SLOVENSKI STANDARD
oSIST prEN 1793-1:2023

01-november-2023

Protihrupne ovire za cestni promet - Preskusna metoda za ugotavljanje akustičnih lastnosti - 1. del: Karakteristike, značilne za absorpcijo zvoka pri razpršenem zvočnem polju

Road traffic noise reducing devices - Test method for determining the acoustic performance - Part 1: Intrinsic characteristics of sound absorption under diffuse sound field conditions

Lärmschutzvorrichtungen an Straßen - Prüfverfahren zur Bestimmung der akustischen Eigenschaften - Teil 1: Produktspezifische Merkmale der Schallabsorption in diffusen Schallfeldern

Dispositifs de réduction du bruit du trafic routier - Méthode d'essai pour la détermination de la performance acoustique - Partie 1 : Caractéristique intrinsèques de l'absorption acoustique dans des conditions de champ acoustique diffus

Ta slovenski standard je istoveten z: **prEN 1793-1**

ICS:

17.140.30	Emisija hrupa transportnih sredstev	Noise emitted by means of transport
93.080.30	Cestna oprema in pomožne naprave	Road equipment and installations

oSIST prEN 1793-1:2023 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 1793-1

August 2023

ICS 17.140.30; 93.080.30

Will supersede EN 1793-1:2017

English Version

Road traffic noise reducing devices - Test method for determining the acoustic performance - Part 1: Intrinsic characteristics of sound absorption under diffuse sound field conditions

Dispositifs de réduction du bruit du trafic routier - Méthode d'essai pour la détermination de la performance acoustique - Partie 1 : Caractéristique intrinsèques de l'absorption acoustique dans des conditions de champ acoustique diffus

Lärmschutzvorrichtungen an Straßen - Prüfverfahren zur Bestimmung der akustischen Eigenschaften - Teil 1: Produktspezifische Merkmale der Schallabsorption in diffusen Schallfeldern

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 226.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

This draft European Standard was established by CEN 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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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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European foreword

This document (prEN 1793-1:2023) has been prepared by Technical Committee CEN/TC 226 “Road equipment”, the secretariat of which is held by AFNOR.

This document will supersede EN 1793-1:2017.

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

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

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

— 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 C);

— The detailed example has been improved to include the declaration of the uncertainty (Annex D);

— The Bibliography has been updated.

EN 1793-1:2023 is part of a series and should be read in conjunction with the following:

— EN 1793-2:2023, *Road traffic noise reducing devices — Test method for determining the acoustic performance — Part 2: Intrinsic characteristics — Airborne sound insulation under diffuse sound field conditions*;

— EN 1793-3:2023, *Road traffic noise reducing devices — Test method for determining the acoustic performance — Part 3: Normalized traffic noise spectrum*;

— EN 1793-4:2023, *Road traffic noise reducing devices — Test method for determining the acoustic performance — Part 4: Intrinsic characteristics — Intrinsic sound diffraction*;

— EN 1793-5:2023, *Road traffic noise reducing devices — Test method for determining the acoustic performance — Part 5: Intrinsic characteristics — Sound absorption under direct sound field conditions;*

— EN 1793-6:2023, *Road traffic noise reducing devices — Test method for determining the acoustic performance — Part 6: Intrinsic characteristics — Airborne sound insulation under direct sound field conditions*.

Introduction

Where a sound reflecting surface is installed along a road, it may be effective to use sound absorbing devices on its traffic 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;

— traffic passing close to a barrier where reflections between the vehicles and the barrier may reduce effectiveness.

This document specifies a test method for qualifying the sound absorption performance of noise reducing devices designed for roads (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 roadside applications.

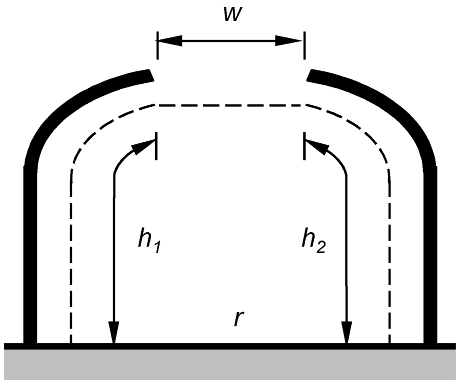
More information on the realization of a diffuse sound field is given in Annex A.

The measurement results of this method for sound absorption are not directly comparable with the results of the direct sound field method (EN 1793-5), 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 reducing devices to be installed on roads under non-reverberant conditions.

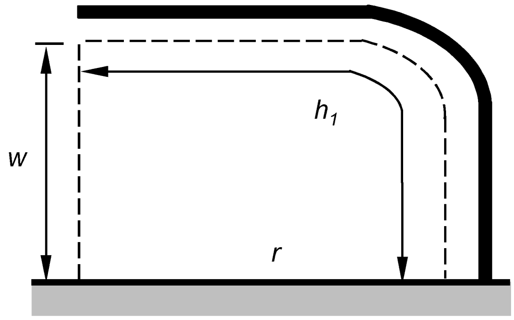
Research studies suggest that some correlation exists between laboratory data, measured according to EN 1793-5 [5] and laboratory data, measured according to the method described in this document [1], [2], [3], [4].

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 road 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, w, 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.

