

SVENSK STANDARD

SS-EN 16272-3-2:2014

Fastställt/Approved: 2014-07-24
Publicerad/Published: 2014-08-14
Utgåva/Edition: 1
Språk/Language: engelska/English
ICS: 17.140.30; 93.080.30; 93.100

**Järnvägar – Spår – Bullerbarriärer och anordningar som påverkar uppkomsten av luftburet ljud – Provningsmetoder för bestämning av akustiska egenskaper –
Del 3-2: Normaliserat spektrum för järnvägsbuller och en-siffrig skattning vid direkt tillämpning i fält**

**Railway applications – Track – 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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EUROPEAN STANDARD

EN 16272-3-2

NORME EUROPÉENNE

EUROPÄISCHE NORM

July 2014

ICS 17.140.30; 93.080.30

English Version

Railway applications - Track - 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

Applications ferroviaires - Voie - 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 en champ direct

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

This European Standard was approved by CEN on 30 April 2014.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

Foreword.....	3
Introduction	4
1 Scope	5
2 Normative references	5
3 Terms and definitions	5
4 Normalized railway noise spectrum.....	6
5 Single-number rating of sound reflection index DL_{RI}	7
6 Single-number ratings of sound insulation index DL_{SI}	8
6.1 General.....	8
6.2 Acoustic elements	8
6.3 Posts	8
6.4 Global.....	9
7 Single-number ratings of sound diffraction index difference $DL_{\Delta DI}$	9
7.1 General.....	9
7.2 Single-number rating of sound diffraction index difference $DL_{\Delta DI, refl}$	9
7.3 Single-number rating of sound diffraction index difference $DL_{\Delta DI, abs}$	10
7.4 Single-number rating of sound diffraction index difference $DL_{\Delta DI, situ}$	10
8 Expression of results	10
Annex A (informative) Guidance note on use of the single-number rating of sound reflection index DL_{RI}	12
Annex B (informative) Guidance note on use of the single-number rating of airborne sound insulation index DL_{SI}	13
Annex C (informative) Guidance note on use of the single-number rating of sound diffraction index difference $DL_{\Delta DI}$	14

Foreword

This document (EN 16272-3-2:2014) 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 January 2015 and conflicting national standards shall be withdrawn at the latest by January 2015.

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This European Standard is one of the series EN 16272, *Railway applications — Track — Noise barriers and related devices acting on airborne sound propagation — Test method for determining the acoustic performance*, as listed below:

- *Part 1: Intrinsic characteristics — Sound absorption in the laboratory under diffuse sound field conditions;*
- *Part 2: Intrinsic characteristics — Airborne sound insulation in the laboratory under diffuse sound field conditions;*
- *Part 3-1: Normalized railway noise spectrum and single number ratings for diffuse field applications;*
- *Part 3-2: Normalized railway noise spectrum and single number ratings for direct field applications (the present document);*
- *Part 5: Intrinsic characteristics — In situ values of sound reflection under direct sound field conditions (Technical Specification);*
- *Part 6: Intrinsic characteristics — In situ values of airborne sound insulation under direct sound field conditions.*

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Introduction

This document is to be read in conjunction with prEN 16272-4, CEN/TS 16272-5 and EN 16272-6 and will be 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 sound diffraction index difference, the main intrinsic acoustic characteristic of added devices, i.e. products which may 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 European Standard 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 European Standard 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 European Standard.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

prEN 16272-4:2014, *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 conditions*

CEN/TS 16272-5:2014, *Railway applications — Track — Noise barriers and related devices acting on airborne sound propagation — Test method for determining the acoustic performance — Part 5: Intrinsic characteristics — In situ values of sound reflection under direct sound field conditions*

EN 16272-6:2014, *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

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

3.1

noise barrier

noise reducing device, which obstructs the direct transmission of airborne sound emanating from railways

Note 1 to entry: It may either span or overhang the railway.

Note 2 to entry: Noise barriers are generally made of acoustic and structural elements (3.3 and 3.4).

3.2

cladding

noise reducing device, which is attached to a wall or other structure and reduces the amount of sound reflected

Note 1 to entry: Claddings are generally made of acoustic and structural elements (3.3 and 3.4).

3.3

acoustic element

element whose primary function is to provide the acoustic performance of the device

3.4

structural element

element whose primary function is to support or hold in place acoustic elements

SS-EN 16272-3-2:2014 (E)

Note 1 to entry: In some noise barriers the acoustic function and the structural function cannot be clearly separated and attributed to different components.

3.5

added device

added component that influences the acoustic performance of the original noise-reducing device (acting primarily on the diffracted energy)

3.6

normalized railway noise spectrum

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 reflection index, sound insulation index and sound diffraction index difference, as applicable

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.

3.7

one-third octave bands level

L_i

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

4 Normalized railway noise spectrum

The normalized railway noise spectrum shown in Table 1 shall be used to assess the acoustic performance of noise barriers and related devices acting on airborne sound propagation near railways.

Table 1 — Normalized railway noise spectrum

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
1 000	- 10
1 250	- 9
1 600	- 9
2 000	- 9
2 500	- 9
3 150	- 10
4 000	- 13
5 000	- 17

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

A single-number rating shall be derived to indicate the performance of the product related to sound reflection index. The individual sound reflection index values shall be weighted according to the normalized railway noise spectrum defined in Table 1.

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

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

where

RI_i is the sound reflection index measured in front of the acoustic elements, in the i -th one-third octave band;

m is the number of the lowest reliable one-third octave frequency band;

L_i is the relative A-weighted sound pressure levels (dB) of the normalized railway noise spectrum, as defined in Table 1, in the i -th one-third octave band.

For product qualification tests in laboratory conditions, the single number rating DL_{RI} shall be calculated for samples of minimum dimensions of 4 m x 4 m.