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SLOVENSKI STANDARD
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Železniške naprave - Zgornji ustroj - Protihrupne ovire in pripadajoče naprave, ki ovirajo razširjanje zvoka po zraku - Preskusna metoda za ugotavljanje akustičnih lastnosti - 6. del: Izdelku lastne karakteristike - Terenske vrednosti izolirnosti pred zvokom v zraku

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

Bahnanwendungen - Oberbau - Lärmschutzwände und verwandte Vorrichtungen zur Beeinflussung der Luftschallausbreitung - Prüfverfahren zur Bestimmung der akustischen Eigenschaften - Teil 6: Produktspezifische Merkmale - In-situ-Werte zur Luftschalldämmung in gerichteten Schallfeldern

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ICS:

17.140.30	Emisija hrupa transportnih sredstev	Noise emitted by means of transport
45.020	Železniška tehnika na splošno	Railway engineering in general

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EUROPEAN STANDARD

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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 6: Intrinsic characteristics - In situ values of airborne sound insulation under direct sound field conditions

Bahnanwendungen - Oberbau - Lärmschutzwände und verwandte Vorrichtungen zur Beeinflussung der Luftschallausbreitung - Prüfverfahren zur Bestimmung der akustischen Eigenschaften - Teil 6: Produktspezifische Merkmale - In-situ-Werte zur Luftschalldämmung in gerichteten Schallfeldern

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COMITÉ EUROPÉEN DE NORMALISATION
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Foreword

This document (prEN 16272-6:2012) 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 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*

— *Part 4: Intrinsic characteristics – In situ values of sound diffraction under direct sound field conditions*

— *Part 5: Intrinsic characteristics – In situ values of sound reflection under direct sound field conditions*

— *Part 6: Intrinsic characteristics – In situ values of airborne sound insulation under direct sound field conditions*

— *Part 7: Extrinsic characteristics – In situ values of insertion loss*

It should be read in conjunction with:

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*

EN 16272-3-1, *Railway applications – Track – 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 field* applications

EN 16272-3-2, *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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Introduction

Noise barriers installed along railways have to provide adequate sound insulation so that sound transmitted directly through the device is not significant compared to the sound diffracted over the top. This European Standard specifies a test method for assessing the airborne sound insulation performance 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 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 to design specifications. Regular application of the method can be used to verify the long term performance of noise barriers.

The method requires the averaging of results of measurements taken at different points behind the device under test. The method is able to investigate flat and non flat products.

The measurement results of this method for airborne sound insulation are comparable but not identical with the results of the FprEN 16272-2:2012 method, mainly because the present method uses a directional sound field, while the FprEN 16272-2:2012 method assumes a diffuse sound field (where all angles of incidence are equally probable). The test method described in this European Standard should not be used to determine the intrinsic characteristics of airborne sound insulation for noise barriers to be installed in reverberant conditions, e.g. inside tunnels or deep trenches or under covers or very close to the rail track.

For the purpose of this European standard reverberant conditions are defined based on the geometric envelope, e, across the rail formed by the barriers, 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 $e = (w + h_1 + h_2)$

This criterion is applied also to the open space between the train body and the barrier surface.

