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Indian Standard

MEASUREMENT OF SOUND INSULATION IN BUILDINGS AND OF BUILDING ELEMENTS

PART VII FIELD MEASUREMENTS OF IMPACT SOUND INSULATION OF FLOORS

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(*Continued on page* 2)

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MEASUREMENT OF SOUND INSULATION IN BUILDINGS AND OF BUILDING ELEMENTS

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0. FOREWORD

0.1 This Indian Standard (Part VII) was adopted by the Indian Standards Institution on 3 December 1981, after the draft finalized by the Acoustics Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

0.2 This standard which covers field measurements of impact sound insulation of floors, is one of the series of Indian Standards on measurement of sound insulation in buildings and of building elements. Other standards in this series are:

Part I	Requirements for laboratories
Part II	Statement of precision requirements
Part III	Laboratory measurements of airborne sound insulation of building elements
Part IV	Field measurements of airborne sound insulation between rooms
Part V	Field measurements of airborne sound insulation of facade elements and facades
Part VI	Laboratory measurements of impact sound insulation of floors
Part VIII	Laboratory measurements of the reduction of transmitted impact noise by floors coverings on a standard floor

0.3 The purpose of this standard is:

a) To give a procedure to measure the impact sound insulation between two rooms in buildings, thus making it possible to check whether the desired acoustical conditions have been obtained; and

b) To give a field procedure to determine whether building elements have met specifications and to check whether faults have occurred during construction.

0.4 While preparing this standard, assistance has been derived from ISO/DIS 140/VII 'Measurement of sound insulation in buildings and of building elements: Part VII Field measurements of impact sound insulation of floors', issued by the International Organization for Standardization.

0.5 In reporting the result of a test made in accordance with this standard, if the final value observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960*.

1. SCOPE

1.1 This standard (Part VII) specifies field method for measuring the impact sound insulation properties of floors between two rooms by using a standard tapping machine and for determining the protection afforded by floors to the occupants of the building.

2. TERMINOLOGY

2.0 For the purpose of this standard, the terms and definitions given in IS : 1885 (Part III/Sec 8)-1974† and IS : 9901 (Part VI)-1961‡ shall apply in addition to the following terms.

2.1 Standardized Impact Sound Pressure Level — The impact sound pressure level L_i, reduced by a correction term which is given in decibels, being ten times the common logarithm of the ratio between the measured reverberation time T of the receiving room and the reference reverberation time T_0. This quantity is denoted by $L'_n T$:

$$L'_n T = L_i - 10 \log_{10} \frac{T}{T_0} dB$$

For dwellings T_0 is given by

$$T_0 = 0{\cdot}5s$$

NOTE 1 — The standardizing of the impact sound pressure level to a reverberation time of 0·5s takes into account that in dwellings the reverberation time has been found to be (nearly independent of the volume and of frequency) equal to 0·5s.

*Rules for rounding off numerical values (*revised*).

†Electrotechnical vocabulary: Part III Acoustics, Section 8 Architectural acoustics.

‡Measurement of sound insulation in buildings and of building elements: Part VI Laboratory measurements of impact sound insulation of floors.

NOTE 2 — The standardizing of the impact sound pressure level to the reverberation time of $T_0 = 0{\cdot}5$s is equivalent to standardizing the impact sound pressure level to an equivalent absorption area of

$$A_0 = 0{\cdot}32\ V$$

where

A_0 = absorption area, in square metres; and

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

2.2 Reduction of Impact Sound Pressure Level (Improvement of Impact Sound Insulation) — The difference between the average sound pressure levels in the receiving room before and after installation of, for example, a floor covering [*see* IS : 9901 (Part VIII)-1981*].

3. EQUIPMENT

3.1 The standardized impact sound source, that is the tapping machine, should conform to IS : 9901 (Part VI)-1981†. Further the equipment shall be suitable for meeting the requirements of **5**.

4. TEST CONDITIONS

4.1 Test Arrangement — For the test arrangement to be used in the field, it is not possible to standardize the area of the test specimen and the volume and shape of the rooms.

4.2 The normalized impact sound pressure level is used when the impact sound insulation properties of a building is to be determined. And the standardized impact sound pressure level is used when the protection afforded to the occupants of the building is to be determined.

