
**Acoustics — Laboratory measurement of
sound insulation of building elements —**

Part 1:

Application rules for specific products

*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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 10140-1 was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 2, *Building acoustics*.

This first edition of ISO 10140-1, together with ISO 10140-2, ISO 10140-3, ISO 10140-4 and ISO 10140-5, cancels and replaces ISO 140-1:1997, ISO 140-3:1995, ISO 140-6:1998, ISO 140-8:1997, ISO 140-10:1991, ISO 140-11:2005 and ISO 140-16:2006, which have been technically revised.

It also incorporates the Amendments ISO 140-1:1997/Amd.1:2004 and ISO 140-3:1995/Amd.1:2004.

ISO 10140 consists of the following parts, under the general title *Acoustics — Laboratory measurement of sound insulation of building elements*:

- *Part 1: Application rules for specific products*
- *Part 2: Measurement of airborne sound insulation*
- *Part 3: Measurement of impact sound insulation*
- *Part 4: Measurement procedures and requirements*
- *Part 5: Requirements for test facilities and equipment*

Introduction

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

This part of ISO 10140 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 ISO 10140-4 and ISO 10140-5 where appropriate. For elements and products without a specific application rule described in this part of ISO 10140, 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 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 this part of ISO 10140 with application rules for other products. It is also intended to incorporate ISO 140-18 into ISO 10140 (all parts).

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 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)
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 1: Application rules for specific products

1 Scope

This part of ISO 10140 specifies test requirements for building elements and products, including detailed requirements for preparation, mounting, operating and test conditions, as well as applicable quantities and 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 referenced documents are indispensable for the application 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 717-1:1996, *Acoustics — Rating of sound insulation in buildings and of building elements — Part 1: Airborne sound insulation*

ISO 717-2, *Acoustics — Rating of sound insulation in buildings and of building elements — Part 2: Impact sound insulation*

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 10140-5:2010, *Acoustics — Laboratory measurement of sound insulation of building elements — Part 5: Requirements for test facilities and equipments*

3 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 operating conditions, and conditioning are given in Annexes A, B, C, D, E, F, G, H and I.

NOTE For products which are not covered by Annexes A, B, C, D, E, F, G, H or I, a new annex can be added, based on available knowledge and practice. The preferred structure of annexes is specified in Clause 4.

When testing in accordance with ISO 10140 (all parts), this part of ISO 10140 shall always be checked for requirements relating to specific elements and products. The basic conditions specified in ISO 10140-2 or ISO 10140-3 shall always be followed.

4 Structure of application rules for specific products

To extend or update the Annexes A, B, C, D, E, F, G, H and I, or to prepare a new annex with application rules for specific products, the required contents are listed below. For some elements or products, certain items might not be relevant. The purpose is to describe boundary, mounting and operating conditions for specific elements, products or groups of products.

- a) Application:
 - 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.

Annex A (normative)

Walls — Airborne sound insulation

A.1 Application

For walls and other partitions, ISO 10140-2 applies. This annex applies 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 given in ISO 10140-2.

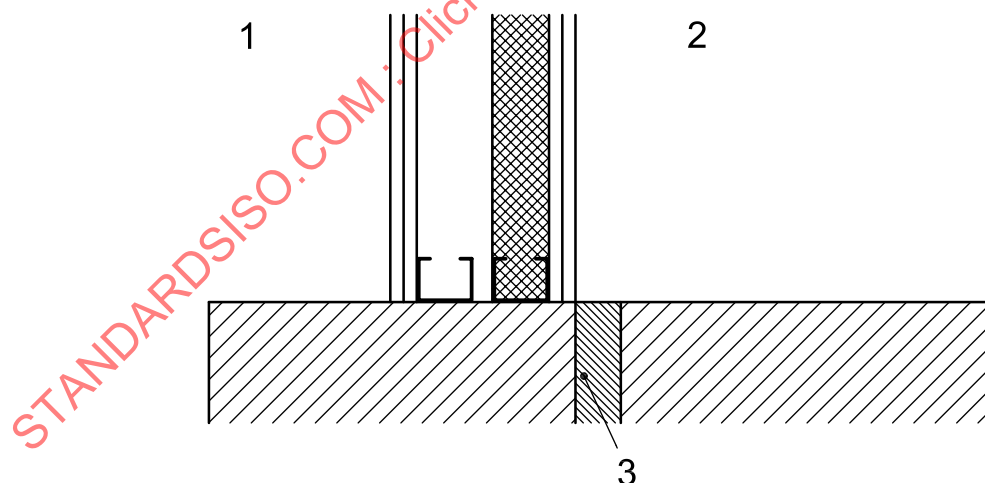
The general guidelines in the relevant clauses of the basic ISO 10140-2 shall always be followed.

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 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 test and operating conditions are given in ISO 10140-2.

A.5 Test report

The test report is given in ISO 10140-2.

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Annex B (normative)

Doors — Airborne sound insulation

B.1 Application

This annex applies 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 given 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 the normal manner.

B.4 Test and operating conditions

The door shall be opened and closed at least five times immediately before testing.

B.5 Test report

The test report is given in ISO 10140-2.

Annex C (normative)

Windows — Airborne sound insulation

C.1 Application

This annex applies to windows.

The quantity determined is the sound reduction index, R , as a function of frequency. The definition of R is given 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 Figure 3 of ISO 10140-5:2010. 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.

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 the 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 test report is given in ISO 10140-2.

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Annex D (normative)

Glazing — Airborne sound insulation

D.1 Application

This annex applies to glazing.

The quantity determined is the sound reduction index, R , as a function of frequency. The definition of R is given 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 $1\,250\text{ mm} \times 1\,500\text{ mm}$ with an allowable tolerance on each dimension of $\pm 50\text{ mm}$, 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 10140-5:2010, Figure 3, fulfils these criteria, and a test opening in accordance with ISO 10140-5:2010, 3.3.2, 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 ($25\text{ mm} \times 25\text{ mm}$) 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 $2\,500\text{ kg/m}^3$, modulus of elasticity $E = 7 \times 10^4\text{ MPa}$) with a thickness of $(10 \pm 0,3)\text{ mm}$ and dimensions of $1\,230\text{ mm} \times 1\,480\text{ mm}$ 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 $\pm 2,0\text{ dB}$:

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.

