Road Traffic Noise reducing devices - Test method for determining the acoustic performance - Part 5: Intrinsic characteristics - In situ values of sound reflection under direct sound field conditions

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NATIONAL FOREWORD

See Eesti standard EVS-EN 1793-5:2016 sisaldab Euroopa standardi EN 1793-5:2016 ja selle paranduse AC:2018 ingliskeelset teksti.	This Estonian standard EVS-EN 1793-5:2016 consists of the English text of the European standard EN 1793-5:2016 and its corrigendum AC:2018.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 30.03.2016.	Date of Availability of the European standard is 30.03.2016.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 17.140.30, 93.080.30

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Supersedes CEN/TS 1793-5:2003

English Version

Road traffic noise reducing devices - Test method for determining the acoustic performance - Part 5: Intrinsic characteristics - In situ values of sound reflection under direct sound field conditions

Dispositifs de réduction du bruit du trafic routier - Méthode d'essai pour la détermination de la performance acoustique - Partie 5: Caractéristiques intrinsèques - Valeurs in situ de réflexion acoustique dans des conditions de champ acoustique direct

Lärmschutzvorrichtungen an Straßen - Prüfverfahren zur Bestimmung der akustischen Eigenschaften - Teil 5: Produktspezifische Merkmale - In-situ-Werte der Schallreflexion in gerichteten Schallfeldern

This European Standard was approved by CEN on 23 January 2016.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists 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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This document consolidates EN 1793-5:2016 and the corrigendum EN 1793-5:2016/AC:2018.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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European foreword

This document (EN 1793-5:2016) has been prepared under the direction of Technical Committee CEN/TC 226 “Road equipment”, by Working Group 6 “Anti-noise devices”, the secretariat of which is held by AFNOR.

This document supersedes CEN/TS 1793-5:2003.

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 September 2016, and conflicting national standards shall be withdrawn at the latest by September 2016.

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.

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

— 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 described in more detail;

— the lowest reliable one-third frequency band has been better defined;

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

— a detailed example is given (Annex B);

— information on the near-field to far-field relationship has been added (Annex C).

It should be read in conjunction with:

EN 1793-1, *Road traffic noise reducing devices - Test method for determining the acoustic performance – Part 1: Intrinsic characteristics of sound absorption under diffuse sound field conditions*

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

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

EN 1793-4, *Road traffic noise reducing devices - Test method for determining the acoustic performance – Part 4: Intrinsic characteristics – In situ values of sound diffraction*

EN 1793-6, *Road traffic noise reducing devices - Test method for determining the acoustic performance – Part 6: Intrinsic characteristics – In situ values of airborne sound insulation under direct sound field conditions*

This document includes the corrigendum EN 1793-5:2016/AC:2018 which corrects Formula (4) in 5.5.1.

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, 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.

Introduction

This document describes a test method for determining the intrinsic characteristics of sound reflection of noise reducing devices designed for roads in non-reverberant conditions (a measure of intrinsic performance). It can be applied *in situ*, i.e. where the noise reducing devices are installed. The method can be applied without damaging the surface.

The method can be used to qualify products to be installed along roads as well as to verify the compliance of installed noise reducing devices to design specifications. Regular application of the method can be used to verify the long term performance of noise reducing devices.

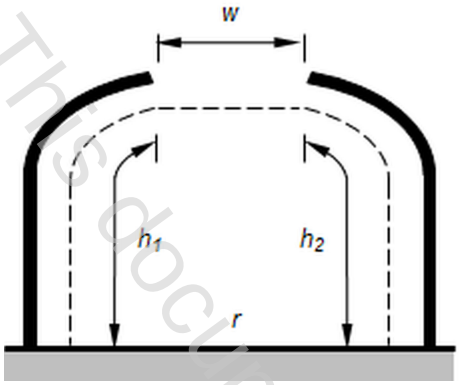
The method requires the average of results of measurements taken in different points in front of the device under test and/or for specific angles of incidences. The method is able to investigate flat and non-flat products.

The measurements results of this method for sound reflection are not directly comparable with the results of the laboratory method (e.g. EN 1793-1), mainly because the present method uses a directional sound field, while the laboratory method assumes a diffuse sound field. The test method described in the present document should not be used to determine the intrinsic characteristics of sound reflection of noise reducing devices to be installed in reverberant conditions, e.g. claddings inside tunnels or deep trenches.

