SLOVENSKI STANDARD
oSIST prEN 16272-3-2:2022

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Železniške naprave - Infrastruktura - Protihrupne ovire in pripadajoče naprave, ki vplivajo na širjenje zvoka v zraku - Preskusna metoda za ugotavljanje akustičnih lastnosti - 3-2. del: Normalizirani spekter železniškega hrupa in enomestne številske stopnje usmerjenega zvočnega polja

Railway applications - Infrastructure - Noise barriers and related devices acting on airborne sound propagation - Test method for determining the acoustic performance - Part 3-2: Normalized railway noise spectrum and single number ratings for direct field applications

Bahnanwendungen - Oberbau - Lärmschutzwände und verwandte Vorrichtungen zur Beeinflussung der Luftschallausbreitung - Prüfverfahren zur Bestimmung der akustischen Eigenschaften - Teil 3-2: Intrinsische Merkmale - Standardisiertes Schienenverkehrslärmspektrum und Einzahl-Angaben für gerichtete Schallfelder

Applications ferroviaires - Infrastructure - Dispositifs de réduction du bruit - Méthode d'essai pour la détermination des performances acoustiques - Partie 3-2 : Spectre de bruit ferroviaire normalisé et indices uniques d'évaluation pour des applications

Ta slovenski standard je istoveten z: **prEN 16272-3-2**

ICS:

17.140.30	Emisija hrupa transportnih sredstev	Noise emitted by means of transport
93.100	Gradnja železnic	Construction of railways

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

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ICS 93.100

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English Version

Railway applications - Infrastructure - Noise barriers and related devices acting on airborne sound propagation - Test method for determining the acoustic performance - Part 3-2: Normalized railway noise spectrum and single number ratings for direct field applications

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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.

If this draft becomes a European Standard, 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.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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

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European foreword

This document (prEN 16272-3-2:2022) 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 16272-3-2:2014.

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

— The ‘Terms, definitions and symbols and abbreviated terms’ clause has been updated;

— An annex with the values of the standard deviation of reproducibility and repeatability of single-number ratings has been added; this makes possible the declaration of the measurement uncertainty and the related confidence level, which is now mandatory (Annex C);

— The Bibliography chapter has been added.

EN 16272-3-2 is part of a series and should be read in conjunction with the following:

— EN 16272-1, Railway applications – Infrastructure — Noise barriers and related devices acting on airborne sound propagation — Part 1: Intrinsic characteristics — Sound absorption under diffuse sound field conditions

— EN 16272-2, Railway applications – Infrastructure — Noise barriers and related devices acting on airborne sound propagation — Part 2: Intrinsic characteristics — Airborne sound insulation under diffuse sound field conditions

— EN 16272-3-1, Railway applications – Infrastructure — Noise barriers and related devices acting on airborne sound propagation — Part 3-1: Normalized railway noise spectrum and single number ratings for diffuse sound field applications

— EN 16272-3-2, Railway applications – Infrastructure — Noise barriers and related devices acting on airborne sound propagation — Part 3-2: Normalized railway noise spectrum and single number ratings for direct sound field applications (the present document)

— EN 16272-4, Railway applications – Track — Noise barriers and related devices acting on airborne sound propagation — Part 4: Intrinsic characteristics — *In situ* values of sound diffraction under direct sound field conditions

— EN 16272-5, Railway applications – Infrastructure — Noise barriers and related devices acting on airborne sound propagation — Part 5: Intrinsic characteristics —Sound absorption under direct sound field conditions[1]

— EN 16272-6, Railway applications – Infrastructure — Noise barriers and related devices acting on airborne sound propagation — Part 6: Intrinsic characteristics — Airborne sound insulation under direct sound field conditions

— EN 16272-7, Railway applications – Track — Noise barriers and related devices acting on airborne sound propagation — Part 7: Extrinsic characteristics — *In situ* values of insertion loss

[1] This document is in preparation

Introduction

This document is to be read in conjunction with EN 16272-1 and EN 16272-2 and is applied only to situations as described in those documents (direct sound field).

