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

Part 7:

**Field measurements of impact sound insulation
of floors**

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

*Partie 7: Mesurage in situ de la transmission des bruits de choc par les
planchers*



Foreword

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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.

International Standard ISO 140-7 was prepared by Technical Committee ISO/TC 43, *Acoustics*, Subcommittee SC 2, *Building acoustics*.

This second edition cancels and replaces the first edition (ISO 140-7:1978), which has been technically revised.

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 of laboratory test facilities with suppressed flanking transmission*
- *Part 2: Determination, verification and application of precision data*
- *Part 3: Laboratory measurement 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*

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- *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 heavyweight 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*

Annexes A and B form an integral part of this part of ISO 140. Annexes C to E are for information only.

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

Part 7:

Field measurements of impact sound insulation of floors

1 Scope

This part of ISO 140 specifies field methods for measuring the impact sound insulation properties of building floors by using a standard tapping machine. The method is applicable to bare floors and also to floors with coverings.

The results obtained can be used to compare the impact sound insulation properties of floors and to compare the apparent impact sound insulation of floors with specified requirements.

NOTE 1 Laboratory measurements of impact sound insulation of floors are dealt with in ISO 140-6.

NOTE 2 Laboratory measurements of the reduction of transmitted impact noise by floor coverings on a heavyweight standard floor are dealt with in ISO 140-8.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 140. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 140 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

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

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 354:1985, *Acoustics — Measurement of sound absorption in a reverberation room.*

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

IEC 60651:1979, *Sound level meters.*

IEC 60804:1985, *Integrating-averaging sound level meters.*

IEC 60942: 1988, *Sound calibrators.*

IEC 61260:1995, *Electroacoustics — Octave band filters and fractional — Octave band filters.*

3 Definitions

For the purposes of this part of ISO 140, the definitions given in ISO 140-3 and the following definitions apply.

3.1 average sound pressure level in a room, L : Ten times the logarithm to the base 10 of the ratio of the space and time average of the sound pressure squared 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 (wall, etc.) is of significant influence; it is expressed in decibels.

In practice, usually the sound pressure levels L_j are measured. In this case L is determined by

$$L = 10 \lg \left(\frac{1}{n} \sum_{j=1}^n 10^{L_j/10} \right) \text{ dB} \quad \dots (1)$$

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

3.2 impact sound pressure level, L_i : Average sound pressure level in a one-third-octave band in the receiving room when the floor under test is excited by the standardized impact sound source; it is expressed in decibels.

3.3 normalized impact sound pressure level, L'_n : Impact sound pressure level L_i increased by a correction term which is given in decibels, being ten times the logarithm to the base 10 of the ratio of the measured equivalent absorption area A of the receiving room to the reference equivalent absorption area A_0 ; it is expressed in decibels:

$$L'_n = L_i + 10 \lg \frac{A}{A_0} \text{ dB} \quad \dots (2)$$

with $A_0 = 10 \text{ m}^2$.

3.4 standardized impact sound pressure level, L'_{nT} : Impact sound pressure level L_i reduced by a correction term which is given in decibels, being ten times the logarithm to the base 10 of the ratio of the measured reverberation time T of the receiving room to the reference reverberation time T_0 ; it is expressed in decibels:

$$L'_{nT} = L_i - 10 \lg \frac{T}{T_0} \text{ dB} \quad \dots (3)$$

NOTE 1 For dwellings T_0 equals 0,5 s.

NOTE 2 The standardizing of the impact sound pressure level to a reverberation time of 0,5 s takes into account that in dwellings the reverberation time has been found to be (nearly independent of the volume and of the frequency) equal to 0,5 s.

NOTE 3 The standardizing of the impact sound pressure level to the reverberation time of $T_0 = 0,5 \text{ s}$ is equivalent to standardizing the impact sound pressure level to a reference absorption area of

$$A_0 = 0,32V$$

where

A_0 is the reference absorption area, in square metres;

V is the volume of the receiving room, in cubic metres.

3.5 reduction of impact sound pressure level, $\Delta L'$: Difference, in decibels, between the average sound pressure levels in the receiving room before and after the installation of, for example, a floor covering.

NOTE See ISO 140-8 for further information.

4 Equipment

The equipment shall comply with the requirements of clause 5.

The standard tapping machine shall meet the requirements given in annex A.

The accuracy of the sound level measurement equipment shall comply with the requirements of accuracy class 0 or 1 defined in IEC 60651 and IEC 60804. If not otherwise stated by the equipment manufacturer, the complete measuring system including the microphone shall be adjusted before each measurement using a sound calibrator which complies with the requirements of accuracy class 1 defined in IEC 60942. For sound level meters calibrated for measurements in sound fields of progressive plane waves, corrections for the diffuse sound field shall be applied.

The filters shall comply with the requirements defined in IEC 61260.

The reverberation time measurement equipment shall comply with the requirements defined in ISO 354.

NOTE For pattern evaluation (type testing) and regular verification tests, recommended procedures for sound level meters are given in OIML R 58^[1] and OIML R 88^[2].

5 Test procedure and evaluation

5.1 General

The field measurements of impact sound insulation of floors shall be made in one-third-octave bands unless octave band measurements have been agreed upon. When the results from octave band measurements are converted to single-number quantities, these results are not directly comparable with those from one-third-octave band measurements. The procedure for octave band measurements is specified in annex B.

5.2 Generation of sound field

The impact sound shall be generated by the tapping machine (see clause 4).

The tapping machine shall be placed in at least four different positions randomly distributed on the floor under test. The distance of the tapping machine from the edges of the floor shall be at least 0,5 m. In the case of anisotropic floor constructions (with ribs, beams, etc.), more positions may be necessary. The hammer connecting line should be orientated at 45° to the direction of the beams or ribs.

The impact sound pressure levels may reveal a time dependency after the tapping is started. In such a case the measurements should not begin until the noise level has become steady. If stable conditions are not reached after 5 min, then the measurements should be carried out over a well-defined measurement period. The measurement period shall be reported.

When floors with soft coverings are under test, the standard tapping machine shall fulfil the special requirements given in annex A. Advice regarding the mounting of the standard tapping machine on soft floor coverings is given also in annex A.

5.3 Measurement of impact sound pressure level

5.3.1 General

Obtain the impact sound pressure level by using a single microphone moved from position to position, or by an array of fixed microphones, or by a continuously moving or oscillating microphone. The sound pressure levels at the different microphone positions shall be averaged on an energy basis [see equation (1)] for all positions of the tapping machine.