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Acoustics — Laboratory measurement of sound insulation of building elements —

Part 1: Application rules for specific products

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*Acoustique — Mesurage en laboratoire de l'isolation acoustique des
éléments de construction —
Partie 1: Règles d'application pour produits particuliers*

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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 2, *Building acoustics*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 126, *Acoustic properties of building elements and of buildings*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 10140-1:2016), which has been technically revised.

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

- all references in the text have been updated;
- in [Clause 2](#), the normative references have been updated;
- former Clause G.6, "Additional information", has been removed;
- [H.6.2.2](#) has been edited;
- in [Annex K](#), rooflights have been added.

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](#)).

This document specifies the application rules for specific elements and products, including specific requirements for the preparation and mounting of the test elements, and for the 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 ISO 10140-4 and ISO 10140-5 where appropriate. For elements and products without a specific application rule described in this document, it is possible to apply ISO 10140-2 and ISO 10140-3. ISO 10140-4 contains basic measurement techniques and processes. ISO 10140-5 contains the requirements for test facilities and equipment. For the structure of ISO 10140 (all parts), see [Table 1](#).

ISO 10140 (all parts) was developed 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. ISO 10140 (all parts) aims at presenting a well-written and arranged format for laboratory measurements.

This document is planned to be updated 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: <ul style="list-style-type: none"> — 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 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.	<ul style="list-style-type: none"> — 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 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.	<ul style="list-style-type: none"> — 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.	<ul style="list-style-type: none"> — 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).	<p>Test facilities, design criteria:</p> <ul style="list-style-type: none"> — volumes, dimensions; — flanking transmission; — laboratory loss factor; — maximum achievable sound reduction index; — reverberation time; — influence of lack of diffusivity in the laboratory. <p>Test openings:</p> <ul style="list-style-type: none"> — standard openings for walls and floors; — other openings (windows, doors, small technical elements); — filler walls in general. <p>Requirements for equipment:</p> <ul style="list-style-type: none"> — loudspeakers, number, positions; — tapping machine and other impact sources; — measurement equipment. <p>Reference constructions:</p> <ul style="list-style-type: none"> — basic elements for airborne and impact insulation improvement; — corresponding reference performance curves.

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Acoustics — Laboratory measurement of sound insulation of building elements —

Part 1: Application rules for specific products

1 Scope

This document specifies test requirements for the laboratory measurement of the sound insulation of building elements and products, including detailed requirements for the preparation and mounting of the test elements, and for the operating and test conditions. It also specifies the applicable quantities, and provides additional test information for reporting.

The general procedures for airborne and impact sound insulation measurements are given in ISO 10140-2 and ISO 10140-3, respectively.

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 717-1, *Acoustics — Rating of sound insulation in buildings and of building elements — Part 1: Airborne sound insulation* <https://standards.iteh.ai/catalog/standards/sist/0bd797be-6548-42f9-9523-c8c0f00b6daf/iso-fdis-10140-1>

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 10140-4, *Acoustics — Laboratory measurement of sound insulation of building elements — Part 4: Measurement procedures and requirements*

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

ISO 12999-1, *Acoustics — Determination and application of measurement uncertainties in building acoustics — Part 1: Sound insulation*

ISO 16940, *Glass in building — Glazing and airborne sound insulation — Measurement of the mechanical impedance of laminated glass*

EN 572-1, *Glass in building — Basic soda lime silicate glass products — Part 1: Definitions and general physical and mechanical properties*

EN 572-2, *Glass in building — Basic soda lime silicate glass products — Part 2: Float glass*

3 Terms and definitions

No terms and definitions are listed in this document.

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

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

4 General

General requirements regarding boundary conditions and mounting of the test element in the laboratory are specified in ISO 10140-2, ISO 10140-3 and ISO 10140-5. Additional and more detailed requirements regarding preparation, mounting and the operating conditions, as well as conditioning, are specified in [Annexes A, B, C, D, E, F, G, H, I, J](#) and [K](#).

NOTE For products not covered in [Annexes A, B, C, D, E, F, G, H, I, J](#) or [K](#), a new annex can be added in subsequent revisions, based on available knowledge and practice. The preferred structure of these annexes is specified in [Clause 5](#).

When testing in accordance with ISO 10140 (all parts), this document shall always be checked for requirements relating to specific elements and products, and [Annexes A](#) to [K](#) shall be implemented, as appropriate. The basic conditions specified in ISO 10140-2 or ISO 10140-3 shall always be followed.

5 Structure of application rules for specific products

The structure and contents of [Annexes A, B, C, D, E, F, G, H, I, J](#) and [K](#) is detailed in this clause. The purpose of these annexes is to describe boundary, mounting and operating conditions for specific elements, products or groups of products. For some elements or products, certain items might not be relevant. Future extensions or updates of the annexes as well as future annexes with application rules for new specific products, are intended to adopt the same structure.