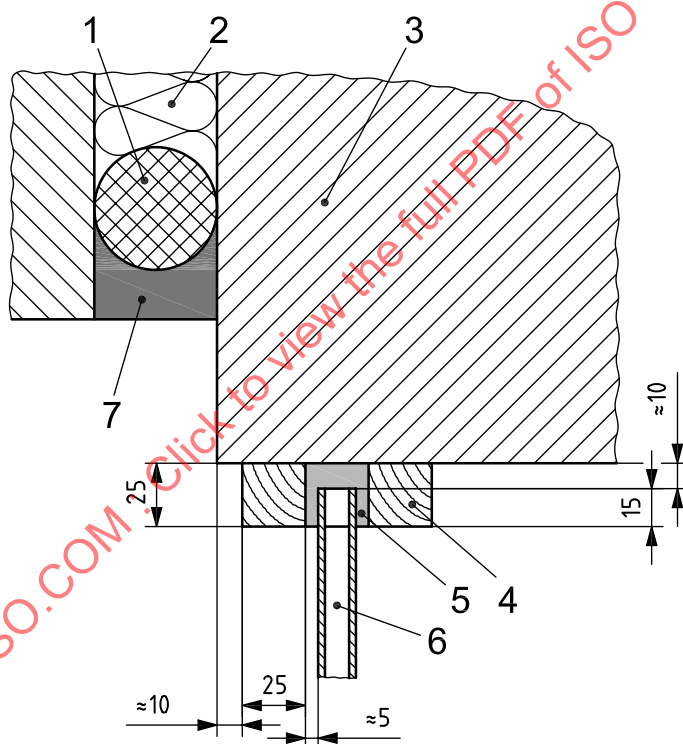
- 1 600 Hz: $R = 31,3$ dB;
- 2 000 Hz: $R = 35,6$ dB;
- 2 500 Hz: $R = 39,2$ dB;
- 3 150 Hz: $R = 42,9$ dB.

A second measurement shall be taken about 24 h later in order to make sure that no hardening process is influencing the measurement. No systematic deviation average, ΔR (mean of the four ΔR values), greater than 0,5 dB is permitted.

NOTE Perennator TX 2001 S has been shown to fulfil these conditions²⁾.

The sound insulation measured for a type of glazing does not necessarily represent the sound insulation of a window with that glazing. Preferably, therefore, the complete window should be measured as well to obtain information on the sound insulation of the window and not only the glazing.

Dimensions in millimetres



Key

- | | | | |
|---|-------------------|---|--|
| 1 | compressible seal | 5 | putty |
| 2 | mineral wool | 6 | glass pane |
| 3 | wall | 7 | resilient material (acoustically reflective) |
| 4 | wooden beading | | |

NOTE This figure shows (as an example) a double-glazed pane installed directly into the (smaller) aperture of a double-filler wall (for more details, see ISO 10140-5:2010, 3.3.2).

Figure D.1 — Example of installation of glass pane

2) Perennator TX 2001 S is an example of a suitable product available commercially. This information is given for the convenience of users of this part of ISO 10140 and does not constitute an endorsement by ISO of this product.

D.4 Test and operating conditions

The sound insulation of certain glazing systems or elements, especially those incorporating laminated glass, can be dependent on the room temperature during the measurements. It is recommended that the sound insulation measurements on such test elements be made at $(20 \pm 3) ^\circ\text{C}$ in both rooms. 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.

D.5 Test report

The test report is given in ISO 10140-2.

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Annex E (normative)

Small technical elements — Airborne sound insulation

E.1 Application

This annex applies to small technical elements, for instance air intakes and other elements smaller than 1 m², such as profiles and shutter boxes.

The acoustic performance of the element is expressed in the element-normalized level difference, $D_{n,e}$ per unit, as defined in ISO 10140-2.

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

For small technical elements, the sound reduction index is less suitable as a descriptor because the area of the test element is not normally well defined and the performance is not necessarily proportional to the area of the test element. Therefore, the performance is expressed as a normalized level difference for a specific unit. Furthermore, due to the small dimensions and mounting conditions, the direct environment around the test element and nearby objects can have a large influence on the results and should therefore be carefully specified.

E.2 Test element

E.2.1 General

Ensure that the test element is installed in a manner representative of field practice using normal connections and sealing conditions at the perimeter and at joints within the unit.

The building elements are small and, in combination with the spatial variations of the sound fields, this leads to significant dependency on their position; it is therefore recommended more than one position of the test element be used (see E.2.2).

In order to achieve a realistic wall thickness around the element, it may be practical or necessary to either increase or decrease the thickness of the partition wall in the area around the element (see E.2.3 and E.2.4).

When a small building unit is mounted near one or more reflecting planes, the sound transmission can differ appreciably from that obtained when the unit is mounted through a partition, but away from any adjoining room surface. Therefore, mount the equipment selected for testing through the partition in positions representative of normal usage. If natural corners or edges are not available in the test opening, it is essential to simulate such mounting conditions by attaching reflective panels at right angles to the partition wall, as described in E.2.5.

E.2.2 Number of positions

Three positions should be used for the mounting of the test element in the partition wall. These positions shall either be simulated, as described in E.2.5, or they shall be located at least 1,2 m from each other.

A dependency on position also occurs for apparently equivalent corners; this makes it necessary to use more than one corner.

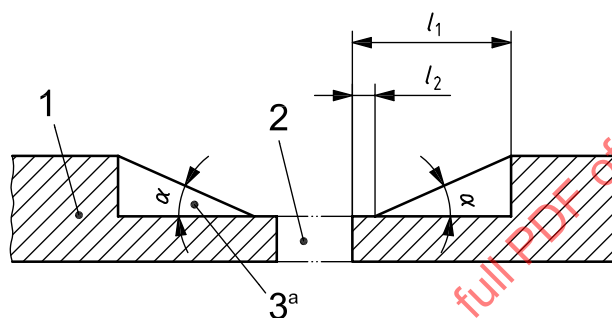
NOTE When simulating corner or edge positions by attaching reflective panels, it is possible to achieve the necessary position averaging by changing the locations and orientations of the reflective panels while the test element stays in the same position.