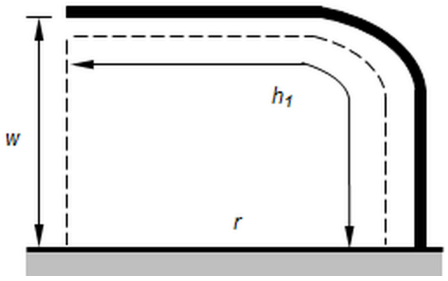
For the purpose of this document reverberant conditions are defined based on the envelope, e, across the road formed by the device under test, trench sides or buildings (the envelope does not include the road surface) as shown by the dashed lines in Figure 1. Conditions are defined as being reverberant when the percentage of open space in the envelope 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 reducing device, while the laboratory method gives a sound absorption coefficient. Laboratory values of the sound absorption coefficient 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 laboratory data, measured according to EN 1793-1 and field data, measured according to the method described in the present document [7], [10], [20], [21].

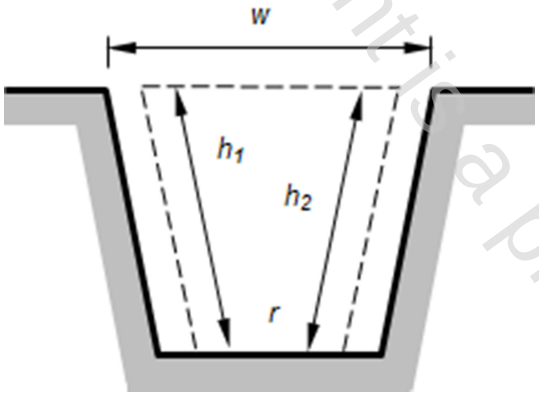
This method may be used to qualify noise reducing devices for other applications, e.g. to be installed nearby industrial sites. In this case the single-number ratings should be calculated using an appropriate spectrum.



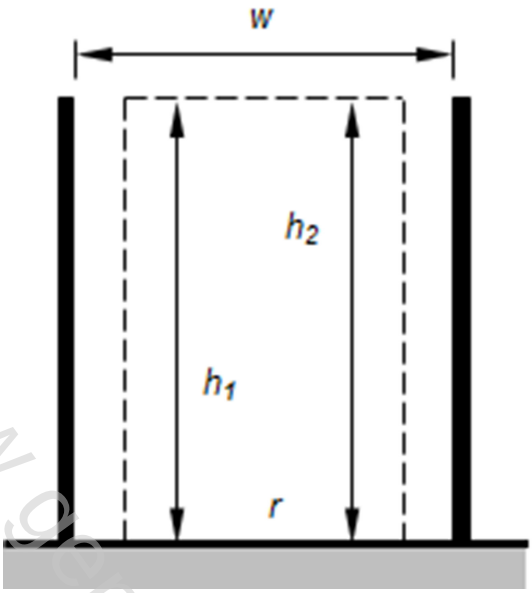
(a) Partial cover on both sides of the road; envelope, $e = w+h_1+h_2$.



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



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



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

Key

r road surface;

w width of open space

NOTE Figure 1 is not to scale.

Figure 1 —Sketch of the reverberant condition check in four cases

1 Scope

This European Standard describes a test method for measuring a quantity representative of the intrinsic characteristics of sound reflection from road noise reducing devices: the reflection index.

The test method is intended for the following applications:

— determination of the intrinsic characteristics of sound reflection of noise reducing devices to be installed along roads, to be measured either on typical installations alongside roads or on a relevant sample section;

— determination of the *in situ* intrinsic characteristics of sound reflection of noise reducing devices 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 reducing devices (with a repeated application of the method).

The test method is not intended for the following applications:

— determination of the intrinsic characteristics of sound reflection of noise reducing devices to be installed in reverberant conditions, e.g. inside tunnels or deep trenches.

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

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.

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

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

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

3 Terms and definitions

For the purposes of this document the following terms and definitions apply:

3.1
noise reducing device (NRD)
device that is designed to reduce the propagation of traffic noise away from the road environment. This may be a noise barrier, cladding, a road cover or an added device. These devices may include both acoustic and structural elements