- a) General: <https://standards.iteh.ai/catalog/standards/sist/0bd797be-6548-42f9-9523-a8c0f0b6daf/iso-fdis-10140-1>
- 1) definition of the element/product it applies to;
 - 2) quantities measured (if needed);
 - 3) reference to test method(s).
- b) Test element:
- 1) size of the test opening and the test element;
 - 2) number of test elements.
- c) Boundary and mounting conditions (should be applied before installation):
- 1) boundary conditions, e.g. filler wall, element boundaries;
 - 2) mounting positions;
 - 3) installation of the test element in the test opening.
- d) Test and operating conditions (should be applied after installation):
- 1) operating conditions, e.g. open/close before test;
 - 2) conditioning/curing/drying;
 - 3) loading;
 - 4) environmental conditions.
- e) Test report.

- f) Additional information: if necessary, any information additional to the information that is required in basic ISO 10140-2 and ISO 10140-3.

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Annex A (normative)

Walls — Airborne sound insulation

A.1 General

For walls and other partitions, ISO 10140-2 is applicable. This annex is applicable to lightweight twin leaf partitions, such as those constructed of gypsum boards.

The quantity determined is the sound reduction index, R , as a function of frequency. The definition of R is specified in ISO 10140-2.

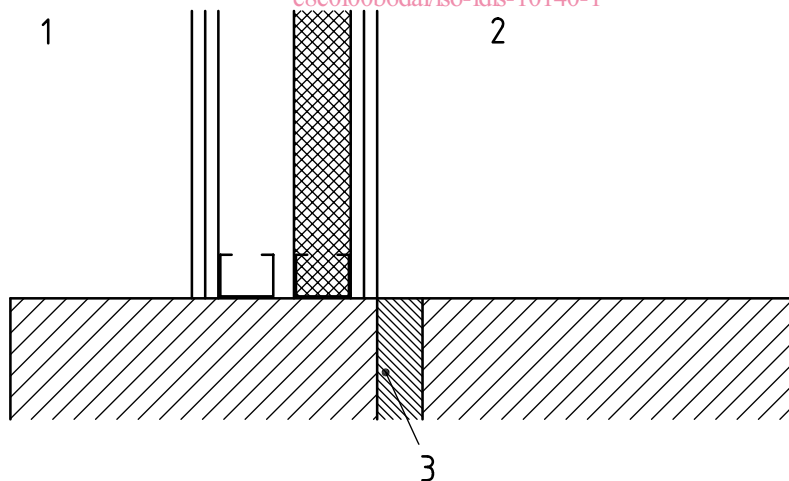
The general guidelines in the relevant clauses of the basic ISO 10140-2 shall always be followed.

A.2 Test element

The test opening for walls should be approximately 10 m².

A.3 Boundary and mounting conditions

The sound reduction index of lightweight twin leaf partitions (e.g. twin leaf gypsum board walls) is influenced by the mounting conditions in the test opening of the laboratory. Important installation parameters include the niche depth and the position of the partition in relation to the acoustic break in the test aperture.



Key

- 1 source room
- 2 receiving room
- 3 acoustic break of the laboratory

Figure A.1 — Example of the position of the test element relative to the acoustic break of the laboratory

To improve the reproducibility between laboratories and facilitate comparison of sound reduction indices for different lightweight double walls, the twin leaf partition shall not be mounted across the

acoustic break of the laboratory, but both leaves should be mounted on the same side of the break, as indicated in [Figure A.1](#). The aperture should meet the requirements in ISO 10140-2.

Other mounting conditions may be used but shall be fully described in the test report.

NOTE 1 Mounting the lightweight partition with one leaf on one side and the other leaf on the other side of the acoustic break can result in higher values for the sound reduction index.

NOTE 2 Other mounting conditions can be suitable for certain types of twin leaf walls, for example walls for semi-detached houses where the leaves are vibrationally uncoupled (for example on separate foundations). In such cases, the wall leaves can be mounted on each side of the acoustic break.

A.4 Test and operating conditions

The guidelines given in ISO 10140-2 shall be followed.

A.5 Test report

The requirements for the test report are specified in ISO 10140-2.

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Annex B (normative)

Doors — Airborne sound insulation

B.1 General

This annex is applicable to internal and external doors (including door sets).

The quantity determined is the sound reduction index, R , as a function of frequency. The definition of R is specified in ISO 10140-2.

The general guidelines in the relevant clauses of the basic ISO 10140-2 shall always be followed.

NOTE For a definition of door, see ISO 1804 and EN 12519.

B.2 Test element

For most doors, a test opening with an area of less than 10 m² is needed. The area of the test element, S , is the area of the opening in the filler wall required to accommodate the door.

B.3 Boundary and mounting conditions

The test opening for doors shall be arranged such that the lower edge is situated near to the level of the floor of the test rooms and such that conditions in the building are reproduced. The door shall be installed for test such that it can be opened and closed in a normal manner.