E.2.3 Local increase of wall thickness

Instead of changing the thickness of the complete partition wall, simulate various wall thicknesses by adding extra panels with a mass per unit area of more than 10 kg/m^2 to the original partition construction. The edges of such additional panels shall be at least 0,5 m from any part of the test element.

E.2.4 Local decrease of wall thickness

If a thick partition wall is needed to achieve a sufficiently high flanking transmission loss, create a realistic wall thickness around the test device by locally reducing the thickness using panels. This shall be done in accordance with Figure E.1.



Key

- 1 partition between test rooms
- 2 test element
- 3 auxiliary transition panels

^a The panels shall be sealed with tape along the edges.

Figure E.1 — Local decrease of wall thickness

The following relations shall hold:

- a) $l_1 > 0,6 \text{ m}$;
- b) $l_2 > 0,1 \text{ m}$; if $l_2 > 0,5 \text{ m}$ in every direction, no smooth transition of thickness is necessary;
- c) $\alpha < 30^\circ$.

E.2.5 Central, corner and edge positions

E.2.5.1 Equipment used away from walls

Install equipment mounted through a partition but normally located away from an adjoining wall, floor or ceiling in such a manner that no part is within 1,00 m of a surface at right angles to the mounting surface; 0,85 m is sufficient, if several elements are tested at the same time.

E.2.5.2 Equipment used near an edge

Locate equipment mounted through a partition, and normally located near an adjoining wall, floor or ceiling, and away from a corner, at least 1,00 m (0,85 m if several elements are tested at the same time) from the

nearest wall not being a part of the edge. Unless otherwise specified by the manufacturer, locate the edge of the equipment 0,1 m from the edge of the wall.

E.2.5.3 Equipment used near a corner

Locate equipment mounted through a partition and normally located near a corner at a distance from the corner which should be representative of typical use, as recommended by the manufacturer.

E.2.5.4 Simulation of corner or edge positions

The simulation of a corner is shown in Figure E.2. To simulate an edge, it is sufficient to use only one panel, the dimensions of which shall be at least $1,2\text{ m} \times 2,4\text{ m}$. The panels shall not be mounted parallel to the boundary surfaces of the room. If it is necessary to use additional panels in both the source room and the receiving room, ensure that the locations and orientations of the panels are the same in both rooms.

The mass per unit area of the panels shall exceed 7 kg/m^2 . Above 100 Hz, the sound absorption coefficient shall be less than 0,1.

Seal the connections between the panels and the partition wall with, for example, a heavy adhesive tape. As the mounting of additional panels to the partition wall can influence its transmission characteristics, include the various panel arrangements in the measurements of the flanking transmission.

Dimensions in metres

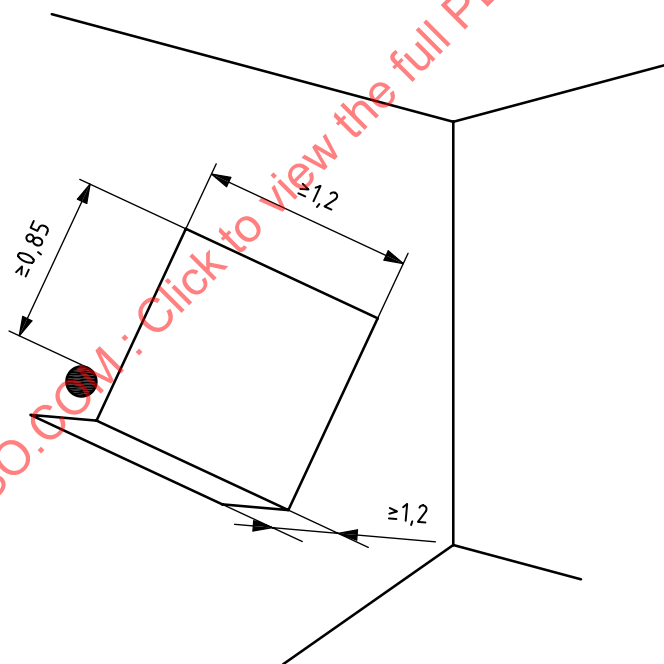


Figure E.2 — Drawing indicating simulation of a corner position by attaching reflective panels at right angles to the partition wall mounted in the test opening

E.3 Boundary and mounting conditions

E.3.1 Transfer air devices

Install the test elements in a manner representative of field practice and in typical locations with respect to the room surfaces, as given in the installation rules above. Mount transfer air devices which are normally mounted near an adjoining ceiling in a position close to a reflective surface at right angles to the partition, but at least

1,00 m (0,85 m if several elements are tested at the same time) from any corner. The distance between the closest part of the device and the adjoining surface shall be 0,1 m. Accessories that are normally used shall be included. Position and fix these accessories in accordance with the manufacturer's instructions.

For devices which can be used in several different positions, carry out measurements with at least an edge present in both rooms.

If the device is continuously adjustable to various wall thicknesses, ensure that the tests comprise at least the two extreme wall thicknesses for which the device is stated to be suitable.

E.3.2 Electrical raceways

Install the test element in a manner representative of field practice and in typical locations with respect to the room surfaces. Mount raceways which are normally mounted directly on walls on a reflective surface at right angles to the partition and according to the manufacturer's directions. Include accessories normally used. Install these accessories according to the manufacturer's instructions.

Install the test element with an exposed continuous duct length of at least 2 m, both in the source and in the receiver room. Provide the exposed duct ends with standard end covers.

Soundproofing accessories used in installations through partition walls are often available in raceways. To test practical sealing and insulating properties of such soundproofing accessories, it is recommended that the raceway be filled to its rated capacity with cables.

NOTE The acoustic performance can vary with the number of cables.

If the edge mounting is simulated with additional panels, ensure that the panel length is at least as long as the duct length.

E.4 Test and operating conditions

For transfer air devices, if the device is provided with some air-flow control, ensure that the equipment is operated in a specified manner typical of normal usage. The fully open condition should be included amongst the tests.

