ICS 93.100 SLOVENSKÁ TECHNICKÁ NORMA Apríl 2024

STN	**Železnice Infraštruktúra Protihlukové bariéry a súvisiace zariadenia proti šíreniu zvuku Skúšobná metóda určovania akustických vlastností Časť 5: Vlastné charakteristiky Zvuková pohltivosť v podmienkach priameho zvukového poľa**	**STN EN 16272-5** 73 6381

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

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

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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 5: Intrinsic characteristics - Sound absorption under direct sound field conditions

Applications ferroviaires - Infrastructure - Dispositifs de réduction du bruit - Méthode d'essai pour la détermination de la performance acoustique - Partie 5 : Caractéristique intrinsèques - Absorption acoustique dans des conditions de champ acoustique direct

Bahnanwendungen - Oberbau - Lärmschutzwände und verwandte Vorrichtungen zur Beeinflussung der Luftschallausbreitung - Prüfverfahren zur Bestimmung der akustischen Eigenschaften - Teil 5: Produktspezifische Merkmale - In-situ-Werte zur Schallreflexion in gerichteten Schallfeldern

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

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

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European foreword

This document (EN 16272-5:2023) 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of an identical text or by endorsement, at the latest by May 2024 and conflicting national standards shall be withdrawn at the latest by May 2024.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 CEN/TS 16272-5:2014.

With respect to the superseded document, the following changes have been done:

— the references have been updated;

— the rotating loudspeaker/microphone assembly has been replaced by a loudspeaker and a 9-microphone square array (the measurement grid);

— the definition of *RI* has been changed;

— the geometrical divergence correction factor has been changed;

— a new correction factor for sound source directivity has been introduced;

— a new correction factor for gain mismatch has been introduced;

— the impulse response alignment for signal subtraction has been specified in more detail;

— the lowest reliable one-third frequency band has been better defined (Annex A);

— the single number rating DL_{RI} is now reported with one decimal digit;

— the way to evaluate the uncertainty of the measurement method from reproducibility data has been introduced (Annex B);

— a detailed example is given, including the evaluation of measurement uncertainty (Annex C);

— a new annex on indoor measurements has been added (Annex D).

EN 16272-5 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

This document describes a test method for determining the intrinsic characteristics of sound reflection of noise barriers and related devices acting on airborne sound propagation designed for railways in non-reverberant conditions (a measure of intrinsic performance). It can be applied indoors or outdoors. Indoors, it can be applied in a purposely built test facility (under direct sound field conditions). Outdoors, it can be applied in a purposely built test facilities, e.g. near a laboratory or a factory, as well as *in situ*, i.e. where the noise barriers are installed. The method can be applied without damaging the surface.

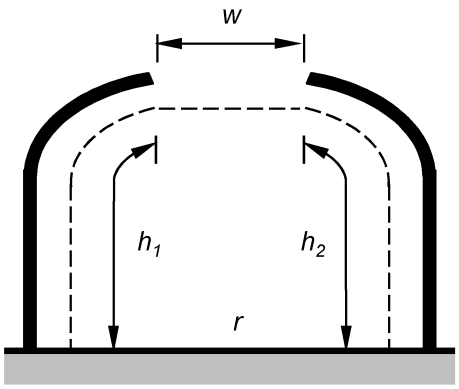
The method can be used to qualify products to be installed along railways as well as to verify the compliance of installed noise barriers and related devices acting on airborne sound propagation to design specifications. Regular application of the method can be used to verify the long-term performance of noise barriers and related devices acting on airborne sound propagation. The method requires the average of results of measurements taken in different points in front of the device under test and/or for specific angles of incidences. The method is able to investigate flat and non-flat products.

The measurement results of this method for sound absorption are not directly comparable with the results obtained under diffuse sound field conditions (e.g. EN 16272-1), mainly because the present method uses a directional sound field, not a diffuse sound field. The test method specified in the present document should not be used to determine the intrinsic characteristics of sound absorption of noise barriers and related devices acting on airborne sound propagation to be installed in reverberant conditions, e.g. claddings inside tunnels or deep trenches.

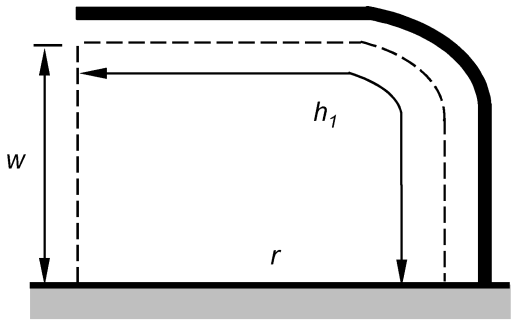
For the purpose of this document reverberant conditions are defined based on the envelope, e, across the railway formed by the device under test, trench sides or buildings (the envelope does not include the rail surface) as shown by the dashed lines in Figure 1. Conditions are defined as being reverberant 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 $e = (w+h_1+h_2)$.

This method introduces a specific quantity, called reflection index, to define the sound reflection in front of a noise barrier, and then calculate a single-number rating for sound absorption from it, while the measurements under diffuse sound field conditions (according to EN 16272-1) give a sound absorption coefficient as a function of frequency and then calculate a single-number rating for sound absorption from it. Values of the sound absorption coefficient measured under diffuse sound field conditions can be converted to conventional values of a reflection coefficient taking the complement to one. In this case, research studies suggest that some correlation exists between diffuse sound field data, measured according to EN 16272-1 and direct sound field data, measured according to the method specified in this document [6], [9], [17], [18], [19], [20].