B.4 Test and operating conditions

In order to soften and break in any seals or sealing mechanisms, the door shall be opened and closed at least five times immediately before testing.

B.5 Test report

The requirements for the test report are specified in ISO 10140-2.

Annex C (normative)

Windows — Airborne sound insulation

C.1 General

This annex is applicable to windows.

The quantity determined is the sound reduction index, R , as a function of frequency. The definition of R is specified in ISO 10140-2.

The general guidelines in the relevant clauses of ISO 10140-2 shall always be followed.

NOTE For a definition of window (terminology), see EN 12519.

C.2 Test element

The preferred dimensions of the test opening for a window are 1 250 mm × 1 500 mm as for the specific small-sized test opening described in ISO 10140-5, but variations from this size can be necessary in recognition of national building practice. For windows, the test opening may be staggered as shown in ISO 10140-5:—, Figure 3. In the case of a window assembly, dimensions may be chosen as representative of the assembly used in practical circumstances. For windows, the area, S , is the area of the opening in the filler wall required to accommodate the test element.

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C.3 Boundary and mounting conditions

The installation of a window assembly shall be as similar as possible to the method which would be used in practice. When the window is mounted in the test opening, the niches on both sides of the windows shall have different depths, preferably in a ratio of about 2:1, unless this conflicts with the particular design of the window. However, it is expected that results obtained with niche depths of different ratios would differ.

The gap between the window and the test opening (about 10 mm to 13 mm around the window when mounted in the test opening) should be filled with absorbing material (for example mineral wool) and made airtight using an elastic sealant on both sides or in accordance with the manufacturer's instructions.

If the test element is intended to be readily openable, it shall be installed for the test in such that a way it can be opened and closed in a normal manner.

C.4 Test and operating conditions

C.4.1 Conditioning

The sound insulation of certain glazing systems or elements, especially those incorporating laminated glass, can depend on the room temperature during the measurements. The temperature of both rooms used for measuring the sound insulation should be $(20 \pm 3) ^\circ\text{C}$. The test elements should be stored for 24 h at the test temperature. In addition, it can be advantageous to make measurements at temperatures similar to those for which the test element is designed.

C.4.2 Operation

If the test element is intended to be openable, it shall be opened and closed at least five times immediately before testing.

C.5 Test report

The requirements for the test report are specified in ISO 10140-2.

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Annex D (normative)

Glazing — Airborne sound insulation

D.1 General

This annex is applicable to glazing.

The quantity determined is the sound reduction index, R , as a function of frequency. The definition of R is specified in ISO 10140-2.

The general guidelines in the relevant clauses of ISO 10140-2 shall always be followed.

NOTE For a definition of glass (terminology), see EN 12758.

D.2 Test element

The dimensions of the test opening for glazing shall be 1 250 mm × 1 500 mm with an allowable tolerance on each dimension of ± 50 mm, preferably maintaining the same aspect ratio. For glazing, the test opening shall be staggered on both sides and on the top by a distance of between 60 mm and 65 mm. The glazing shall be mounted in the smaller opening as shown in [Figure D.1](#). For glazing, the area, S , is the area of the opening in the filler wall required to accommodate the test element.

The specific small-sized test opening described in ISO 10140-5:—, Figure 3, fulfils these criteria, and a test opening in accordance with ISO 10140-5:—, 4.3.3, shall be used.

NOTE Details of the measurement conditions for glazing are prescribed in order to ensure the best possible comparison between results obtained by different laboratories.

D.3 Boundary and mounting conditions

The glazing shall be installed into the test opening such that the niches on both sides of the pane have different depths with a ratio of 2:1. A gap of about 10 mm shall remain between the pane and the reveal of the test opening. This gap shall be filled with a type of putty, which shall be tested as described below. To fix the glazing, two wooden beads (25 mm × 25 mm) shall be used (see [Figure D.1](#)). The space between the glazing and the wooden beads shall be filled with putty about 5 mm thick. The beads shall cover not more than 15 mm and not less than 12 mm of the glass¹⁾.

The putty used for filling the 10 mm gap between the perimeter of the glazing and the reveal of the test opening, and the 5 mm gap between the glazing and the wooden beads shall be qualified by the following test method. A single soda-lime/silica glass pane (float, density 2 500 kg/m³, modulus of elasticity $E = 7 \times 10^4$ MPa) with a thickness of $(10 \pm 0,3)$ mm and dimensions of 1 230 mm × 1 480 mm shall be mounted with this putty in accordance with [Figure D.1](#). The airborne sound reduction index shall be determined in one-third octave bands in the frequency range from 1 600 Hz to 3 150 Hz. The first measurement shall begin not later than 1 h after mounting. The results shall be as follows, to within $\pm 2,0$ dB:

- 1 600 Hz: $R = 31,3$ dB;
- 2 000 Hz: $R = 35,6$ dB;

1) This method of mounting and sealing a glass pane into the test opening is given as a practical, quick and reproducible solution, although this is not the type of mounting in practice.