E.5 Test report

The test report is given in ISO 10140-2. The following additional information shall also be reported:

- a) a detailed description of the corners or edges used, being normally available or simulated;
- b) a detailed description of the methods used to increase or decrease the wall thickness in order to install the test element.

Annex F (normative)

Floors — Airborne and impact sound insulation

F.1 Application

This annex applies to floors.

The quantity determined is the sound reduction index, R , as a function of frequency or the normalized impact sound pressure level, L_n , as a function of frequency. The definitions of R and L_n are given in ISO 10140-2 and ISO 10140-3, respectively.

The general guidelines in the relevant clauses of ISO 10140-2 and ISO 10140-3 shall always be followed.

F.2 Test element

The test opening for floors should be between 10 m² and 20 m².

F.3 Boundary and mounting conditions

Follow the guidelines given in ISO 10140-2 and ISO 10140-3.

F.4 Test and operating conditions

Follow the guidelines given in ISO 10140-2 and ISO 10140-3.

F.5 Test report

The test report is given in ISO 10140-2 and ISO 10140-3.

Annex G (normative)

Acoustical linings — Improvement of airborne sound insulation

G.1 Application

This annex applies to acoustical linings on walls and floors.

The quantity determined is the sound reduction improvement index, ΔR , in decibels, which is defined as the difference between the sound reduction indices of the basic element with and without the lining for each one-third octave band:

$$\Delta R = R_{\text{with}} - R_{\text{without}}$$

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

NOTE 1 The sound reduction improvement of a lining can be different for direct and flanking sound transmission as well as for airborne and impact sound excitation. The method described in this part of ISO 10140 yields the sound reduction improvement for direct airborne sound transmission.

NOTE 2 This annex does not deal with the sound reduction improvement by linings on flexible lightweight structures, such as timber frame floors or double-leaf gypsum board walls.

NOTE 3 The sound reduction index of walls/floors and acoustical linings are characterized separately for the comparison of products. In addition, the European calculation model for the acoustic performance of buildings from the performance of elements distinguishes the sound reduction index of a wall (or floor) and the improvement of the sound reduction index by an additional lining. The laboratory measurement of this sound reduction improvement is the subject of this annex.

G.2 Test element

The test element (i.e. the acoustical lining) and the basic structure shall cover the whole test opening.

Corresponding to the application of the lining, the constructions specified in ISO 10140-5:2010, Annex B, shall be used as standard basic elements. The basic element is defined as the wall or ceiling (floor) to which an additional lining is fixed (see ISO 10140-5:2010, Annex B).

Characterizing a lining alone requires that its acoustic performance be independent from the basic structure to which it is fixed. This is fulfilled when the mass per unit area of the basic structure is much larger than the surface mass of the lining, when the critical frequency of the basic structure is below the measured frequency range and the structural coupling between the lining and the basic structure is weak. If the actual situation differs from these conditions, the effect of the lining is to some extent dependent on the properties of the basic structure. The independent characterization of the acoustic performance of a lining thus requires heavyweight elements. However, a lot of practical applications involve various lightweight elements. As a practical compromise, the following are descriptions of different types of test.

- a) In all cases, the lining shall be applied to either a heavy massive wall of about 350 kg/m² with its critical frequency around 125 Hz or to the standard concrete floor in accordance with ISO 10140-5:2010, Annex B, depending on the use of the lining. The measured improvement due to the lining is given as a frequency spectrum and as a single-number improvement value according to this annex. As it is based on mean basic element characteristics, the results are largely independent of the particular features of the test facility and the basic element used, and thus characterize the lining in the most general way.

- b) If the performance of a lining on a lightweight solid wall is of interest, a standard lightweight wall of about 70 kg/m^2 with a critical frequency around 500 Hz shall be used in accordance with ISO 10140-5:2010, Annex B. The results shall be given as a frequency spectrum and as a single-number improvement value according to this annex. The critical frequency can strongly influence the improvement by the lining, hence the results are not likely to be transferable to other basic constructions. However, using the weighting procedure in this annex, the influences of the particular test facility and basic construction on the single-number ratings are minimized, thus making the results comparable between different laboratories.
- c) In order to specify the effect of linings in specific situations, other basic structures can be used in addition to those specified for the general characterization of the product. As no average properties of the basic element are available in this case, single-number results can only be given in terms of the direct difference between the weighted sound reduction indices with and without lining (subsequently called "direct difference of the weighted sound reduction indices"). These improvement values include the particular features of the laboratory and the basic element, thus allowing a comparison of different linings under these particular conditions.

G.3 Boundary and mounting conditions

The lining shall be mounted to the basic element as in practice. The lining shall be linked to the flanking parts of the laboratory as in practice, but there shall be no strong coupling between the basic element and the lining via the edges of the laboratory flanking elements. Either the flanking parts of the laboratory shall be sufficiently heavy (for details, see ISO 10140-5) or there shall be a structural break in the flanking elements, positioned between the basic element and the lining, or the lining, shall not be rigidly fixed along its edges to the flanking elements (i.e. use a flexible sealant where necessary).

G.4 Test and operating conditions

The curing period of the lining and its fixing shall be long enough to reach final conditions. The sound reduction index of the basic element shall not change during the two measurements, hence it shall either be at its final condition or the two measurements shall be carried out within a sufficiently short time interval. For masonry and concrete, this requires a curing period of not less than two weeks. Alternatively, the time lag between the two sound reduction measurements shall not exceed one third of the curing time elapsed before the first measurement.

NOTE For example, when the two measurements are carried out within one day, they can be started not less than three days after the end of construction of the concrete or masonry basic element.