5. TEST PROCEDURE AND EVALUATION

5.1 Generation of Sound Field

5.1.1 The impact sound shall be generated by the tapping machine (*see* **3**). The position of the tapping machine shall be in accordance with **5.5**.

5.2 Measurement of Impact Sound Pressure Level — Provision of **5.2** of IS : 9901 (Part VI)-1981† shall apply.

*Measurement of sound insulation in buildings and of building elements: Part VIII Laboratory measurements of the reduction of transmitted impact noise by floors coverings on a standard floor.

†Measurement of sound insulation in buildings and of building elements: Part VI Laboratory measurements of impact sound insulation of floors.

5.3 Frequency Range of Measurements

5.3.1 The sound pressure level should be measured by using third-octave or octave band filters. The discrimination characteristics of the filters should be in accordance with IS : 6964-1973*. Third-octave band filters having at least the following centre frequencies should be used:

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

If octave band filters are used, as a minimum the series beginning with centre frequency 125 Hz and ending at 2 000 Hz should be used.

NOTE 1 — Use of lower frequency is dependent on the distribution of natural frequency.

NOTE 2 — The minimum reverberation times for the empty room are adjusted to a volume of 180 m^3. For other volumes, these times should be multiplied by the factor $(V/180)^{\frac{1}{3}}$ (V being the volume of the room expressed in cubic metres) except at high frequencies, where the air absorption is the predominant factor influencing the decay rate.

5.4 Measurement and Evaluation of the Equivalent Absorption Area — Provision of **5.4** of IS : 9901 (Part VI)-1981† shall apply.

5.5 Position of the Tapping Machine — Provision of **5.5** of IS : 9901 (Part VI)-1981† shall apply.

5.6 Measurement Procedure — Provision of **5.6** of IS : 9901 (Part VI)-1981† shall apply.

6. PRECISION

6.1 It is required that the measurement procedure should give satisfactory repeatability. For the instrumentation and in specific cases for the complete measurement condition, this can be determined in accordance with the method shown in IS : 9901 (Part II)-1981‡.

6.2 It is recommended that different organizations in the same country periodically perform comparison measurements on the same test specimen to check the repeatability and the reproducibility of their test procedures.

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*Octave, half-octave and third-octave band filters for analysis of sound and vibrations.

†Measurement of sound insulation in buildings and of building elements : Part VI Laboratory measurements of impact sound insulation of floors.

‡Measurement of sound insulation in buildings and of building elements : Part II Statement of precision requirements.

7. EXPRESSION OF RESULTS

7.1 For the statement of the impact sound insulation of the test specimen, the normalized impact sound pressure level should be given at all frequencies, preferably in the form of a curve.

7.2 For the statement of the protection afforded to the occupants of the building, the standardized impact sound pressure level should be given at all frequencies, preferably in the form of a curve.

7.3 The band width used for the measurement and for the presentation shall be stated in every graph or table. If a numerical adjustment is made from third-octave to octave bands, the graph or table of results shall bear the caption octave band levels calculated from third-octave band measurements.

7.4 For graphs with the level in decibels plotted against frequency on a logarithmic scale, the length for a 10/1 frequency ratio should be equal to the length for 10 dB, 25 dB or 50 dB on the ordinate scale (*see* IS : 8159-1976*).

8. TEST REPORT

8.1 The test report should state:

a) Name of organization that has performed the measurements;

b) Date of test;

c) Description of the floor construction, with sectional drawing including the size and the flanking construction;

d) Volume of the receiving room;

e) Type of filters used;

f) Either normalized impact sound pressure level of test specimen or standardized impact sound pressure level in the receiving room, whichever is appropriate, as a function of frequency;

g) Brief description of details of procedure and equipment (*see* **5.6**); and

h) Limit of measurement in case the sound pressure level in any band is not measurable on account of background noise (acoustical or electrical) or transmission of airborne noise.

With respect to the evaluation of a single value from the curve L_n (f), *see* Indian Standard Specification for rating of sound insulation for dwellings (*under preparation*).

*Scales and sizes for plotting frequency characteristics and polar diagrams.

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	Unit	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	Unit	Symbol
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	Unit	Symbol	Definition
Force	newton	N	1 N = 1 $kg.m/s^2$
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2