SIST

SLOVENSKI STANDARD
SIST EN 16272-1:2024

01-februar-2024

Železniške naprave - Infrastruktura - Protihrupne ovire in pripadajoče naprave, ki vplivajo na širjenje zvoka v zraku - Preskusna metoda za ugotavljanje akustičnih lastnosti - 1. del: Posebne karakteristike - Absorpcija zvoka pri razpršenem zvočnem polju

Railway applications - Infrastructure - Noise barriers and related devices acting on airborne sound propagation - Test method for determining the acoustic performance - Part 1: Intrinsic characteristics - Sound absorption under diffuse sound field conditions

Bahnanwendungen - Oberbau - Lärmschutzwände und verwandte Vorrichtungen zur Beeinflussung der Luftschallausbreitung - Prüfverfahren zur Bestimmung der akustischen Eigenschaften - Teil 1: Produktspezifische Merkmale - Schallabsorption (Labormethode) bei diffusen Schallfeldern

Applications ferroviaires - Infrastructure - Dispositifs de réduction du bruit - Méthode d'essai pour la détermination des performances acoustique - Partie 1: Caractéristique intrinsèques - Absorption acoustique dans des conditions de champ acoustique diffus

Ta slovenski standard je istoveten z: **EN 16272-1:2023**

ICS:

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

SIST EN 16272-1:2024 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 16272-1

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ICS 93.100

Supersedes EN 16272-1:2012

English Version

Railway applications - Infrastructure - Noise barriers and related devices acting on airborne sound propagation - Test method for determining the acoustic performance - Part 1: Intrinsic characteristics - Sound absorption under diffuse sound field conditions

Applications ferroviaires - Infrastructure - Dispositifs de réduction du bruit - Méthode d'essai pour la détermination des performances acoustique - Partie 1: Caractéristique intrinsèques - Absorption acoustique dans des conditions de champ acoustique diffus

Bahnanwendungen - Infrastruktur - Lärmschutzwände und verwandte Vorrichtungen zur Beeinflussung der Luftschallausbreitung - Prüfverfahren zur Bestimmung der akustischen Eigenschaften - Teil 1: Produktspezifische Merkmale - Schallabsorption unter den Bedingungen eines diffusen Schallfeldes

This European Standard was approved by CEN on 8 October 2023.

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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.

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

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European foreword

This document (EN 16272-1:2023) has been prepared by Technical Committee CEN/TC 256 “Railway application”, 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 May 2024 and conflicting national standards shall be withdrawn at the latest by May 2024.

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 16272-1:2012.

With respect to the superseded document, the following changes have been made:

— ISO/IEC Guide 98-3 and ISO 12999-2 has been added to the references;

— a clause for terms and definitions has been added (new Clause 3);

— the description of the test arrangement has been improved;

— 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 α_S has been replaced by a new absorption coefficient α_{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 α_{NRD} might be derived from α_S);

— the content of the test report has been better defined;

— an annex has been added explaining the physical hypotheses under the assumption of a diffuse sound field (Annex A);

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

— a detailed example is presented, including the declaration of the uncertainty (Annex C);

— The Bibliography has been updated.

EN 16272-1 is part of a series and should be read in conjunction with the other parts. All parts are listed below:

EN 16272-1, *Railway applications — Infrastructure — Noise barriers and related devices acting on airborne sound propagation — Test method for determining the acoustic performance — 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 — Test method for determining the acoustic performance — Part 2: Intrinsic characteristics - Airborne sound insulation under diffuse sound field conditions* (the present document)

EN 16272-3-1, *Railway applications — Infrastructure — Noise barriers and related devices acting on airborne sound propagation — Test method for determining the acoustic performance — 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 — Test method for determining the acoustic performance — 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 — Test method for determining the acoustic performance — 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 — Test method for determining the acoustic performance — Part 5: Intrinsic characteristics - Sound absorption under direct sound field conditions*

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

CEN/TS 16272-7, *Railway applications — Track — Noise barriers and related devices acting on airborne sound propagation — Test method for determining the acoustic performance — Part 7: Extrinsic characteristics - In situ values of insertion loss*

Any feedback and questions on this document should be directed to the users' national standards body. A complete listing of these bodies can be found on the CEN website.

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, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.

Introduction

Where a sound reflecting surface is installed along a railway, it may be effective to use sound absorbing devices on its rail side to reduce additional noise nuisance caused by reflected sound. This treatment may be needed in the presence of the following:

— noise barriers, rocks or retaining walls that can reflect sound waves toward unprotected areas;

— vertical cuttings or reflective surfaces that face each other;

— tunnels and their approaches;

— trains passing close to a barrier where reflections between the train and the barrier may reduce effectiveness.