G.5 Test report

The test report is given in ISO 10140-2. The following additional information shall also be reported:

- a) a detailed description of the basic element (dimensions, mass per unit area, materials), details of fixing into the test facility (boundary conditions of the element) and a reference to the corresponding standard basic element from ISO 10140-5:2010, Annex B, or a statement that it is not one of the standard basic elements;
- b) a detailed description of the lining and its fixing to the basic element;
- c) R_{with} , R_{without} and ΔR as specified in G.6. For standard basic elements in accordance with ISO 10140-5:2010, B.2, ISO 10140-5:2010, B.3, and ISO 10140-5:2010, B.4: ΔR_{w} , $\Delta(R_{\text{w}} + C)$ and $\Delta(R_{\text{w}} + C_{\text{tr}})$ as specified in G.6, with an index in accordance with G.6.1.2 and G.6.1.3, indicating the basic element used. For other basic elements: $\Delta R_{\text{w,direct}}$, $\Delta(R_{\text{w}} + C)_{\text{direct}}$ and $\Delta(R_{\text{w}} + C_{\text{tr}})_{\text{direct}}$ in accordance with G.6.1.3, without any further index for the type of basic element;
- d) the total loss factor of the basic element with lining, if measured, as a table of one-third octave band values.

G.6 Additional information

G.6.1 Single-number rating for improvement of sound reduction index by linings

G.6.1.1 General

All results of R_{with} , R_{without} and ΔR shall be given as one-third octave band levels to one decimal place. If required, octave band values ΔR_{Oct} , in decibels, shall be calculated from the corresponding one-third octave band values, ΔR_n , using Equation (G.1).

$$\Delta R_{\text{Oct}} = -10 \lg \left(\sum_{n=1}^3 \frac{10^{(-\Delta R_n / 10)}}{3} \right) \quad (\text{G.1})$$

R_{with} , R_{without} and ΔR shall be given as frequency spectra in a table as follows:

- R_{with} and R_{without} as one-third octave band level spectra;
- ΔR as one-third octave and as octave band level spectra.

To evaluate the single-number rating, ΔR_w , from the one-third octave band ΔR values given to one decimal place, the measured values of the sound reduction improvement are used in conjunction with standard reference curves for the standard basic elements by calculation (see ISO 10140-5:2010, Annex B). The difference between the weighted sound reduction indices of the reference standard basic element with and without lining yields the weighted improvement of sound reduction index, ΔR_w , of the lining. A similar procedure is used for the A-weighted improvement of sound reduction indices of the lining, $\Delta(R_w + C)$ and $\Delta(R_w + C_{tr})$ (see ISO 717-1:1996, 4.5). To calculate the A-weighted sound reduction indices, with and without the lining, sound level spectra in accordance with ISO 717-1:1996, Table 4, or Table B.1 (extended frequency range), shall be used.

NOTE 1 The procedures for determination of single-number quantities are described in ISO 717. However, at the time of publication, ISO 717 has not been revised or amended to include a single-number rating for the improvement of the sound reduction index by linings. G.6.1 will be withdrawn once this takes place.

NOTE 2 To evaluate the single-number rating, ΔR_w , from the one-third octave band ΔR values, the same procedure is used as when evaluating the weighted improvement of impact sound insulation ΔL_w from the normalized impact sound pressure levels L_n according to ISO 717-2.

G.6.1.2 Quantities determined

The single-number ratings determined in accordance with this subclause are as given below.

- The weighted sound reduction improvement index, ΔR_w . The single-number rating calculated from the sound reduction improvement index, ΔR . An additional index indicates the standard basic element used: “heavy” for the heavyweight wall or floor and “light” for the lightweight wall in accordance with ISO 10140-5:2010, Annex B. For example: $\Delta R_{w,\text{heavy}}$.
- The direct difference of the weighted sound reduction indices, $\Delta R_{w,\text{direct}}$, in decibels: the difference of the weighted sound reduction indices of the basic element with and without lining under the particular conditions of the measurement (without generalization by means of a reference curve for the sound reduction of the basic element) as given by Equation (G.2):

$$\Delta R_{w,\text{direct}} = R_{w,\text{with}} - R_{w,\text{without}} \quad (\text{G.2})$$

G.6.1.3 Rating procedures

Take the one-third octave band sound reduction improvement index ΔR values, as measured. Add them to the reference values of the sound insulation index, $R_{\text{ref,without}}$, of the matching standard basic element as given in ISO 10140-5:2010, Annex B:

$$R_{\text{ref,with}} = R_{\text{ref,without}} + \Delta R \quad (\text{G.3})$$

Determine the weighted sound reduction indices $R_{\text{w,ref,with}}$ and $R_{\text{w,ref,without}}$ and the corresponding spectrum adaptation terms in accordance with ISO 717-1. The weighted improvement of sound reduction index is then given by Equation (G.4):

$$\Delta R_{\text{w}} = R_{\text{w,ref,with}} - R_{\text{w,ref,without}} \quad (\text{G.4})$$

The A-weighted improvement of sound reduction indices $\Delta(R_{\text{w}} + C)$, respectively $\Delta(R_{\text{w}} + C_{\text{tr}})$, are calculated in an equivalent way.

An additional index indicates the reference basic element used: “heavy” for the heavyweight wall and floor and “light” for the lightweight wall in accordance with ISO 10140-5:2010, Annex B. For example: $\Delta(R_{\text{w}} + C)_{\text{heavy}}$.

If basic elements besides the standard basic elements are used, the single-number ratings follow directly from the single-number ratings for that basic element with and without the tested acoustical lining according to the definition in G.6.1.2.

Annex H (normative)

Floor coverings — Improvement of impact sound insulation

H.1 Application

This annex applies to floor coverings intended to improve the impact sound insulation of floors.

The quantity determined is the improvement of impact sound insulation, ΔL , in decibels, as a function of frequency. ΔL is defined as the reduction in normalized impact sound pressure level resulting from the installation of the test floor covering on a specific reference floor, as given by Equation (H.1):

$$\Delta L = L_{n0} - L_n \quad (\text{H.1})$$

where

L_{n0} is the normalized impact sound pressure level of the reference floor without the floor covering;

L_n is the normalized impact sound pressure level of the reference floor with the floor covering.

If the reduction of impact sound pressure level is needed in octave bands, these values shall be calculated from the three one-third octave band values in each octave band using Equation (H.2):

$$\Delta L_{\text{oct}} = -10 \lg \left(\sum_{n=1}^3 \frac{10^{-\Delta L_{1/3\text{oct},n}/10}}{3} \right) \text{ dB} \quad (\text{H.2})$$

The reference floors are specified in ISO 10140-5:2010, Annex C; there is one heavyweight reference floor and three types of lightweight reference floors.