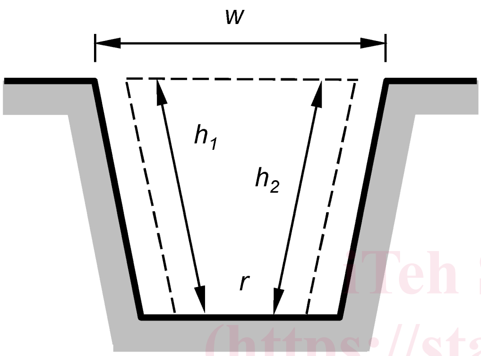
This method may be used to qualify noise reducing devices for other applications, e.g. to be installed nearby industrial sites. In this case the single-number ratings should be calculated using an appropriate spectrum.



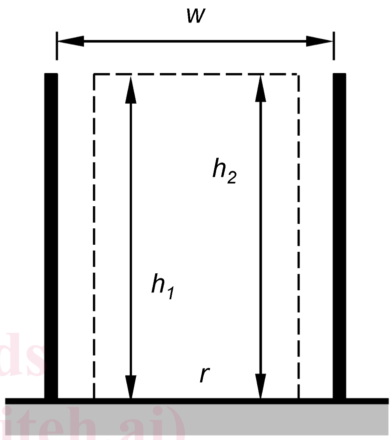
a) Partial cover on both sides of the road; geometric envelope, $e = w+h_1+h_2$



b) Partial cover on one side of the road; geometric envelope, $e = w+h_1$



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



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

Key

r road 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 — Sketch of the reverberant condition check in four cases

1 Scope

This document specifies the laboratory method for measuring the sound absorption performance of road traffic noise reducing devices 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 reducing devices to be installed on roads in non-reverberant conditions.

The test method in EN ISO 354 referred to in this document excludes devices that act as weakly damped resonators. Some devices will depart significantly from these requirements and in these cases, care is needed in interpreting the results.

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 1793-3:2023, *Road traffic noise reducing devices - Test method for determining the acoustic performance - Part 3: Normalized traffic noise spectrum*

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

ISO 9613-1:1993, *Acoustics — Attenuation of sound during propagation outdoors — Part 1: Calculation of the absorption of sound by the atmosphere*

ISO/IEC Guide 98-3:2008, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

EN ISO 12999-2:2020, *Acoustics - Determination and application of measurement uncertainties in building acoustics - Part 2: Sound absorption (ISO 12999-2:2020)*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
road traffic noise reducing device
RTNRD
device designed to reduce the propagation of traffic noise away from the road environment

Note 1 to entry: An RTNRD can comprise acoustic elements (3.2) only or both structural (3.3) and acoustic elements.

Note 2 to entry: Applications of RTNRDs include noise barriers (3.5), claddings(3.6), covers (3.7) and added devices(3.8).

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 parts of the RTNRD

3.4
self supporting acoustic element
acoustic element including its own structural element to support itself

3.5
noise barrier
road traffic noise reducing device which obstructs the direct transmission of airborne sound emanating from road traffic

3.6
cladding
road traffic noise reducing device which is attached to a wall or other structure and reduces the amount of sound reflected

3.7
cover
road traffic noise reducing device which either spans or overhangs the road

3.8
added device
additional component that influences the acoustic performance of the original road traffic noise reducing device

Note 1 to entry: The added device is acting primarily on the diffracted energy.

4 Symbols and abbreviations

For the purposes of this document, the following symbols 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	m^2
A_2	Equivalent sound absorption area of the reverberation room containing a test specimen	m^2
A_T	Equivalent sound absorption area of the test specimen	m^2
c_1	Propagation speed of sound in air in the empty reverberation room	ms^{-1}
c_2	Propagation speed of sound in air in the reverberation room with the test specimen during the measurement	ms^{-1}

Symbol or abbreviation	Designation	Unit
$DL_{\alpha,\text{NRD}}$	Single-number rating of sound absorption performance 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
L_i	Normalized A weighted sound pressure level of traffic noise in the *i*-th one-third octave band defined in EN 1793–3	dB
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_1 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_2 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	m^2
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	m^3
V_2	Net volume of the reverberation room containing a test specimen	m^3
V_s	Net volume of the test sample	m^3

5 Test arrangement

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

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.

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

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

(Figures 2 and 3). The side that would face the road traffic shall face the inner part of the room (Figures 2 and 3). The post shall be sealed as in practice.

The test specimen shall have a reflecting frame sealed against it on its entire perimeter and without any gap between the frame and the surface on which the test specimen is placed (Figures 2 to 6).

The test specimen shall be placed directly against one of the surfaces (floor, wall or ceiling) of the chamber without any gap (Figures 2, 3 and 4). A dense filling material, such as sand or concrete (density > 200 kg/m^3), shall always be inserted between the panels and chamber surface to completely fill all gaps.

If the sample under test includes a plenum as part of the design, this shall be reproduced in the reverberation room and reported in the test report. If the sample under test includes a plenum that is not a design feature, the plenum shall be completely filled with a dense filling material such as sand or concrete.

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

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 (Figure 5). Alternatively, a T-shaped element with the same width of reflective surface as the visible face of the post can be used to replace the post.

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 a dense filling material such as sand or concrete (Figure 6). Alternatively, a T-shaped element with the same width of reflective surface as the visible face of the post can be used to replace the post.

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.

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.