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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 conditions

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A list of organizations represented on this committee can be obtained on request to its secretary.

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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

Applications ferroviaires - Voie - Dispositifs de réduction du bruit - Méthode d'essai pour la détermination des performances acoustiques - Partie 2: Caractéristiques intrinsèques - Isolation au bruit aérien en salle réverbérante dans des conditions de champ acoustique diffus

Bahnanwendungen - Oberbau - Lärmschutzwände und verwandte Vorrichtungen zur Beeinflussung der Luftschallausbreitung - Prüfverfahren zur Bestimmung der akustischen Eigenschaften - Teil 2: Produktspezifische Merkmale - Luftschalldämmung (Labormethode) bei diffusen Schallfeldern

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Foreword

This document (EN 16272-2:2012) 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of an identical text or by endorsement, at the latest by April 2013, and conflicting national standards shall be withdrawn at the latest by April 2013.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

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: Normalised 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* [1)]

— *Part 4: Intrinsic characteristics — In situ values of sound diffraction under direct sound field conditions* [1)]

— *Part 5: Intrinsic characteristics — In situ values of sound reflection under direct sound field conditions* [2)]

— *Part 6: Intrinsic characteristics — In situ values of airborne sound insulation under direct sound field conditions* [1)]

— *Part 7: Extrinsic characteristics – In situ values of insertion loss* [2)]

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1) In preparation.

2) This document has been prepared as a CEN Technical Specification and is in preparation.

Introduction

Noise barriers installed along railways need 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 particular railway applications in reverberant field (a measure of intrinsic performance). It is not concerned with determining sound insulation performance in situ, nor with determining the acoustic efficiency at receiver positions (insertion loss), which additionally depend on 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 site geometry, ground impedance, meteorological effects, etc. The test is designed to allow the intrinsic airborne sound insulation performance of the device under test to be measured. The resulting rating should aid the selection of the devices for particular railway applications in reverberant field.

The measurements results of this method for airborne sound insulation are comparable but not identical with the results of the prEN 16272-6 method, mainly because the present method assumes a diffuse sound field, while the prEN 16272-6 method uses a directional sound field. Research studies suggest that a very good correlation exists between data measured according to the method described in the present standard and data measured according to the method described in prEN 16272-6.

The test method described in this European Standard should not be used to determine completely the intrinsic characteristics of airborne sound insulation for noise reducing devices to be installed in non-reverberant conditions, e.g. alongside railways in open space.

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

This European Standard should be read in conjunction with:

— 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: Normalised railway noise spectrum and single number ratings for diffuse field applications*;

— prEN 16272-6, *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*.

1 Scope

This European Standard specifies the laboratory method for measuring the airborne sound insulation of noise barriers. It covers the assessment of the intrinsic airborne sound insulation performance of noise barriers and related devices acting on airborne sound propagation designed for railways which can reasonably be assembled inside the testing facility described in EN ISO 10140 series.

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.

ENV 13005*, Guide to the expression of uncertainty in measurement*

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: Normalised railway noise spectrum and single number ratings for diffuse field applications*

EN ISO 10140 (all parts)*, Acoustics — Laboratory measurement of sound insulation of building elements*

3 Terms and definitions

For the purpose 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; it may either span or overhang the railway

Note 1 to entry: Noise barriers are generally made of acoustic and structural elements (see 3.2 and 3.3).

3.2
acoustic element
element whose primary function is to provide the acoustic performance of the device

3.3
structural element
element whose primary function is to support or hold in place acoustic elements

4 Symbols and abbreviations

For the purposes of this document, the following symbols and abbreviations apply.

Table 1 — Symbols and abbreviations

Symbol or abbreviation	Designation	Unit
L	Greatest distance between the side edge of the sample and the post included in the sample	m
R_i	Sound reduction index in the *i*-th one-third octave band according to EN ISO 10140 series	dB