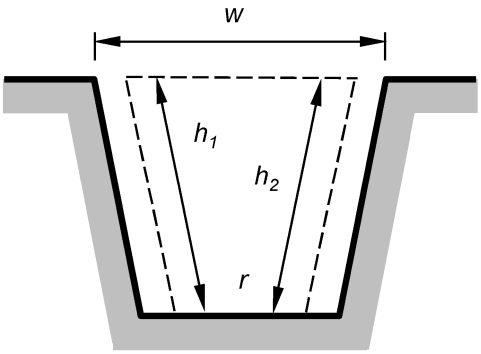
NOTE This method can be used to qualify noise barriers and related devices acting on airborne sound propagation for other applications, e.g. to be installed nearby industrial sites. In this case the single-number ratings (see EN 16272-3-2) is calculated using an appropriate spectrum.



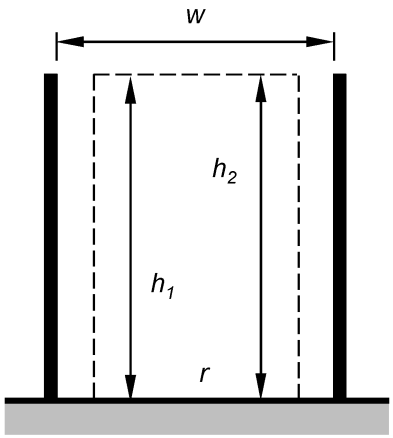
a) Partial cover on both sides of the railway; envelope, $e = w+h_1+h_2$.



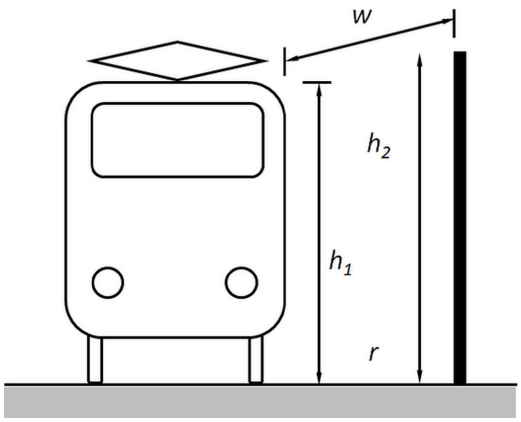
b) Partial cover on one side of the railway; $e = w+h_1$, $h_2 = 0$.



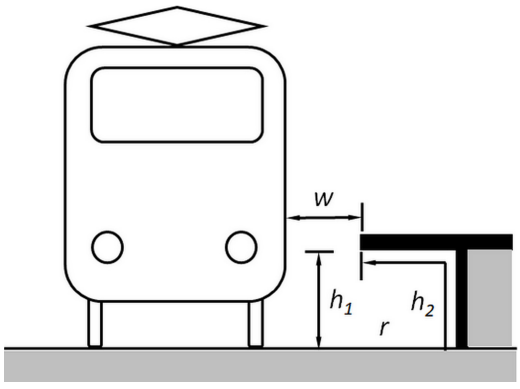
c) Deep trench envelope, $e = w+h_1+h_2$.



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	rail surface
w	width of open space
h_1	Developed length of element, e.g. cover, trench side, barrier or building
h_2	Developed length of element, e.g. cover, trench side, barrier or building
NOTE	Figure 1 is not to scale.

Figure 1 — (not to scale) Sketch of the reverberant condition check in some cases

1 Scope

This document describes a test method for measuring a quantity representative of the intrinsic characteristics of sound absorption from railway noise barriers and related devices acting on airborne sound propagation, the sound reflection index *RI*, and then calculate a single-number rating for sound absorption from it.

The test method is intended for the following applications:

— determination of the intrinsic characteristics of sound absorption of noise barriers and related devices acting on airborne sound propagation to be installed along railways, to be measured either on typical installations alongside railways or on a relevant sample section;

— determination of the intrinsic characteristics of sound absorption of noise barriers and related devices acting on airborne sound propagation in actual use under direct sound field conditions;

— comparison of design specifications with actual performance data after the completion of the construction work;

— verification of the long-term performance of noise barriers and related devices acting on airborne sound propagation (with a repeated application of the method).

The test method is not intended for the following applications:

— determination of the intrinsic characteristics of sound absorption of noise barriers and related devices acting on airborne sound propagation to be installed in reverberant conditions, e.g. inside tunnels or deep trenches.

Results for the sound reflection index are expressed as a function of frequency, in one-third octave bands, where possible, between 100 Hz and 5 kHz. If it is not possible to get valid measurements results over the whole frequency range indicated, the results are given in a restricted frequency range and the reasons of the restriction(s) are clearly reported.

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 16272-3-2, *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 field applications*

EN 16951-1, *Railway applications - Track - Noise barriers and related devices acting on airborne sound propagation - Procedures for assessing long term performance - Part 1: Acoustic characteristics*

EN 61672-1, *Electroacoustics - Sound level meters - Part 1: Specifications*

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