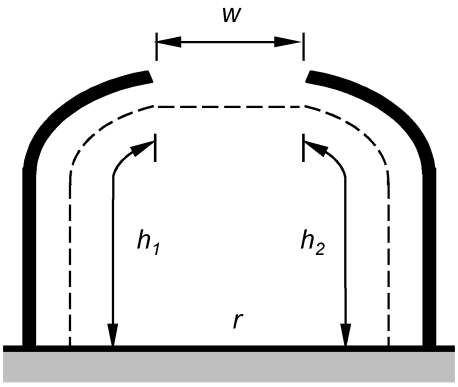
This document specifies a test method for qualifying the sound absorption performance of noise barriers and related devices acting on airborne sound propagation designed for railways (a measure of intrinsic performance). It is not concerned with determining insertion loss (extrinsic performance) which depends on additional factors which are not related to the product itself, e.g. the dimensions of the barrier and quality of installation work and site factors such as ground impedance, site geometry etc. The test is designed to allow the intrinsic sound absorption performance of the device to be measured under diffuse sound field conditions; the resulting rating should aid the selection of devices for particular rail side applications.

More information on the realization of a diffuse sound field is given in Annex A.

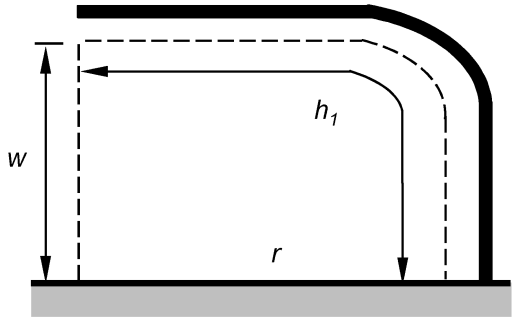
The measurement results of this method for sound absorption are not directly comparable with the results of the direct sound field method (EN 16272-5), mainly because the present method uses a diffuse sound field, while the direct sound field method assumes a directional sound field. The test method described in the present document should not be used to determine the intrinsic characteristics of sound absorption for noise barriers and related devices acting on airborne sound propagation to be installed on railways under non-reverberant conditions.

For the purpose of this document, reverberant conditions are defined based on the envelope, *e,* across the road formed by the device under test, trench sides or buildings (the envelope does not include the railway surface) as shown by the dashed lines in Figure 1. Conditions are defined as being reverberant when the percentage of open space in the envelope is less than or equal to 25 %, i.e. reverberant conditions occur when $w/e \leq 0{,}25$, where $e = (w + h_1 + h_2)$ or $e = (w + h_1)$ as per Figure 1. This criterion is applied also to the open space between the train body and the noise barrier surface.

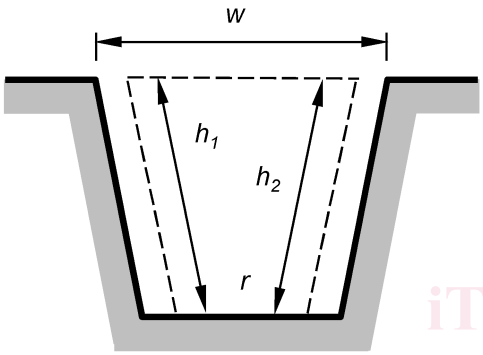
This method may be used to qualify noise barriers and related devices acting on airborne sound propagation for other applications, e.g. to be installed nearby industrial sites. In this case the single-number ratings should be calculated using an appropriate spectrum.



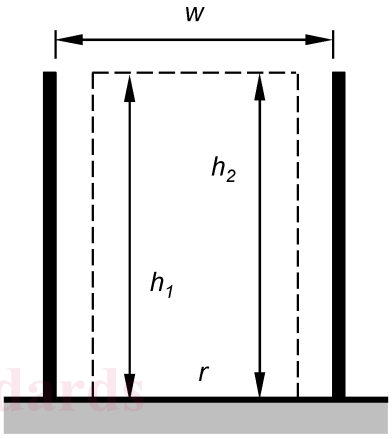
a) Partial cover on both sides of the railway; envelope, $e = w+h_1+h_2$



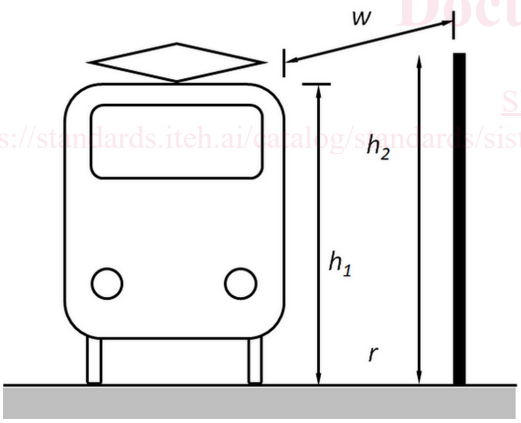
b) Partial cover on one side of the railway; envelope, $e = w+h_1$, $h_2 = 0$



c) Deep trench; envelope, $e = w+h_1+h_2$

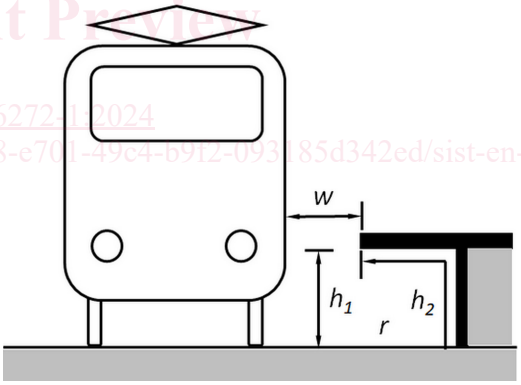


d) Tall barriers or buildings; envelope, $e = w+h_1+h_2$



e) Train passing close to a noise barrier

envelope, $e = w+h_1+h_2$



f) Train passing close to a platform at the station

envelope, $e = w+h_1+h_2$

Key

r	railway surface	h_1	Developed length of element, e.g. cover, trench side, barrier or building
w	width of open space	h_2	Developed length of element, e.g. cover, trench side, barrier or building

NOTE Figure 1 is not to scale.