The general guidelines in the relevant clauses of the basic ISO 10140-3:2010 shall always be followed.

When it is necessary to specify the reference floor used in the measurement, ΔL_w , $\Delta L_{t,1,w}$, $\Delta L_{t,2,w}$ and $\Delta L_{t,3,w}$ should be used for the heavyweight reference floor and lightweight reference floors No. 1, No. 2 and No. 3, respectively.

NOTE If the receiving room absorption is unchanged during the test, it is assumed that the reduction in impact sound pressure level is equivalent to the reduction in normalized impact sound pressure level.

H.2 Test element

H.2.1 General

The reference floor on which the floor covering is installed shall be chosen from the heavyweight and lightweight reference floors specified in ISO 10140-5:2010, Annex C, and shall be installed in accordance with ISO 10140-3:2010, 6.2.1.

NOTE 1 An alternative test arrangement using a wooden mock-up floor assembly installed over the standard heavyweight reference floor can provide estimates of the impact sound improvement of floor coverings mounted on lightweight floor constructions in circumstances where it is not feasible to install the lightweight reference floor as specified in ISO 10140-5:2010, Annex G. Specific guidance for measurements using this wooden mock-up floor is given in H.6.2.

NOTE 2 In ISO 10140-3:2010, Annex A, an alternative method using a heavy/soft source suitable for simulation of sounds generated by such heavy and soft impacts as human footsteps or children jumping is specified.

Three categories of floor coverings are defined, for which different installation and testing procedures apply. These depend on both the category of floor covering and the type of reference floor on which it is tested.

Depending upon the type of floor covering, the test elements shall be either slightly larger than the tapping machine with supports or equal to the floor area.

When soft coverings are under test, the standard tapping machine shall fulfil special requirements given in ISO 10140-5:2010, E.1. Advice regarding the mounting of the standard tapping machine on soft floor coverings is given in ISO 10140-5:2010, E.1, and ISO 10140-3:2010, 5.1.

H.2.2 Classification of floor coverings

H.2.2.1 Category I — Small specimens

This category includes flexible coverings (plastics, rubber, cork, matting, or combinations thereof), which may be installed loosely or by adhesion to the floor surface

Install three or more samples, preferably of different production runs but from the same source. Each sample shall be large enough to support the whole tapping machine.

H.2.2.2 Category II — Large specimens

This category includes rigid homogeneous surface materials or complex floor coverings of which at least one constituent is rigid.

The specimen shall cover the whole surface from wall to wall, or at least 10 m² with a smaller dimension of at least 2,3 m.

H.2.2.3 Category III — Stretched materials

This category includes flexible coverings which cover the floor from wall to wall. Large specimens should be tested.

The specimen shall cover the whole surface from wall to wall, or at least 10 m² with a smaller dimension of at least 2,3 m.

H.2.2.4 Materials of uncertain classification

In the case of uncertainty, as to the appropriate category for a material, the testing laboratory decides whether small or large specimens should be tested.

H.3 Boundary and mounting conditions

See ISO 10140-3.

H.4 Test and operating conditions

H.4.1 Load

The assembled floor covering (category II materials) may be tested under load. A normal furnishing should be simulated with a uniformly distributed load of 20 kg/m² to 25 kg/m². The distributed load should be arranged with at least one weight per square metre of the flooring area.

For category III materials (stretched materials, including flexible coverings which cover the floor from wall to wall) large specimens should be tested, but loading is not required

H.4.2 Installation

Follow the manufacturer's installation instructions with careful attention to the edges of the test specimen.

H.4.3 Adhesive mounting

Floor coverings mounted with adhesive normally require adhesive over the entire surface. If the adhesive is applied in isolated patches, describe the exact procedure in the test report. Follow the manufacturer's instructions for use of the adhesive, particularly concerning the amount of adhesive and the bonding-time. The test report shall describe the type of adhesive and the bonding-time.

H.4.4 Curing

Do not test coverings such as cast *in situ* concrete floating slabs before the required curing period has passed. For example, three weeks are recommended for ordinary concrete.

H.4.5 Environmental conditions

For many floor coverings, the acoustic properties depend on temperature and humidity. The test report shall state the temperature at the centre of the upper floor surface and the humidity of the air in the same room as the covering. The floor temperature should lie within the range of 18 °C to 25 °C.

H.4.6 Position of the tapping machine

Guidance on adjustment of the falling height of the hammers of the tapping machine is given in ISO 10140-5:2010, Annex E. When situated on a specimen that does not cover the whole floor, the hammers shall touch the specimen at least 100 mm from the edges.

Each set of measurements on the bare floor and covered floor shall be made with as many tapping machine positions as necessary to yield a reliable mean value.

H.4.6.1 Floor coverings on a heavyweight reference floor

H.4.6.1.1 Testing floor coverings of category I

If the floor coverings are installed as small specimens on the reference floor, at least three specimens shall be used. The minimum size of each specimen shall be 650 mm × 350 mm. The number of tapping machine positions shall be the same as the number of specimens. The hammers shall impact the test specimen at least 100 mm from its edges. Place the tapping machine with its feet successively on each specimen of floor covering with all hammers impacting on the specimen in each case. Determine the normalized impact sound pressure level with floor covering, L_n (see ISO 10140-4:2010, 5.3). Repeat with the tapping machine on the uncovered floor using the same positions. Determine the normalized impact sound pressure level without floor covering, L_{n0} (see ISO 10140-4:2010, 5.3).

Calculate the reduction of impact sound pressure level (improvement of impact sound insulation) (see H.1).

Alternatively, the tapping machine can be placed on either side of each specimen and as close to it as possible, in which case the line of hammers shall be parallel to the long dimension of the specimen (see Figure H.3). For each specimen of floor covering, the impact sound pressure level corresponding to the uncovered floor is the arithmetic mean of the level determined for the two machine positions on either side of the specimen.

H.4.6.1.2 Testing floor coverings of category II or III

At least four tapping machine positions shall be used when measuring the reduction of transmitted impact noise by floor coverings on a heavyweight reference floor (see Figure H.1).

