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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 - 3-1. del: Posebne karakteristike - Normalizirani spekter železniškega hrupa in enomestne številске stopnje razpršenega zvočnega polja**

Railway applications - Infrastructure - Noise barriers and related devices acting on airborne sound propagation - Test method for determining the acoustic performance - Part 3-1: Intrinsic characteristics - Normalized railway noise spectrum and single number ratings for diffuse sound field applications

Bahnanwendungen - Oberbau - Lärmschutzwände und verwandte Vorrichtungen zur Beeinflussung der Luftschallausbreitung - Prüfverfahren zur Bestimmung der akustischen Eigenschaften - Teil 3-1: Produktspezifische Merkmale - Standardisiertes Schienenverkehrslärmspektrum und Einzelangaben für Anwendungen im diffusen Schallfeld

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Applications ferroviaires - Infrastructure - Dispositifs de réduction du bruit - Méthode d'essai pour la détermination des performances acoustiques - Partie 3-1 : Spectre de bruit ferroviaire normalisé et indices uniques d'évaluation pour des applications en champ sonore diffus

**Ta slovenski standard je istoveten z: prEN 16272-3-1**

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**ICS:**

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

**oSIST prEN 16272-3-1:2022**

**en,fr,de**

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**DRAFT**  
**prEN 16272-3-1**

February 2022

ICS 93.100

Will supersede EN 16272-3-2:2014

English Version

**Railway applications - Infrastructure - Noise barriers and related devices acting on airborne sound propagation - Test method for determining the acoustic performance - Part 3-1: Intrinsic characteristics - Normalized railway noise spectrum and single number ratings for diffuse sound field applications**

Applications ferroviaires - Infrastructure - Dispositifs de réduction du bruit - Méthode d'essai pour la détermination des performances acoustiques - Partie 3-1 : Spectre de bruit ferroviaire normalisé et indices uniques d'évaluation pour des applications en champ sonore diffus

Bahnanwendungen - Oberbau - Lärmschutzwände und verwandte Vorrichtungen zur Beeinflussung der Luftschallausbreitung - Prüfverfahren zur Bestimmung der akustischen Eigenschaften - Teil 3-1: Produktspezifische Merkmale - Standardisiertes Schienenverkehrslärmspektrum und Einzahl-Angaben für Anwendungen im diffusen Schallfeld

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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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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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COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

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## European foreword

This document (prEN 16272-3-1:2022) 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 16272-3-1:2012.

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

- ISO 12999-1 and ISO 12999-2 have been added to the References;
- The 'Terms, definitions and symbols and abbreviated terms' clause has been updated;
- In EN 16272-1:2021 the method for determining sound absorption coefficients in each one-third octave band, as described in EN ISO 354, has been modified: the Sabine absorption coefficient  $\alpha_s$  has been replaced by a new absorption coefficient  $\alpha_{NRD}$  that is specific to noise barriers and related devices acting on airborne sound propagation and which takes account of the volume of the test sample (the new coefficient  $\alpha_{NRD}$  might be derived from  $\alpha_s$ );
- Consequently, in EN 16272-3-1:2021 the new absorption coefficient  $\alpha_{NRD}$  is used to calculate the single-number rating of sound absorption  $DL\alpha_{NRD}$ ;
- 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 16272-3-1 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 (the present document)
- 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
- 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

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- 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<sup>1</sup>
- 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

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<sup>1</sup> This document is in preparation

## Introduction

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

As the two main intrinsic acoustic characteristics of noise barriers and related devices acting on airborne sound propagation in a diffuse sound field, sound absorption and airborne sound insulation, are frequency dependent, there is a 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 in reverberant conditions, e.g. inside tunnels or deep trenches.

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## 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 16272-1, *Railway applications - Track - Noise barriers and related devices acting on airborne sound propagation - Test method for determining the acoustic performance - Part 1: Intrinsic characteristics - Sound absorption in the laboratory under diffuse sound field conditions*

EN 16272-2, *Railway applications - Track - Noise barriers and related devices acting on airborne sound propagation - Test method for determining the acoustic performance - Part 2: Intrinsic characteristics - Airborne sound insulation in the laboratory under diffuse sound field conditions*

ISO 12999-1, *Acoustics — Determination and application of measurement uncertainties in building acoustics — Part 1: Sound insulation*

ISO 12999-2, *Acoustics — Determination and application of measurement uncertainties in building acoustics — Part 2: Sound absorption*

## 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: 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 Abbreviations

For the purposes of this document, the following symbols apply

**Table 1 — Symbols and abbreviated terms**

Symbol or abbreviation	Designation	Unit
$\alpha_{NRD,i}$	Sound absorption coefficient in the $i$ -th one-third octave band	-
$DL_{\alpha,NRD}$	Single-number rating of sound absorption performance in a diffuse sound field expressed as a difference of A weighted sound pressure levels	dB
$DL_R$	Single-number rating of airborne sound insulation performance in a diffuse 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
$R_i$	Sound reduction index in the $i^{\text{th}}$ one-third octave band	dB

## 4 Normalized railway noise spectrum for diffuse 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 diffuse 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

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2500	—	9
3150	—	10
4000	—	13
5000	—	17

## 5 Single-number rating of sound absorption $DL_{\alpha,NRD}$

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

The individual absorption coefficient values obtained according to EN 16272-1 shall be weighted according to the normalized railway noise spectrum defined in Table 2.

The single-number rating of sound absorption  $DL_{\alpha,NRD}$ , in decibels, is given by:

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

where:

$\alpha_{NRD,i}$  is the sound absorption coefficient in the  $i^{\text{th}}$  one-third octave band;

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

In some cases the ratio of the summation terms in Formula (1) can exceed 1 which precludes the calculation of  $DL_{\alpha,NRD}$ . For this reason the maximum value of this ratio shall be limited to 0,99.

NOTE Annex A provides guidance on the use of the single-number rating of sound absorption.

## 6 Single-number rating of sound reduction index $DL_R$

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

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

The single-number rating of airborne sound reduction index  $DL_R$ , in decibels, is given by:

$$DL_R = -10 \log \left[ \frac{\sum_{i=1}^{18} 10^{-0,1R_i} 10^{0,1L_i}}{\sum_{i=1}^{18} 10^{0,1L_i}} \right] \quad (2)$$

where:

$R_i$  is the sound reduction index in the  $i^{\text{th}}$  one-third octave band;

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

NOTE Annex B provides guidance on the use of the single-number rating of airborne sound insulation.