As the two main intrinsic acoustic characteristics of noise barriers and related devices acting on airborne sound propagation in a direct sound field, the sound reflection index and the sound insulation index, are frequency dependent, there is a need to define a reference railway noise spectrum for test purposes.

Also the diffraction index difference, the main intrinsic acoustic characteristic of added devices, i.e. products to be added on the top of noise barriers and intended to contribute to sound attenuation acting primarily on the diffracted sound field, is frequency dependent and there is an analogous need to define a reference railway noise spectrum for test purposes.

This document defines the basic properties of railway noise measured at the rail track side in terms of a characteristic normalized railway noise spectrum which is needed to evaluate single-number ratings of noise barriers and related devices acting on airborne sound propagation, except those used in reverberant conditions, e.g. inside tunnels or deep trenches.

1 Scope

This document specifies a normalized railway noise spectrum for the evaluation and assessment of the acoustic performance of devices designed to reduce airborne railway noise near railways.

All noise reducing devices different from noise barriers and related devices acting on airborne sound propagation, e.g. devices for attenuation of ground borne vibration and on board devices are out of the scope of this document.

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 16272-4:2016, *Railway applications - Track - Noise barriers and related devices acting on airborne sound propagation - Test method for determining the acoustic performance - Part 4: Intrinsic characteristics - In situ values of sound diffraction under direct sound field*

EN 16272-5, *Railway applications — Infrastructure — Noise barriers and related devices acting on airborne sound propagation — Test method for determining the acoustic performance — Part 5: Intrinsic characteristics — Sound absorption under direct sound field conditions*

EN 16272-6, *Railway applications - Track - Noise barriers and related devices acting on airborne sound propagation - Test method for determining the acoustic performance - Part 6: Intrinsic characteristics - In situ values of airborne sound insulation under direct sound field conditions*

3 Terms and definitions and symbols and abbreviated terms

3.1 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 https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1.1
normalized noise spectrum for railways
spectrum that is used for the calculation of the acoustic performance of noise barriers and related devices acting on airborne sound propagation near railways, in terms of single-number ratings of sound absorption and airborne sound insulation

Note 1 to entry: The spectrum is expressed in terms of relative A-weighted sound pressure levels in decibels, for one-third octave bands, L_i, in the frequency range from 100 Hz to 5 kHz

3.1.2
one-third octave bands level L_i
relative A-weighted sound pressure level in decibels, of a normalized railway noise spectrum for one-third octave band with centre frequency f_i

3.2 Symbols and abbreviated terms

For the purposes of this document, the following symbols apply.

Table 1 — Symbols and abbreviated terms

Symbol or abbreviation	Designation	Unit
DL_{RI}	Single-number rating of sound absorption performance in a direct sound field expressed as a difference of A-weighted sound pressure levels	dB
DL_{SI}	Single-number rating of airborne sound insulation performance in a direct sound field expressed as a difference of A-weighted sound pressure levels	dB
$DL_{\Delta DI,refl}$	Single-number rating of diffraction index difference of an added device mounted on a reflective reference wall in a direct sound field expressed as a difference of A-weighted sound pressure levels	dB
$DL_{\Delta DI,abs}$	Single-number rating of diffraction index difference of an added device mounted on an absorptive reference wall in a direct sound field expressed as a difference of A-weighted sound pressure levels	dB
$DL_{\Delta DI,situ}$	Single-number rating of diffraction index difference of an added device mounted on an *in situ* test construction in a direct sound field expressed as a difference of A-weighted sound pressure levels	dB
f_i	Nominal centre frequency of the i-th one-third octave band	Hz
i	Index of the i-th one-third octave frequency band, between 100 Hz and 5 kHz	-
L_i	Relative A-weighted sound pressure level, in decibels, of the normalized traffic noise spectrum in the i-th one-third octave band	dB
L_E	Length of an acoustic element	m
m	number of the lowest reliable one-third octave frequency band according to EN 16272-5 (for *RI*) or EN 16272-6 (for *SI*)	-
RI_i	Sound reflection index in the i-th one-third octave band	-
SI_i	Sound insulation index in the i-th one-third octave band	dB
w_E	Weight for the single-number rating for acoustic elements	-
w_P	Weight for the single-number rating across posts	-
ΔDI_{refl}	Sound diffraction index difference of an added device mounted on a reflective reference wall	dB
ΔDI_{abs}	Sound diffraction index difference of an added device mounted on an absorptive reference wall	dB
ΔDI_{situ}	Sound diffraction index difference of an added device mounted on an *in situ* test construction	dB