Figure 1 — Sketch of the reverberant condition check in six cases

1 Scope

This document specifies the laboratory method for measuring the sound absorption performance of railway noise barriers and related devices acting on airborne sound propagation in reverberant conditions. It covers the assessment of the intrinsic sound absorption performance of devices that can reasonably be assembled inside the testing facility described in EN ISO 354.

This method is not intended for the determination of the intrinsic characteristics of sound absorption of noise barriers and related devices acting on airborne sound propagation to be installed on railways in non-reverberant conditions.

The test method in EN ISO 354 referred to in this document excludes devices that act as weakly damped resonators. However, some devices will depart significantly from these requirements and in these cases, the interpretation of the results may be not straightforward.

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 16272-3-1, *Railway applications — Infrastructure — Noise barriers and related devices acting on airborne sound propagation — Test method for determining the acoustic performance — Part 3-1: Normalized railway noise spectrum and single number ratings for diffuse sound field applications*

EN ISO 354:2003, *Acoustics — Measurement of sound absorption in a reverberation room (ISO 354:2003)*

ISO 9613-1, *Acoustics — Attenuation of sound during propagation outdoors — Part 1: Calculation of the absorption of sound by the atmosphere*

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

ISO/IEC Guide 98-3, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

3 Terms, definitions, symbols and abbreviations

3.1 Terms and definitions

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

ISO and IEC maintain terminology 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/

NOTE For the purpose of this document, the following definitions take precedence over other definitions from the above websites.

3.1.1
noise barrier
noise reducing device, which obstructs the direct transmission of airborne sound emanating from railways and which will typically span between posts and also may overhang the railway

Note 1 to entry: Noise barriers are generally made of acoustic and structural elements (see 3.1.3 and 3.1.4).

Note 2 to entry: In some noise barriers, the acoustic function and the structural function cannot be clearly separated and attributed to different components.

3.1.2
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 (see 3.1.3 and 3.1.4).

3.1.3
acoustic element
element whose primary function is to provide the acoustic performance of the device

3.1.4
structural element
element whose primary function is to support or hold in place acoustic elements

3.1.5
added device
added component that influences the acoustic performance of the original noise-reducing device (acting primarily on the diffracted energy)

3.2 Symbols and abbreviations

For the purposes of this document, the symbols and abbreviations in Table 1 apply.

Table 1 — Symbols and abbreviations

Symbol or abbreviation	Designation	Unit
α_{NRD}	Sound absorption coefficient	-
A_1	Equivalent sound absorption area of the empty reverberation room	m²
A_2	Equivalent sound absorption area of the reverberation room containing a test specimen	m²
A_T	Equivalent sound absorption area of the test specimen	m²
c_1	Propagation speed of sound in air in the reverberation room with the test specimen during the measurement	ms^{-1}
c_2	Propagation speed of sound in air in the empty reverberation	ms^{-1}
$DL_{\alpha,NRD}$	Single-number rating of sound absorption performance in a diffuse sound field expressed as a difference of A weighted sound pressure levels	dB
h_f	Height of reflective frame	m
i	Index of the i-th one-third octave frequency band (between 100 Hz and 5 kHz)	-
k_p	Coverage factor	-
L	Length of the test panels on one side of the post	m
m_1	Power attenuation coefficient calculated according to ISO 9613-1 using the climatic conditions that have been present in the empty reverberation room during the measurement. The value of m can be calculated from the attenuation coefficient, α, which is used in ISO 9613-1	m^{-1}
m_2	Power attenuation coefficient calculated according to ISO 9613-1 using the climatic conditions that have been present in the reverberation room with the test specimen during the measurement. The value of m can be calculated from the attenuation coefficient, α, which is used in ISO 9613-1	m^{-1}
m	Coefficient for calculating the standard deviation of repeatability	-
n	Term for calculating the standard deviation of repeatability	-
S	Area (of the floor of the reverberation room) covered by the test specimen	m²
s_r	Standard deviation of repeatability	-
s_R	Standard deviation of reproducibility	-
T_1	Reverberation time of the empty reverberation room	s
T_2	Reverberation time of the reverberation room after the test specimen has been introduced	s
u	Standard uncertainty	-
U	Expanded uncertainty	-
V_1	Net volume of the empty reverberation room	m³
V_2	Net volume of the reverberation room containing a test specimen	m³
V_s	Net volume of the test sample	m³