5 Test arrangement

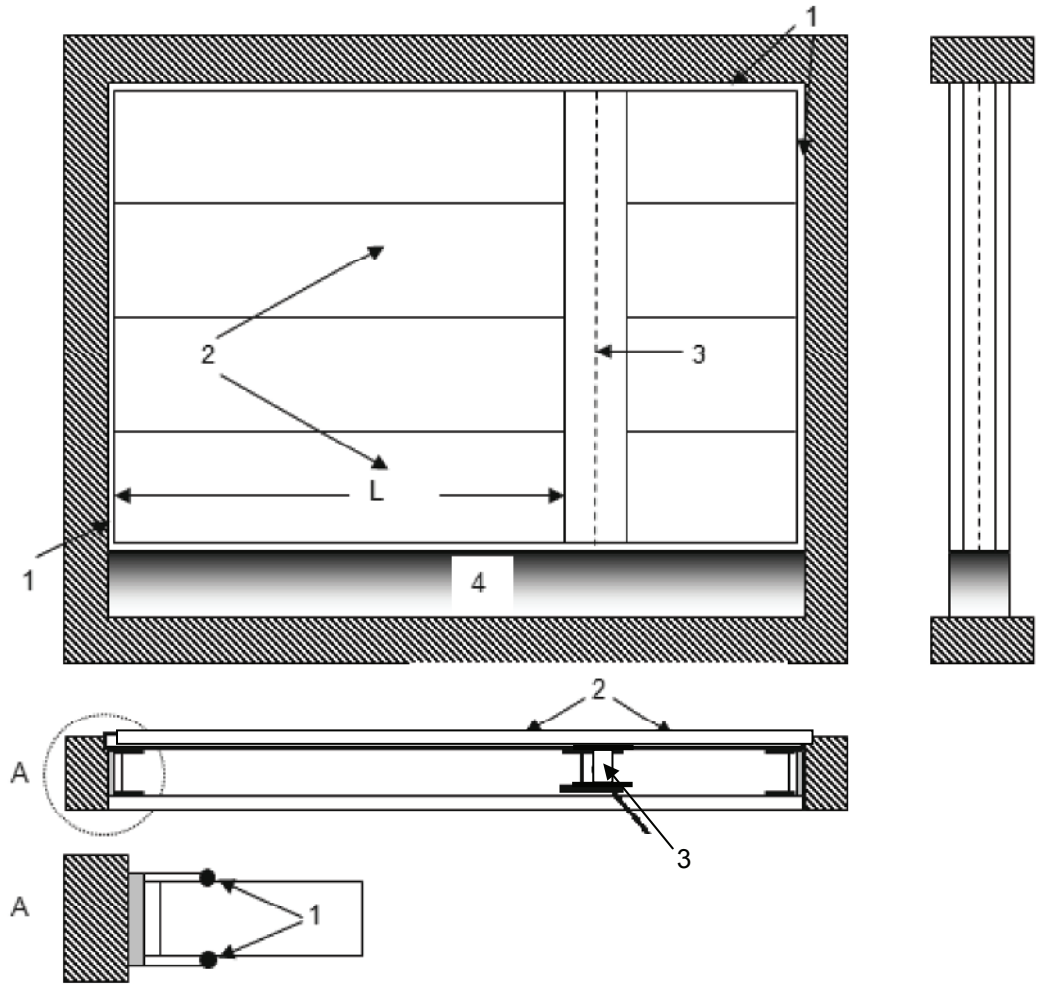
The test arrangement shall be as described in EN ISO 10140 series for partitions, with the following modifications:

a) The test specimen shall be mounted in the test opening and assembled in the same manner as the manufactured device is used in practice, with the same connections and seals between the component parts. The edge supports shall not overlap the sample by more than 70 mm and shall be sealed to prevent the leakage of sound.

b) Where posts are employed in construction, at least one post shall be included in the specimen with panels attached on both sides. The length of the panels on one side of the post shall be $L \geq 2$ m (see Figure 1 and Figure 2). The side that would face the rail shall face the source room.

c) The sample under test, excluding the plinth for levelling, shall have a windowed area not less than 9,5 m^2.

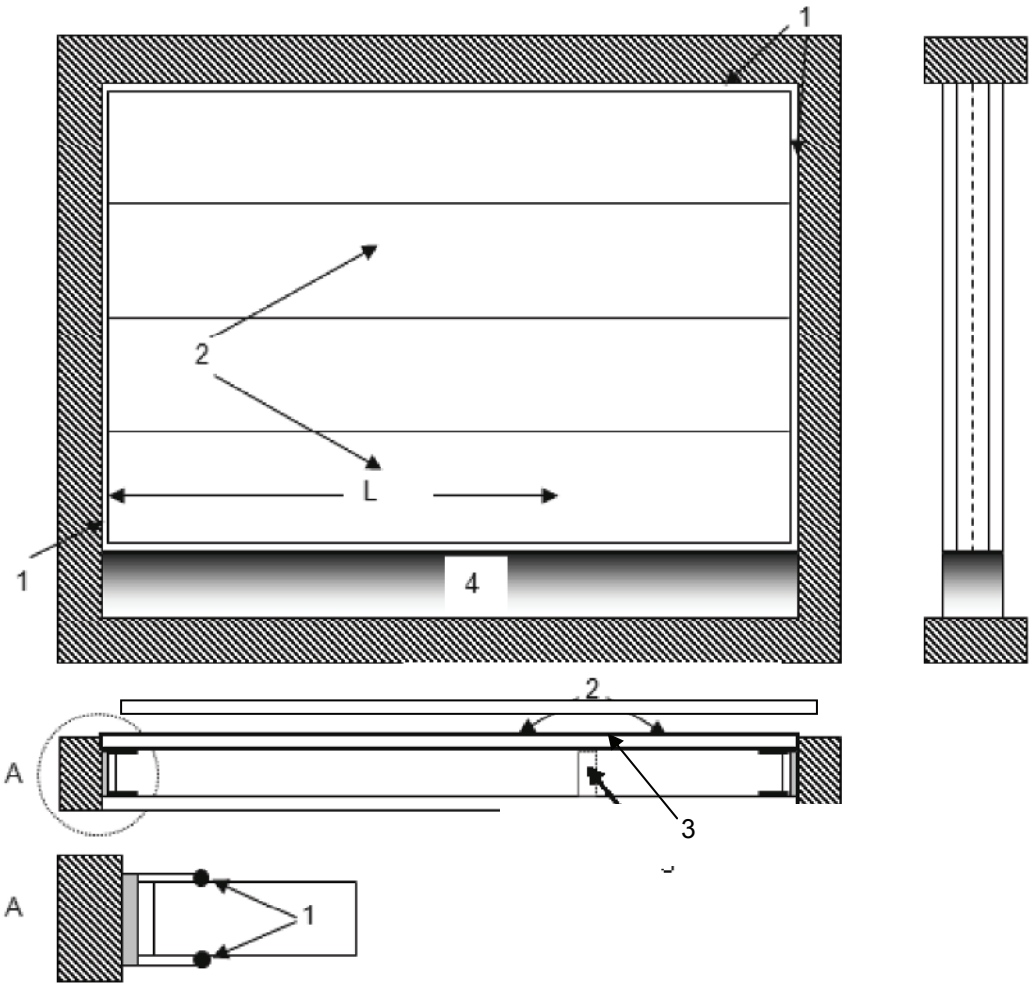
d) The sample surface area to be used in calculations shall be the total surface area of the sample excluding the plinth for levelling and the overlap surface of the edge supports.