Determine the normalized impact sound pressure level with floor covering, L_n , and without the floor covering, L_{n0} , using the same positions for the tapping machine (see ISO 10140-4:2010, 5.3).

Calculate the reduction of impact sound pressure level (improvement of impact sound insulation) (see H.1).

H.4.6.2 Testing floor coverings on a lightweight reference floor

H.4.6.2.1 Testing floor coverings of category I

If installed as small specimens on the reference floor, there shall be at least three test specimens. The minimum size of each specimen is 650 mm × 350 mm. The number of tapping machine positions shall be the same as the number of specimens. The hammers shall impact the test specimen at least 100 mm from its edges. The line of hammers should be oriented at 45° to the direction of the beams, ribs or joists. The tapping machine shall be positioned so that at least one hammer is directly above a joist as shown in Figure H.2. Place the tapping machine with its feet successively on each specimen of floor covering with all hammers impacting on the test specimen in each case. Determine the normalized impact sound pressure level with floor covering, L_n (see ISO 10140-4:2010, 5.3). Repeat with the tapping machine on the uncovered floor using the same positions. Determine the normalized impact sound pressure level without floor covering, L_{n0} (see ISO 10140-4:2010, 5.3).

Alternatively, the tapping machine can be placed on either side of each specimen and as close to it as possible, in which case the line of hammers shall be parallel to the long dimension of the specimen (see Figure H.3). For each specimen of floor covering, the impact sound pressure level corresponding to the uncovered floor is the arithmetic mean of the level determined for the two machine positions on either side of the specimen.

Calculate the reduction of impact sound pressure level (improvement of impact sound insulation) (see H.1).

H.4.6.2.2 Testing floor coverings of category II or III

At least six tapping machine positions shall be used when measuring the reduction of transmitted impact noise by floor coverings on lightweight reference floors. The positions shall be randomly distributed on the floor under test. The line of hammers should be oriented at 45° to the direction of the beams, ribs or joists.

Determine the normalized impact sound pressure level with floor covering, L_n , and without floor covering, L_{n0} , using the same positions for the tapping machine (see ISO 10140-4:2010, 5.3).

Calculate the reduction of impact sound pressure level (improvement of impact sound insulation) (see H.1).

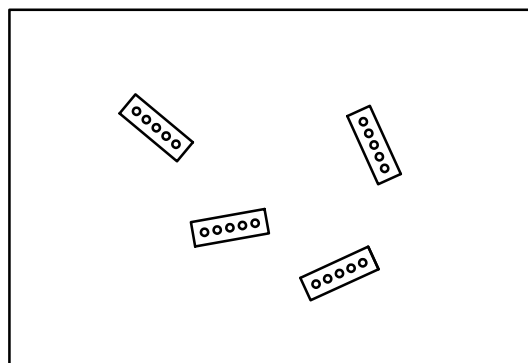


Figure H.1 — Typical locations for tapping machine for category II and III floor coverings on heavyweight reference floor

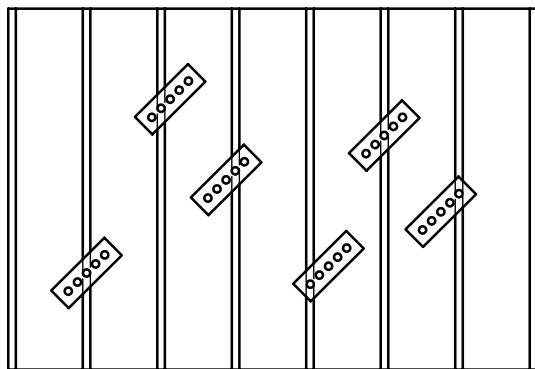
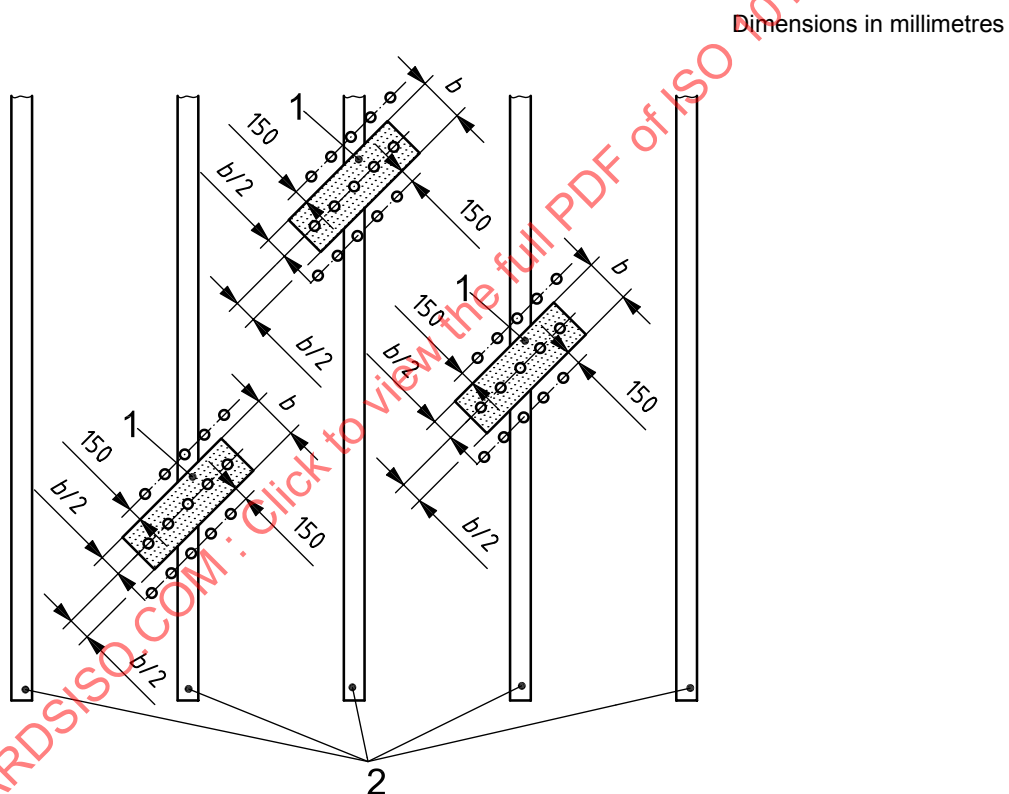


Figure H.2 — Typical locations for tapping machine for floor coverings on lightweight reference floor



Key

- 1 test specimen (category I)
- 2 joist
- b width of the test specimen

The shaded rectangles mark the test specimen positions and the set of small circles mark the position where the hammers of the tapping machine should strike the lightweight reference floor or the test specimens respectively.

