INTERNATIONAL STANDARD

ISO 140-12

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Acoustics — Measurement of sound insulation in buildings and of building elements —

Part 12: Laboratory measurement of room-to-room airborne and impact sound insulation of an access floor

Acoustique — Mesurage de l'isolement acoustique des immeubles et des éléments de construction —

Partie 12: Mesurage en laboratoire de la transmission latérale entre deux pièces des bruits aériens et des bruits de choc par un plancher surélevé

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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 3.

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 member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 140 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 140-12 was prepared by the European Committee for Standardization (CEN) in collaboration with ISO Technical Committee TC 43, *Acoustics*, Subcommittee SC 2, *Building acoustics*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Throughout the text of this standard, read "...this European Standard..." to mean "...this International Standard...".

ISO 140 consists of the following parts, under the general title *Acoustics — Measurement of sound insulation in buildings and of building elements*:

— *Part 1: Requirements for laboratory test facilities with suppressed flanking transmission*

— *Part 2: Determination, verification and application of precision data*

— *Part 3: Laboratory measurements of airborne sound insulation of building elements*

— *Part 4: Field measurements of airborne sound insulation between rooms*

— *Part 5: Field measurements of airborne sound insulation of façade elements and façades*

— *Part 6: Laboratory measurements of impact sound insulation of floors*

— *Part 7: Field measurements of impact sound insulation of floors*

— *Part 8: Laboratory measurements of the reduction of transmitted impact noise by floor coverings on a solid standard floor*

— *Part 9: Laboratory measurement of room-to-room airborne sound insulation of a suspended ceiling with a plenum above it*

— *Part 10: Laboratory measurement of airborne sound insulation of small building elements*

— *Part 11: Measurement of impact sound improvement of light-weight floors*

— *Part 12: Laboratory measurement of room-to-room airborne and impact sound insulation of an access floor*

— *Part 13: Guidelines*

Contents

Foreword

The text of EN ISO 140-12:2000 has been prepared by Technical Committee CEN/TC 126 " Acoustic properties of building products and of buildings", the secretariat of which is held by AFNOR, in collaboration with Technical Committee ISO/TC 43 "Acoustics".

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 2000, and conflicting national standards shall be withdrawn at the latest by July 2000.

The present draft is a part of a series of standards whose list is given below :

EN ISO 140 "Acoustics - Measurement of sound insulation in buildings and of building elements"

— *Part 1 : Requirements for laboratory test facilities with suppressed flanking transmission (ISO 140-1:1997) ;*

— *Part 2 : Determination, verification and application of precision data (ISO 140-2:1991);*

— *Part 3 : Laboratory measurements of airborne sound insulation of building elements ;*

— *Part 4 : Field measurements of airborne sound insulation between rooms (ISO 140-4:1998);*

— *Part 5 : Field measurements of airborne sound insulation of façade elements and façades (ISO 140-5:1998);*

— *Part 6 : Laboratory measurements of impact sound insulation of floors (ISO 140-6:1998);*

— *Part 7 : Field measurements of impact sound insulation of floors (ISO 140-7:1998);*

— *Part 8 : Laboratory measurements of the reduction of transmitted impact noise by floor coverings on a heavyweight standard floor (ISO 140-8:1997);*

— *Part 9 : Laboratory measurements of room-to-room airborne sound insulation of a suspended ceiling with a plenum above it (ISO 140-9:1985);*

— *Part 10 : Laboratory measurement of airborne sound insulation of small building elements (ISO 140-10:1991);*

— *Part 12 : Laboratory measurement of room-to-room airborne and impact sound insulation of an access floor (ISO 140-12:2000).*

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This standard specifies a laboratory method to measure the airborne and impact sound insulation of an access floor with a plenum of defined height mounted below an acoustical barrier which separates two rooms of a specified test facility.

This method utilizes a laboratory space arranged in such a manner that it simulates a pair of horizontally adjacent, typical offices or rooms sharing a common access floor system, plenum space and a dividing wall. The dividing wall extends from the ceiling to the upperside of the floor system which at the junction is either continuous or discontinuous.

The quantities being measured are the airborne and impact sound insulation between two rooms of a specified test facility when the sound transmitted by paths other than the access floor and common plenum space is negligible. These quantities are called the normalized flanking level difference and the normalized flanking impact sound pressure level.