Key

1 sealing materials
2 panels
3 post
4 bricked up plinth for levelling (if necessary)

Figure 1 — Illustration of sample arrangement for devices having visible posts — Top: front view (left) and side view (right); Middle: top view: Bottom: detail of zone A



Key

1 sealing materials
2 panels
3 post
4 bricked up plinth for levelling (if necessary)

Figure 2 — Illustration of sample arrangement for devices having no visible posts — Top: front view (left) and side view (right); Middle: top view; Bottom: detail of zone A

6 Test procedure and evaluation

The sound reduction indices R_i in each one-third octave band in the range 100 Hz to 5 kHz shall be determined using the method described in the EN ISO 10140 series.

7 Measurement uncertainty

The uncertainty of results obtained from measurements according to this European Standard shall be evaluated, preferably in compliance with ENV 13005, using the method described in the EN ISO 10140 series. If reported, the expanded uncertainty together with the corresponding coverage factor for a stated coverage

probability of 95 % as defined in ENV 13005 shall be given. More information on measurement uncertainty is given in Annex A.

8 Test report

8.1 Expression of results

The one-third octave band values of the sound reduction index R_i shall be given at all frequencies of measurement in tabular form and in the form of a graph. The values shall be rounded to the nearest first decimal place.

The measurement uncertainty of the sound reduction index R_i shall be given at all frequencies of measurement.

If a single-number rating of airborne sound insulation is to be calculated, then this shall be done in accordance with EN 16272-3-1.

8.2 Further information

The test report shall contain:

a) reference to this European Standard;

b) description of test conditions, procedures and equipment used in accordance with the EN ISO 10140 series;

c) full description of the test specimen including manufacturer's name and product identifier with sectional drawings and photographs showing mounting conditions, masses, densities, dimensions and specifications of panels, posts and seals, including any internal component;

d) name and address of the organisation which performed the measurements;

e) signature of the person responsible for the test;

f) date of the test.

Annex A
(informative)

Measurement uncertainty

A.1 General

The accepted format for expression of uncertainties generally associated with methods of measurement is that given in ENV 13005. This format incorporates an uncertainty budget, in which all the various sources of uncertainty are identified and quantified, from which the combined total uncertainty can be obtained. The data necessary to enable such a format to be adopted in the case of this European Standard are the same as for the EN ISO 10140 series because the measurement procedure is the same (see Clause 5). Therefore, reference shall be made to the EN ISO 10140 series and related treatment of the measurement uncertainty.

A.2 Measurement uncertainty based upon reproducibility data

The information on measurement reproducibility can be helpful towards the derivation of measurement uncertainties, but it is incomplete. In particular, it does not give an analysis of the various components of measurement uncertainty and their magnitudes.

In the absence of data for uncertainty contributions, values for the standard deviation of reproducibility, when available, may be used as an estimate of the combined standard uncertainty of determinations of airborne sound insulation. A value may then be selected for the coverage factor, and the product of the two will yield an estimate of the expanded measurement uncertainty, with the chosen coverage probability. By convention, a coverage probability of 95 % is usually chosen. To avoid any misinterpretations, the chosen coverage probability should always be stated in test reports together with the expanded measurement uncertainty.

Bibliography

[1] prEN 16272-6, *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*

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