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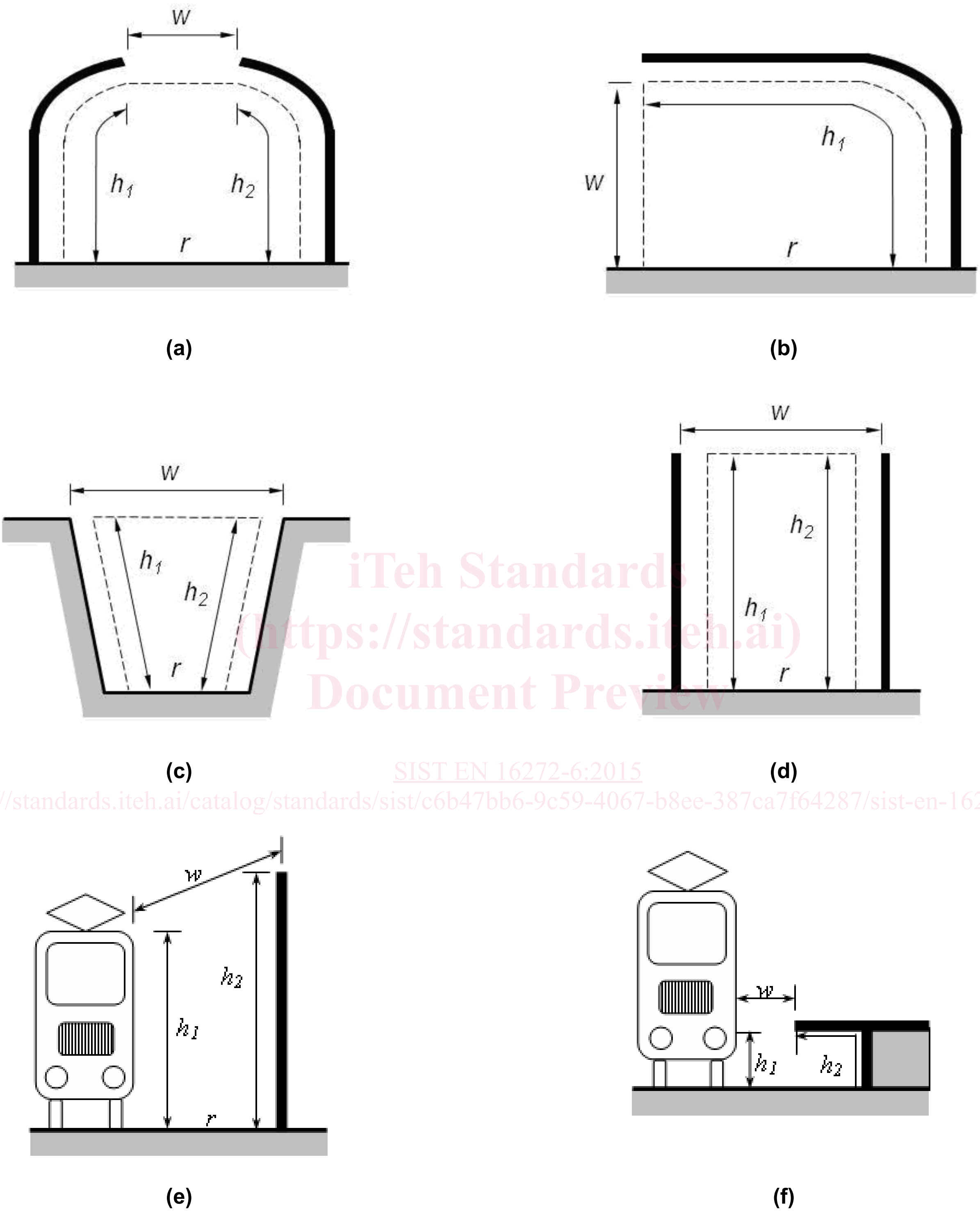

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Figure 1 — (not to scale) Sketch of the reverberant condition check in six cases. (a) Partial cover on both sides of the railway; envelope, $e = w + h_1 + h_2$. (b) Partial cover on one side of the railway; $e = w + h_1$. (c) Deep trench envelope, $e = w + h_1 + h_2$. (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, $e = w + h_1 + h_2$. In all cases r: railway surface; w: width of open space

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This European Standard introduces a specific quantity, called sound insulation index, to define the airborne sound insulation of a noise barrier. This quantity should not be confused with the sound reduction index used in building acoustics, sometimes also called transmission loss. Research studies suggest that a very good correlation exists between data measured according to FprEN 16272-2:2012 and data measured according to the method described in the present document.

This method may be used to qualify noise barriers for other applications, e.g. to be installed along roads or nearby industrial sites. In this case the single-number ratings should be calculated using an appropriate spectrum.

