SLOVENSKI STANDARD
oSIST prEN ISO 10140-4:2020

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Akustika - Laboratorijsko merjenje zvočne izolirnosti gradbenih elementov - 4. del: Merilni postopki in zahteve (ISO/DIS 10140-4:2020)

Acoustics - Laboratory measurement of sound insulation of building elements - Part 4: Measurement procedures and requirements (ISO/DIS 10140-4:2020)

Akustik - Messung der Schalldämmung von Bauteilen im Prüfstand - Teil 4: Messverfahren und Anforderungen (ISO/DIS 10140-4:2020)

Acoustique - Mesurage en laboratoire de l'isolation acoustique des éléments de construction - Partie 4: Exigences et modes opératoires de mesurage (ISO/DIS 10140-4:2020)

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Acoustics — Laboratory measurement of sound insulation of building elements —

Part 4:
Measurement procedures and requirements

Acoustique — Mesurage en laboratoire de l'isolation acoustique des éléments de construction —

Partie 4: Exigences et modes opératoires de mesure

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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).

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For an explanation on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 2, *Building acoustics*.

This second edition cancels and replaces the first edition (ISO 10140-4:2010), which has been technically revised.

The main changes compared to the previous edition are as follows:

— normative references updated

— terms and definitions updated

— all references updated

— first and last paragraph of 4.8 edited

— title of 5.3.1 added

— note in 5.3.3 edited

A list of all parts in the ISO 10140 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

ISO 10140 (all parts) concerns laboratory measurement of the sound insulation of building elements (see Table 1).

ISO 10140-1 specifies the application rules for specific elements and products, including specific requirements for preparation, mounting, operating and test conditions. ISO 10140-2 and ISO 10140-3 contain the general procedures for airborne and impact sound insulation measurements, respectively, and refer to this part of ISO 10140 and ISO 10140-5 where appropriate. For elements and products without a specific application rule described in ISO 10140-1, it is possible to apply ISO 10140-2 and ISO 10140-3. This part of ISO 10140 contains basic measurement techniques and processes. ISO 10140-5 contains requirements for test facilities and equipment. For the structure of ISO 10140 (all parts), see Table 1.

ISO 10140 (all parts) was created to improve the layout for laboratory measurements, ensure consistency and simplify future changes and additions regarding mounting conditions of test elements in laboratory and field measurements. It is intended for ISO 10140 (all parts) to present a well-written and arranged format for laboratory measurements.

It is intended to update ISO 10140-1 with application rules for other products.

Table 1 — Structure and contents of ISO 10140 (all parts)

Relevant part of ISO 10140	Main purpose, contents and use	Detailed content
ISO 10140-1	It indicates the appropriate test procedure for elements and products. For certain types of element/product, it can contain additional and more specific instructions about quantities and test element size and about preparation, mounting and operating conditions. Where no specific details are included, the general guidelines are according to ISO 10140-2 and ISO 10140-3.	Appropriate references to ISO 10140-2 and ISO 10140-3 and product-related, specific and additional instructions on: — specific quantities measured; — size of test element; — boundary and mounting conditions; — conditioning, testing and operating conditions; — additional specifics for test report.
ISO 10140-2	It gives a complete procedure for airborne sound insulation measurements according to ISO 10140-4 and ISO 10140-5. For products without specific application rules, it is sufficiently complete and general for the execution of measurements. However, for products with specific application rules, measurements are carried out according to ISO 10140-1, if available.	— Definitions of main quantities measured — General mounting and boundary conditions — General measurement procedure — Data processing — Test report (general points)
ISO 10140-3	It gives a complete procedure for impact sound insulation measurements according to ISO 10140-4 and ISO 10140-5. For products without specific application rules, it is sufficiently complete and general for the execution of measurements. However, for products with specific application rules, measurements are carried out according to ISO 10140-1, if available.	— Definitions of main quantities measured — General mounting and boundary conditions — General measurement procedure — Data processing — Test report (general points)

Table 1 *(continued)*

Relevant part of ISO 10140	Main purpose, contents and use	Detailed content
ISO 10140-4	It gives all the basic measurement techniques and processes for measurement according to ISO 10140-2 and ISO 10140-3 or facility qualifications according to ISO 10140-5. Much of the content is implemented in software.	— Definitions — Frequency range — Microphone positions — SPL measurements — Averaging, space and time — Correction for background noise — Reverberation time measurements — Loss factor measurements — Low-frequency measurements — Radiated sound power by velocity measurement
ISO 10140-5	It specifies all information needed to design, construct and qualify the laboratory facility, its additional accessories and measurement equipment (hardware).	Test facilities, design criteria: — volumes, dimensions; — flanking transmission; — laboratory loss factor; — maximum achievable sound reduction index; — reverberation time; — influence of lack of diffusivity in the laboratory. Test openings: — standard openings for walls and floors; — other openings (windows, doors, small technical elements); — filler walls in general. Requirements for equipment: — loudspeakers, number, positions; — tapping machine and other impact sources; — measurement equipment. Reference constructions: — basic elements for airborne and impact insulation improvement; — corresponding reference performance curves.