Figure H.3 — Alternative arrangement for tapping machine with small specimens of category I floor coverings on a lightweight reference floor

H.5 Test report

See ISO 10140-3. The following additional information shall also be reported.

For laboratory measurement of the change of impact sound insulation due to floor covering, the test report shall also include the following:

- a) descriptions of the reference floor including type (heavyweight or lightweight type 1, 2, or 3), including dimensions, materials, surface mass, etc.;
- b) for the floor covering, the layers of multi-layered coverings and the adhesive, the names and addresses of the manufacturers, the commercial designation, and the source of supply of the test specimen;
- c) detailed description, including the type, mass, surface dimensions and thickness of the test specimens (under load where specified), with appropriate drawings where necessary;
- d) method of mounting, with particular reference to the adhesive, its mass per unit area and bonding time, and, in the case of floating slab floors, the curing time for the concrete;
- e) number, location and installation time of the loads, where used;
- f) material and dimensions and number of supports of the tapping machine;
- g) a statement as to whether the test specimen suffered visible damage during the test (for example compaction);

NOTE It is desirable that the tested specimen is retained in the laboratory for subsequent inspection.

- h) reduction in impact sound pressure level due to the floor covering under test, as a function of frequency, the weighted reduction of impact sound pressure level, ΔL_w , and the spectrum adaptation term;
- i) normalized impact sound pressure level of the bare reference floor used in the test, as a function of frequency, the weighted normalized impact sound pressure level and the related spectrum adaptation term of the reference floor with and without the floor covering under test: $L_{nw,r}$ and $C_{l,r}$ or $L_{nw,0}$ and $C_{l,0}$.

H.6 Additional information

H.6.1 Improvement with heavy/soft impact

Install the floor covering, in accordance with requirements of H.3, on a reference floor specified in ISO 10140-5:2010, Annex C.

Measure the maximum impact sound pressure level, $L_{i,Fmax,j}$, with and without the test floor covering.

NOTE The maximum impact sound pressure level, $L_{i,Fmax,j}$, is defined in ISO 10140-3:2010, Annex A.

From the results of measurements with and without floor covering under test, the reduction of impact sound pressure level (improvement of impact sound insulation), ΔL_r , in decibels shall be calculated as given by Equation (H.3).

$$\Delta L_r = L_{i,Fmax,0} - L_{i,Fmax} \quad (H.3)$$

where

$L_{i,Fmax,0}$ is the impact sound pressure level of the reference floor without floor covering;

$L_{i,Fmax}$ is the impact sound pressure level of the reference floor with floor covering.

H.6.2 Procedures using a wooden mock-up floor to determine the impact sound improvement of floor coverings when mounted on lightweight floor constructions

H.6.2.1 General

This method applies to all kinds of floor coverings. The results are only applicable to mounting conditions similar to those used in the test. To ensure that the results are applicable to the actual lightweight floor, the board material and thickness used in the mock-up floor should be similar to that of the actual lightweight floor. It is possible that when a different board material and thickness are used, the results only give an estimate of the improvement on the actual lightweight floor.

NOTE 1 There are two sound transmission paths to the receiving room. One is structure-borne sound via the feet of the top floor and the other is airborne sound from the source room through the concrete slab to the receiving room. In general, the structure-borne sound dominates, but, in some cases, particularly at high frequencies, the airborne path influences the result and causes an underestimate of the impact sound improvement of the structure-borne path. Some lightweight floors have very weak transmission via the structure-borne path, e.g. floors with independent ceilings or with ceilings suspended on resilient hangers and, in such cases, the results obtained using this annex can be misleading.

NOTE 2 The effect of a resilient floor covering depends on the resilience of the floor on which the covering is mounted. The stiffer the floor, the greater the improvement in impact sound insulation due to the floor covering. According to H.4.6.1, the floor covering can be mounted on a thick concrete slab, which can be considered as being infinitely stiff. The results are different if the floor covering is mounted on a lightweight floor. The purpose of this method is to provide an alternative to H.4.6.2 (for a laboratory where it is not feasible to install a lightweight reference floor) to simulate the effect of lightweight floor constructions by mounting the floor covering on a wooden assembly representative of the upper part of a typical lightweight floor construction. This resilient board is mounted on feet, which in turn rest on a subfloor identical to the heavyweight reference floor. The resilient board on its feet is designated "top floor" and together with the heavyweight reference floor, designated "subfloor", they constitute the "test floor".

H.6.2.2 Test arrangement

Requirements for the wooden mock-up floor and its installation are given in ISO 10140-5:2010, Annex G.

Optionally, the standard top floor described above in H.6.2.1 may be supplemented by other top floors simulating the upper part of arbitrary lightweight floors. This is done by replacing the 22 mm chipboard (particle board) by other boards or combinations thereof.

H.6.2.3 Preparation and installation of test specimen

During the test, the top floor shall be loaded with five weights of 20 kg to 25 kg each, plus the tapping machine. The positions should be fixed with one weight in the middle of the top floor, and the remaining four at corners 40 cm from the edges of the top floor. The loads shall be applied when measuring both with and without floor covering.

Parquet floors shall cover the whole top floor. Soft floor coverings shall be laid loosely on the top floor.

H.6.2.4 Test procedure

Follow the test procedure laid down in the main body of this annex, but use at least six positions for the tapping machine. The six positions shall be fixed. The same positions are used with and without the floor covering. Minimum distance to loads should be approximately 300 mm.

H.6.3 Expression of results

An example of the form for the expression of results obtained by laboratory measurements of the reduction of impact sound level by a floor covering according to this annex is given in Figure H.4. The user is allowed to copy this form.