The method can be extended to the study of the additional sound insulation that can be achieved by auxiliary systems, such as material used either as plenum barriers or as backing for all of, or part of the floor.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 20140-2, *Acoustics - Measurement of sound insulation in buildings and of building elements - Part 2 : Determination, verification and application of precision data (ISO 140-2:1991).*

EN 20354, Ac*oustics - Measurement of sound absorption in a reverberation room (ISO 354:1985).*

EN 60651, *Sound level meters (IEC 60651).*

EN 60804, *Integrating-averaging sound level meters (IEC 60804).*

EN 61260, *Electroacoustics – Octave-band and fractional-octave-band filters (IEC 61260).*

EN ISO 140-1, *Acoustics - Measurement of sound insulation in buildings and of building elements - Part 1 : Requirements of laboratory test facilities with suppressed flanking transmission (ISO 140-1:1997).*

EN ISO 140-3:1995, *Acoustics - Measurement of sound insulation in buildings and of building elements - Part 3 : Laboratory measurements of airborne sound insulation of building elements (ISO 140-3:1995).*

EN ISO 140-6:1998, *Acoustics - Measurement of sound insulation in buildings and of building elements - Part 6 : Laboratory measurements of impact sound insulation of floors (ISO 140-6:1998).*

EN ISO 717-1, *Acoustics - Rating of sound insulation in buildings and of building elements - Part 1 : Airborne sound installation (ISO 717-1:1996).*

EN ISO 717-2, *Acoustics - Rating of sound insulation in buildings and of building elements - Part 2 : Impact sound insulation (ISO 717-2:1996).*

3 Definitions

For the purposes of this standard, the following definitions apply :

3.1
average sound pressure level in a room
10 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. This quantity is denoted by L and is expressed in decibels.

If a continuously moving microphone is used, L is determined by :

$$L = 10 \lg \frac{\frac{1}{T_m}\int_0^{T_m} p^2(t)\,dt}{p_0^2} \quad \text{dB} \tag{1}$$

where

p is the sound pressure in pascals ;

p_0 = 20 µPa is the reference sound pressure ;

T_m is the integration time in seconds.

If fixed microphone positions are used, L is determined by :

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

where

$p_1, p_2 \ldots p_n$ are r.m.s. sound pressures at n different positions in the room. In practice usually the sound pressure levels L_i are measured. In this case L is determined by :

$$L = 10 \lg \frac{1}{n}\sum_{i=1}^{n} 10^{L_i/10} \quad \text{dB} \tag{3}$$

where

L_i are the sound pressure levels L_1 to L_n at n different positions in the room.

3.2
flanking level difference
the difference in the space and time average sound pressure levels produced in two rooms by a sound source in one of the rooms resulting from the flanking transmission due to the tested element. This quantity is denoted by D_f and is expressed in decibels.

$$D_f = L_1 - L_2 \quad (4)$$

where

L_1 is the average sound pressure level in the source room in decibels;

L_2 is the average sound pressure level in the receiving room in decibels.

3.3
normalized flanking level difference
the flanking level difference corresponding to a reference value of absorption area in the receiving room. This quantity is denoted by $D_{n,f}$ and is expressed in decibels.

$$D_{n,f} = D_f - 10 \lg \frac{A}{A_0} \quad \text{dB} \quad (5)$$

where

A is the equivalent absorption area in the receiving room;

A_0 is the reference absorption area (for the laboratory, A_0 = 10 m²).

The maximum value of the normalized flanking level difference of the facility obtained according to 5.1.3 is noted $D_{n,f,max}$.

3.4
flanking impact sound pressure level
the average value of average sound pressure level in the receiving room produced by a standardized tapping machine operating at different positions on the element in the emission room, by the flanking transmission due to the tested element

$$L_f = 10 \lg \left(\frac{1}{n} \sum_i^n 10^{L_i/10} \right) \quad \text{dB} \quad (6)$$

where L_i is the average sound pressure level in the receiving room produced by the tapping machine at position i.

3.5
normalized flanking impact sound pressure level
the flanking impact sound pressure level corresponding to a reference value of absorption area in the receiving room. This quantity is denoted $L_{n,f}$ and is expressed in decibels.

$$L_{n,f} = L_f - 10 \lg \frac{A}{A_0} \quad \text{dB} \quad (7)$$

3.6
plenum space
the whole of the void below the access floor in both rooms in the test facility

4 Measuring equipment

The equipment shall be suitable for meeting the requirements of clause 6.

The tapping machine shall meet the requirements given in annex A of EN ISO 140-6:1998.

The sound level measurement equipment shall meet the requirements of a type 0 or 1 instrument according to EN 60651 and EN 60804.