4 Normalized railway noise spectrum for direct sound field applications

The normalized railway noise spectrum shown in Table 2 shall be used to assess the acoustic performance of noise barriers and related devices acting on airborne sound propagation for direct sound field applications near railways.

Table 2 — Normalized traffic noise spectrum for diffuse sound field applications

f_i Hz	L_i railways dB
100	— 27
125	— 25
160	— 23
200	— 21
250	— 19
315	— 17
400	— 15
500	— 13
630	— 12
800	— 11
1000	— 10
1250	— 9
1600	−9
2000	−9
2500	— 9
3150	— 10
4000	— 13
5000	— 17

5 Single-number rating of sound reflection index DL_{RI}

A single-number rating shall be derived from frequency dependent data to indicate the performance of the product.

The individual sound reflection index values obtained according to EN 16272-5 shall be weighted according to the normalized railway noise spectrum defined in Table 2.

The single-number rating of sound reflection index DL_{RI}, in decibels, is given by:

$$DL_{RI} = -10log\left[\frac{\sum_{i=m}^{18} RI_i 10^{0,1L_i}}{\sum_{i=m}^{18} 10^{0,1L_i}}\right] \quad (1)$$

where:

m is the number of the lowest reliable one-third octave frequency band according to EN 16272-5;

RI_i is the sound reflection index in the i-th one-third octave band, measured according to EN 16272-5;

L_i is the normalized A-weighted sound pressure level, in decibels, of railway noise in the i-th one-third octave band as defined in Table 2.

The single-number rating DL_{RI} shall be calculated for samples of minimum dimensions of 4 × 4 m.

In some cases the ratio of the summation terms in the expression of DL_{RI} can exceed 1 which precludes the correct calculation of DL_{RI} I. For this reason the maximum value of this ratio shall be limited to 0,99.

NOTE Annex A provides guidance to the use of the single-number rating of sound reflection index.

6 Single-number rating of sound insulation index DL_{SI}

6.1 General

Whenever possible, three single-number ratings shall be derived from measurements to indicate the performance of the product: one for acoustic elements, one for posts (if applicable) and a global rating. The individual sound insulation index values coming from element scanning and post scanning shall be weighted according to the normalized traffic noise spectrum defined in Table 2.

6.2 Acoustic elements

The single-number rating of sound insulation index for acoustic elements $DL_{SI,E}$, in decibels, is given by:

$$DL_{SI,E} = -10log\left[\frac{\sum_{i=m}^{18} 10^{-0,1SI_{E,i}} 10^{0,1L_i}}{\sum_{i=m}^{18} 10^{0,1L_i}}\right] \quad (2)$$

where:

m is the number of the lowest reliable one-third octave frequency band according to EN 16272-6;

$SI_{E,i}$ is the sound insulation index across the acoustic elements, in the i-th one-third octave band, measured according to EN 16272-6;

L_i is the normalized A-weighted sound pressure level, in decibels, of railway noise in the i-th one-third octave band as defined in Table 2.

For qualification purposes, the single-number rating for acoustic elements $DL_{SI,E}$ shall be calculated for samples of minimum dimensions conforming to Clause 5.3 in EN 16272-6.

For other purposes, single-number ratings shall be informative and explicitly reported with the frequency range, in one-third octave bands, over which they are calculated. For example, for a 3,5 m noise barrier of 3,5 m height the single-number rating for acoustic elements is $DL_{SI,E\ (250\ Hz\ -\ 5\ 000\ Hz)}$, because 250 Hz is the lowest reliable frequency.

NOTE Annex B provides guidance to the use of the single-number rating of sound insulation index.