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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

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Submission of Comments

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- All comments should be submitted online at <https://standardsdevelopment.bsigroup.com/>. You will need to register in order to comment.

Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



DRAFT International Standard

ISO/DIS 13472-2

Acoustics — Measurement of sound absorption properties of road surfaces in situ —

Part 2: Spot method for reflective surfaces

*Acoustique — Mesurage in situ des propriétés d'absorption
acoustique des revêtements de chaussées —*

Partie 2: Méthode ponctuelle pour les surfaces réfléchissantes

ICS: 17.140.30; 93.080.20

ISO/TC 43/SC 1

Secretariat: DIN

Voting begins on:
2024-04-19

Voting terminates on:
2024-07-12

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 1, *Noise*.

This second edition cancels and replaces the first edition (ISO 13472-2:2010), which has been technically revised.

The main changes are as follows:

- mandatory choice of the transfer function formulation and quality requirements for the coherence function;
- an alternative microphone arrangement and application of alternating transfer functions are presented to cancel the distortion due to destructive interference at the microphone positions.

A list of all parts in the ISO 13472 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document specifies a test method for measuring *in situ*, the sound absorption coefficient under normal incidence of road surfaces as a function of frequency.

This method provides a means to evaluate the sound absorption characteristics of a road surface without damaging the surface. It is intended to be used to qualify the absorption characteristics of road surfaces used for vehicle and tyre testing. It can also be used during road construction, road maintenance and other traffic noise studies. However, the field of application is limited to low absorption surfaces such as those in accordance with ISO 10844 and similar surfaces. Due to air leakage the method is not reliable if the measured sound absorption coefficient exceeds 0,15. Surfaces with a sound absorption coefficient of 0,10 or below are considered reflective.

This method (Part 2 of the ISO 13472 series) is based on propagation of the test signal from the source to the road surface and back to the receiver through an impedance tube with a diameter of 80 mm to 100 mm. The tube covers an area of approximately 0,005 m² to 0,008 m² and a frequency range, in one-third-octave bands, from 250 Hz to 1 600 Hz for a 100 mm diameter to 2 000 Hz for an 80 mm diameter. It uses the test procedure and signal processing described in ISO 10534-2, but because of the defined frequency range of application, the dimensions of the system are not freely adjustable.

The essential part in the ISO 10534-2 procedure is the determination of the transfer function between two microphones at different distances from the sample at the end of the tube. In this case of a reflecting sample at specific frequencies destructive interferences (nodes) will occur at the microphone positions jeopardizing the correct determination of the transfer function between the microphone pair.

Therefore in this document the ISO 10534-2 procedure is extended with a preference for transfer function H calculated as the ratio of the auto spectrum S_{22} at the lowest microphone position and the cross spectrum S_{21} and requirements on the resolution, the sample frequency and the block length in the FFT analysis added with a requirement on the average narrow band coherence within a third octave band. Recommendations for improvement of the accuracy by alternative microphone arrangement, variation in transfer function and type of random noise are presented in an annex.

This method is complementary to the extended surface method (ISO 13472-1^[4]) that covers an area of approximately 3 m² and a frequency range, in one-third-octave bands, from 250 Hz to 4 000 Hz.

Both methods should give similar results in the valid frequency range, but their fields of application and therefore their accuracy will differ strongly. The method described in ISO 13472-1 has limited accuracy at small sound absorption values and is therefore unfit to check compliance of surfaces with the requirements in ISO 10844 or similar regulations, while the method described in this standard fails at higher sound absorption values.

Within their ranges of applicability the methods are applicable also to acoustic materials other than road surfaces.

The measurement results by this method are comparable with the results of the impedance tube method, performed on bore cores taken from the surface such as ISO 10534-1, ISO 10534-2 and ASTM E 1050-19.

The measurement results obtained with this method are in general not comparable with the results of the reverberation room method (ISO 354^[1]), because the method described in this International Standard uses a plane progressive wave at normal incidence, while the reverberation room method uses a diffuse sound field.

Acoustics — Measurement of sound absorption properties of road surfaces in situ —

Part 2: Spot method for reflective surfaces

1 Scope

This document specifies a test method for measuring *in situ* the sound absorption coefficient of road surfaces for the one-third-octave band frequencies ranging from 250 Hz to 1 600 Hz under normal incidence conditions. If necessary for practical applications the diameter of the tube can be reduced to 80 mm. This will increase the upper boundary of the frequency range to 2 000 Hz one-third-octave band (see 5.4) but reduces the area under test.

The test method is intended for the following applications:

- determination of the sound absorption coefficient (and, if of interest, also the complex acoustical impedance) of semi-dense to dense road surfaces;
- determination of the sound absorption properties of test tracks according to ISO 10844^[2] or other similar standards and test surfaces defined in national and international type approval regulations for road vehicles and their tyres;
- verification of the compliance of the sound absorption coefficient of a road surface with design-specifications or other requirements.

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.

ISO 10534-2:2023, *Acoustics — Determination of sound absorption coefficient and impedance in impedance tubes — Part 2: Transfer-function method*

IEC 61260, *Electroacoustics — Octave and fractional-octave-band filters*

ISO Guide 98-3, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement*

3 Terms and definitions

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

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

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

3.1 frequency range

frequency interval in which measurements are valid, specified in one-third-octave bands according to IEC 61260

Note 1 to entry: The frequency range is specified in one-third-octave bands. This means that its lowest frequency is the lower limit of the lower one-third-octave band specified and its highest frequency is the upper limit of the highest one-third-octave band specified. A frequency range specified in one-third-octave bands of 250 Hz to 1 600 Hz center frequency implies a frequency range specified in narrow bands of 220 Hz to 1 800 Hz.

3.2 sound absorption coefficient at normal incidence

α

fraction of the sound power of a plane wave at normal incidence on the test object that is absorbed within the test object

3.3 sound pressure reflection factor at normal incidence

r

complex ratio of the pressure of the reflected wave to the pressure of the incident wave at the surface of the test object for a plane wave at normal incidence

3.4 plane of reference for the road surface

hypothetical plane defined by the underside of the sealing device at which the sound pressure reflection factor and the normal surface impedance is calculated

3.5 cross spectrum

S_{12}

product $p_2 \cdot p_1^*$ determined by the complex sound pressure p_1 and p_2 at two microphone positions 1 and 2

Note 1 to entry: * means the complex conjugate

3.6 auto spectrum

S_{11}

product $p_1 \cdot p_1^*$ determined by the complex sound pressure p_1 at a microphone position 1.

3.7 transfer function

H_{12}

transfer function from microphone position 1 to 2, defined by the complex ratio $p_2/p_1 = (S_{22}/S_{21})$

Note 1 to entry: The transfer function can also be defined as (S_{12}/S_{11}) but applying that definition will lead a slightly higher error when averaged over one-third-octave bands (ref [7]).

3.8 coherence function

γ_{12}^2

coherence between the signals at positions 1 and 2 defined by $\gamma^2 = |S_{12}|^2 / (S_{11} \cdot S_{22})$

3.10 normal surface impedance

Z

ratio of the complex sound pressure to the normal component of the complex sound particle velocity in the reference plane