The third-octave band filters shall meet the requirement of EN 61260.

The reverberation time measurement equipment shall meet the requirements of EN 20354.

NOTE Requirements for pattern evaluation and regular verification tests on the fulfilment of the equipment requirements should be considered. Recommendations on the extend of the evaluation and verification procedure are given for sound level meters in OIML R 58 and R 88, for the standard tapping machine those recommendations are given in annex A of EN ISO 140-6:1996.

5 Test arrangement

5.1 Requirements for the laboratory

The laboratory test facility is divided into two rooms of approximately equal volumes by a wall. The essential features of the test facility are specified in 5.1.1 to 5.1.6 and are shown schematically in figure 1.

5.1.1 Construction of the test facility

The ground plan of the test facility shall be rectangular. A vibration break shall be provided in the floor of the facility between the two rooms in order to ensure that flanking transmission by the floor is negligible.

Vibration breaks in the outer walls and the roof are recommended.

The level of the background noise shall be sufficiently low to permit a measurement of the sound transmitted from the source room, taking into consideration the power output of the source room and the isolating properties of the specimens for which the laboratory is intended. The reverberation time in the rooms should not be excessively long. Where the reverberation time at low frequencies exceeds 2 s or is less than 1 s, a check should be made to determine whether the measured quantities depend on the reverberation time. When such a dependence is found (even with diffusers in the rooms) the room shall be modified to reduce the reverberation time to values between 1 s and not higher than :

$$2\left(\frac{V}{50}\right)^{2/3}\ \text{s}$$

at low test frequencies (V is the room volume in cubic metres).

These requirements refer to the test rooms without test object and a heavy dividing wall.

NOTE For the purposes of determining the reverberation time of each room, a suitable impervious plenum barrier should be installed between the foot of the dividing wall and the floor.

5.1.2 Dimensions of the test facility

The width of the test facility shall be (4,5 ± 0,5) m and the height from the ceiling to the upperside of the face of the access floor shall be at least 2,3 m when all dimensions are measured internally.

The volume V of each room shall be at least 50 m^3. It is recommended that the dividing wall is positioned such that the two rooms volumes differ by at least 10 % when the access floor is in position.

The minimum depth in both room shall be 3,5 m.

NOTE 1 If large variations of the sound pressure levels in the room space indicate standing wave structures, diffusing elements should be installed in the rooms. The positions and the necessary number of elements should be evaluated by experiment with the goal that the measured quantities are not influenced when further diffusing elements are installed.

NOTE 2 The requirements and recommendations, as stated above, are intended to improve reproducibility between measurements made by different organizations on similar materials.

5.1.3 Dividing wall

The dividing wall is the acoustical barrier which divides the test facility above the access floor into two rooms. The dividing wall shall be mounted in such a way that it is not loading the access floor. The gap between the dividing wall and the access floor is sealed with a flexible material. The thickness of the wall shall be less than 200 mm or tapered to 200 mm. The tapering between the widest part of the wall and the floor shall be achieved by means of an angle not exceeding 30° from the vertical. The construction of the dividing wall shall be such that $D_{n,f,max}$ is 10 dB higher than the $D_{n,f}$ of any floor which is likely to be tested.

NOTE For checking the airborne sound insulation of the facility, a suitable plenum barrier of construction similar to the dividing wall can be installed between the foot of the dividing wall and the floor, without the access floor.

5.1.4 Access floor height

The access floor height as measured from the surface of the access floor to the surface of the floor of the test facility shall be 150 mm. If this height is not possible because of constructive reasons, a height as near to 150 mm as possible shall be used. Other heights may be tested if need be.

5.1.5 Plenum lining

One sidewall and both endwalls of the plenum shall be lined with suitable sound-absorbing material. This material shall have such properties that when tested as a plane absorber in accordance with EN 20354, it has sound absorption coefficients not less than those shown in the following table.

Octave band centre frequency in Hz	125	250	500	1 000	2 000	4 000
Sound absorption coefficient, α_s	0,65	0,80	0,80	0,80	0,80	0,80

For the other sidewall and the floor, the sound absorption coefficient shall be less than 0,10 at all frequencies given in the table.

For practical purposes, the thickness of the lining shall not exceed 150 mm.

5.2 Installation of access floor

The area of a floor should be equal to the area given by the length and width of the test facility.

If for practical reasons, the length of the test object should be less than that of the facility, the test object shall have a length of at least 3,5 m and be rigidly terminated.