positions of the wheel-rail contact, associated with current traffic.