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Järnvägar – Spår – Bullerbarriärer och anordningar som påverkar uppkomsten av luftburet ljud – Provningsmetoder för bestämning av akustiska egenskaper –
Del 1: Karaktäristiska egenskaper – Ljudabsorption i laboratoriet vid diffusa ljudförhållanden

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

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Denna standard är framtagen av kommittén för Järnvägar, SIS/TK 254.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 16272-1

October 2012

ICS 93.100

English Version

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

Applications ferroviaires - Dispositifs de réduction du bruit - Méthode d'essai pour la détermination des performances acoustiques - Partie 1: Caractéristiques intrinsèques - Absorption acoustique en salle réverbérante dans des conditions de champ acoustique diffus

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

This European Standard was approved by CEN on 15 September 2012.

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COMITÉ EUROPÉEN DE NORMALISATION
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Foreword

This document (EN 16272-1:2012) 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of an identical text or by endorsement, at the latest by April 2013, and conflicting national standards shall be withdrawn at the latest by April 2013.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)]

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1) In preparation.

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

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 give rise to a reverberant field and thus reduce barrier effectiveness.

This European Standard specifies a test method for assessing 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 sound absorption 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 sound absorption performance of the device under test to be measured and the resulting rating should aid the selection of the devices for particular railway applications.

The measurements results of this method for sound absorption are comparable but not identical with the results of the FprCEN/TS 16272-5 method, mainly because the present method assumes a diffuse sound field (where all angles of incidence are equally probable), while the FprCEN/TS 16272-5 method uses a directional sound field. Values of the sound absorption coefficient measured with the method described in this European Standard can be converted to conventional values of a reflection coefficient taking the complement to one. In this case, research studies suggest that a quite good correlation exists between data measured according to the method described in the present European Standard and data measured according to the method described in FprCEN/TS 16272-5.

The test method described in this European Standard should not be used to determine completely the intrinsic characteristics of sound absorption 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*

— FprCEN/TS 16272-5, *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*

1 Scope

This European Standard specifies the laboratory method for measuring the sound absorption of flat noise barriers or flat claddings for retaining walls or tunnels. It covers the assessment of the intrinsic sound absorption 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 354. The test method in EN ISO 354, referred to in this European Standard, is strictly valid only for flat absorbers and in particular excludes devices which act as slightly damped resonators. Some devices will depart significantly from these requirements and in these cases care is needed in interpreting the results.

All noise reducing devices that differ 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.

NOTE The test method in EN ISO 354 is based on measurements in a reverberation room where diffuse sound field conditions prevail. As a uniformly applicable method for the determination of the sound absorptive performance of noise reducing devices under free field conditions is still under development, the measurement results according to this European Standard are temporarily considered relevant for application on noise reducing devices in reverberant as well as in free field conditions.

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

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 3.3 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 (see 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

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
α_{Si}	Sound absorption coefficient in the *i*-th one-third octave band according to EN ISO 354	-
DL_{α}	Single number rating of sound absorption	dB
L	Greatest distance between the side edge of the sample and the post included in the sample	m

5 Test arrangement

The test arrangement shall be as described in EN ISO 354, with the following modifications:

a) The test specimen shall be assembled in the test chamber in the same manner as the manufactured device is used in practice, with the same connections and seals between the component parts.

b) All the reflecting parts exposed on the rail side of the material (posts, brackets and other parts) shall be present on the specimen as in practice.

c) 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 inner part of the room (see Figure 1 and Figure 2). The post shall be sealed as in practice.

d) The test specimen shall have a reflecting frame sealed against it on its entire perimeter (see Figure 1 to Figure 5).

e) For testing noise barriers, the specimen shall be placed directly against one of the surfaces (floor, wall or ceiling) of the chamber without any gap (see Figure 1, Figure 2 and Figure 3). If needed, concrete, used as filler, shall be inserted between panels and chamber surface.

f) If the sample under test includes non flat panels, leaving cavities between the panels and the chamber floor, these cavities should be completely filled with concrete (see Figure 3).

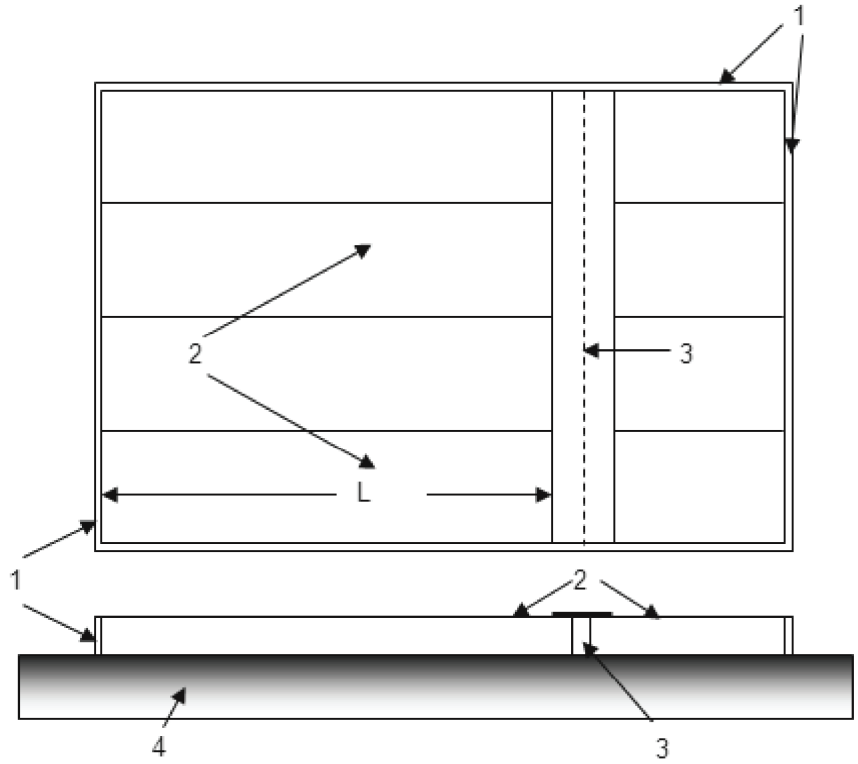
g) If the sample under test includes a post it is recommended to cut it to fit the panel thickness.

h) If the sample under test includes a post having a thickness larger than that of the acoustic elements and protruding toward the interior of the test chamber, the reflective area created by the post fitting the acoustic elements shall be reproduced covering it by reflective strips (see Figure 4).

i) If the sample under test includes a post having a thickness larger than that of the acoustic elements and protruding toward the floor of the test chamber, the cavities created by the post under the acoustic elements shall be completely filled with concrete (see Figure 5).

j) Any combination of the conditions above may be applied in order to be sure that no cavities, gaps or plenum exist between the sample under test and the chamber surface unless explicitly prescribed for the device in its normal use.

k) For testing absorptive cladding for use on retained cuttings, tunnel walls and other reflective surfaces, the specimen shall be mounted against one of the surfaces of the chamber leaving the same gap and using the same components as proposed for the actual construction. In this case, the mounting conditions and components, e.g. the distance between the back of the sample and the surface of the chamber, shall be clearly reported.



Key

1 reflective frame
2 panels
3 post
4 chamber surface (floor)

NOTE L ≥ 2 m.

Figure 1 — Illustration of sample arrangement for devices having visible posts — Top: front view; Bottom: side view