Acoustics — Laboratory measurement of sound insulation of building elements —

Part 4: Measurement procedures and requirements

1 Scope

This part of ISO 10140 specifies the basic measurement procedures for airborne and impact sound insulation in laboratory test facilities.

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.

ISO 3382-2, *Acoustics — Measurement of room acoustic parameters — Part 2: Reverberation time in ordinary rooms*

ISO/DIS 10140-1:2020, *Acoustics — Laboratory measurement of sound insulation of building elements — Part 1: Application rules for specific products*

ISO 10140-2, *Acoustics — Laboratory measurement of sound insulation of building elements — Part 2: Measurement of airborne sound insulation*

ISO 10140-3, *Acoustics — Laboratory measurement of sound insulation of building elements — Part 3: Measurement of impact sound insulation*

ISO/DIS 10140-5:2020, *Acoustics — Laboratory measurement of sound insulation of building elements — Part 5: Requirements for test facilities and equipment*

ISO 10848-1:2017, *Acoustics — Laboratory and field measurement of flanking transmission for airborne, impact and building service equipment sound between adjoining rooms — Part 1: Frame document*

ISO 18233, *Acoustics — Application of new measurement methods in building and room acoustics*

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 https://www.iso.org/obp

3.1
energy average sound pressure level in a room
L
ten times the common logarithm of the ratio of the space and time average of the squared sound pressure to the square of the reference sound pressure, the space average being taken over the entire room with the exception of those parts where the direct radiation of a sound source or the near field of the boundaries (walls, etc.) is of significant influence

Note 1 to entry: *L* is expressed in decibels.

3.2
reverberation time
T
time required for the sound pressure level in a room to decrease by 60 dB after the sound source has stopped

Note 1 to entry: The reverberation time is expressed in seconds.

Note 2 to entry: The range evaluated is defined by the times at which the decay curve first reaches 5 dB and 25 dB, respectively, below the initial level.

3.3
structural reverberation time
T_s
time required for the acceleration level in a structure to decrease by 60 dB after the structure-borne sound source has stopped

Note 1 to entry: The structural reverberation time is expressed in seconds.

Note 2 to entry: T_s is calculated using linear extrapolation of much shorter evaluation ranges than 60 dB, preferably 15 dB or 20 dB.

3.4
background noise level
measured sound pressure level in the receiving room from all sources other than the loudspeaker or tapping machine in the source room.

3.5
continuously moving microphone
microphone that, with respect to a fixed point,

a) moves with approximately constant speed in a circle, or

b) sweeps to and fro along the arc of a circle, which is as large as possible, but is not to be less than 270°, over a fixed time period

4 Measurement procedures and requirements

4.1 Frequency range

All quantities shall be measured using one-third octave band filters having at least the following centre frequencies, in hertz:

100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1 000, 1 250, 1 600, 2 000, 2 500, 3 150, 4 000, 5 000

If additional information in the low-frequency range is required, use one-third octave band filters with the following centre frequencies, in hertz:

50, 63, 80

For additional measurements at low frequencies, guidance is given in Annex A.

4.2 Measurement of sound pressure levels

4.2.1 General

Obtain the energy average sound pressure level using a single microphone moved from position to position, an array of fixed microphones or a continuously moving microphone.

4.2.2 Minimum separation distances for microphone positions

The following separation distances are minimum values and shall be exceeded where possible:

a) 0,7 m between fixed microphone positions;

b) 0,7 m between any microphone position and the room boundaries;

c) 0,7 m between any microphone position and any diffusers;

d) 1,0 m between any microphone position and the test element;

e) 1,0 m between any microphone position and the sound source.

4.2.3 Averaging times

4.2.3.1 Fixed microphone positions

At each individual microphone position, the averaging time shall be at least 6 s for each frequency band, with centre frequencies in the frequency range of 100 Hz to 400 Hz. For bands of higher frequencies, it is permissible to decrease the time to not less than 4 s.

4.2.3.2 Continuously moving microphone

The averaging time shall cover a whole number of traverses and shall not be less than 30 s. Using a moving loudspeaker, the measurement period shall equal the time of movement of the loudspeaker which shall be at least 30 s.

4.2.4 Energy average sound pressure level

4.2.4.1 Fixed microphone positions

The energy average sound pressure level is determined using Equation (1).

$$L = 10\lg\frac{p_1^2 + p_2^2 + \ldots + p_n^2}{np_0^2} \tag{1}$$

where

$p_1, p_2, \ldots, p_n$ are root-mean-square (r.m.s.) sound pressures at n different positions in the room.

In practice, the sound pressure levels are usually measured and the energy average level, L, shall be determined using Equation (2).

$$L = 10\lg\frac{1}{n}\sum_{j=1}^{n}10^{L_j/10} \tag{2}$$

where

$L_1, L_2, \ldots, L_n$ are the sound pressure levels at n different positions in the room.