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1 Scope

This European Standard describes a test method for measuring a quantity representative of the intrinsic characteristics of airborne sound insulation for railway noise barriers: the sound insulation index.

The test method is intended for the following applications:

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

— determination of the in situ intrinsic characteristics of airborne sound insulation of noise barriers in actual use;

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

— verification of the long term performance of noise barriers (with a repeated application of the method);

— interactive design process of new products, including the formulation of installation manuals.

The test method is not intended for the following applications:

— determination of the intrinsic characteristics of airborne sound insulation of noise barriers to be installed in reverberant conditions, e.g. inside tunnels or deep trenches or under covers.

Results 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 measurement results over the whole frequency range indicated, the results shall be given in a restricted frequency range and the reasons for the restriction(s) shall be clearly reported.

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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

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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.

FprEN 16272-2:2012, *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*

prEN 16272-3-2:2012, *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*

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

ISO/IEC Guide 98-3, *Uncertainty of measurement – Guide to the expression of uncertainty in measurement*

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3 Terms and definitions

For the purpose of this European Standard the following terms and definitions apply.

3.1
noise barrier
noise reducing device, which obstructs the direct transmission of airborne sound emanating from railways; it may either span or overhang the railway

Note 1 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

3.5
added device
added component that influences the acoustic performance of the original noise-reducing device (acting primarily on the diffracted energy)

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

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3.6
rail side exposure
the use of the product as a noise barrier installed alongside railways

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3.7
sound insulation index
the result of airborne sound insulation test described by Formula (1)

3.8
reference height
a height h_S equal to half the height, h_B, of the noise barrier under test: $h_S = h_B/2$ (see Figures 2 and 3). When the height of the device under test is greater than 4 m and, for practical reasons, it is not advisable to have a height of the source $h_S = h_B/2$, it is possible to have $h_S = 2$ m, accepting the corresponding low frequency limitation (see 4.5.8).

3.9
source reference plane for sound insulation index measurements
a plane facing the sound source side of the noise barrier and touching the most protruding parts of the device under test within the tested area (see Figures 2, 4 and 9)

Note 1 to entry: The device under test includes both structural and acoustical elements.

3.10
microphone reference plane
a plane facing the receiver side of the noise barrier and touching the most protruding parts of the device under test within the tested area (see Figures 4 and 9)

Note 1 entry: The device under test includes both structural and acoustical elements.

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3.11
source reference position
a position facing the side to be exposed to noise when the device is in place, located at the reference height h_S and placed so that its horizontal distance to the source reference plane is d_s = 1 m (see Figures 2, 5, 8 and 9)

Note 1 to entry: The actual dimensions of the loudspeaker used for the background research on which this European Standard is based are: 0,40 m x 0,285 m x 0,285 m (length x width x height).

3.12
measurement grid for sound insulation index measurements
a vertical measurement grid constituted of nine equally spaced points. A microphone shall be placed at each point (see Figures 3, 5, 6, 8, 9 and 5.5).

3.13
barrier thickness for sound insulation index measurements
the distance t_B between the source reference plane and the microphone reference plane at a height equal to the reference height h_S (see Figures 4, 8 and 9)

3.14
free-field measurement for sound insulation index measurements
measurement taken with the loudspeaker and the microphone in an acoustic free field in order to avoid reflections from any nearby object, including the ground (see Figure 6)

3.15
Adrienne temporal window
the composite temporal window described in 4.5.6

3.16
background noise
noise coming from sources other than the source emitting the test signal

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3.17
signal-to-noise ratio, S/N
the difference in decibels between the level of the test signal and the level of the background noise at the moment of detection of the useful event (within the Adrienne temporal window)

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3.18
impulse response
the time signal at the output of a system when a Dirac function is applied to the input. The Dirac function, also called δ function, is the mathematical idealisation of a signal that is infinitely short in time which carries a unit amount of energy