IS : 9901 (Part I) - 1981
(Reaffirmed 1995)

Indian Standard

MEASUREMENT OF SOUND INSULATION IN BUILDINGS AND OF BUILDING ELEMENTS

PART I REQUIREMENTS FOR LABORATORIES

(First Reprint OCTOBER 1997)

UDC 699.844 : 727.57

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 2 *March* 1982

Indian Standard

MEASUREMENT OF SOUND INSULATION IN BUILDINGS AND OF BUILDING ELEMENTS

PART I REQUIREMENTS FOR LABORATORIES

Acoustics Sectional Committee, LTDC 5

Chairman

DR M. PANCHOLY
Emeritus Scientist
National Physical Laboratory, New Delhi

Members	*Representing*
DR K. ACHYUTHAN	Ministry of Defence (R & D)
SHRI R. S. VOHRA (*Alternate*)	
SHRI SANDEEP AHUJA	Ahuja Radios, New Delhi
SHRI S. P. JERATH (*Alternate*)	
COL T. R. BHALOTRA	Ministry of Defence (DGI)
LT COL KISHANLAL (*Alternate*)	
DR A. F. CHHAPGAR	National Physical Laboratory (CSIR), New Delhi
DR P. N. GUPTA	Department of Electronics, New Delhi
SHRI TEK CHANDANI (*Alternate*)	
SHRI R. K. JAIN	Electronic Component Industries Association, (ELCINA), New Delhi
SHRI L. K. VISHWANATH (*Alternate*)	
SHRI K. S. KALIDAS	Railway Board, New Delhi
SHRI V. JAYARAMAN (*Alternate*)	
SHRI J. S. MONGA	Botton Industrial Corporation, New Delhi
SHRI M. S. MONGA (*Alternate*)	
SHRI B. C. MUKHERJEE	National Test House, Calcutta
SHRI J. K. BHATTACHARYA (*Alternate*)	
DR (KM) SHAILAJA NIKAM	All India Institute of Speech & Hearing, Mysore
SHRI K. D. PAVATE	Central Electronics Engineering Research Institute (CSIR), Pilani
SHRI M. R. KAPOOR (*Alternate*)	
SHRI A. V. RAMANAN	Films Division, Bombay
RESEARCH ENGINEER	Directorate General of All India Radio, New Delhi
SHRI M. SANKARALINGAM	Directorate General of Supplies & Disposals, New Delhi
SHRI R. S. ARORA (*Alternate*)	
SHRI SARWAN KUMAR	Directorate General of Civil Aviation, New Delhi
SHRI K. CHANDRACHUDAN (*Alternate*)	

(*Continued on page* 2)

(*Continued from page* 1)

Members	*Representing*
SHRI M. N. SHUKLA SHRI S. K. TANDON (*Alternate*)	Posts and Telegraphs Board, New Delhi
SUPERINTENDENT SURVEYOR OF WORKS (FOOD)	Central Public Works Department, New Delhi
SHRI L. K. VISHWANATH	Peico Electronics & Electricals Ltd, Bombay *and* The Radio Electronics and Television Manufacturers' Association, Bombay
SHRI K. D'SA (*Alternate*)	
SHRI R. C. JAIN, Head (Electronics)	Director General, BIS (*Ex-officio Member*)

Secretary

SHRI PAVAN KUMAR
Assistant Director (Electronics), BIS

Indian Standard

MEASUREMENT OF SOUND INSULATION IN BUILDINGS AND OF BUILDING ELEMENTS

PART I REQUIREMENTS FOR LABORATORIES

0. FOREWORD

0.1 This Indian Standard (Part I) was adopted by the Indian Standards Institution on 25 August 1981, after the draft finalized by the Acoustics Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

0.2 The purpose of this standard is to provide a coordinated statement of requirements for laboratories used for measurement of sound insulation of building elements.

0.3 Laboratories for the determination of airborne and impact sound reduction of structural elements should be constructed in such a way that the measurement results can be directly or indirectly applied to the conditions in actual buildings.

0.4 In the case of laboratories with suppressed radiation from flanking elements, the behaviour of the element in the actual building can be concluded only indirectly and only in some cases from the measurement results in the laboratory. The test rooms described in this standard belong to this group of laboratories. This group includes laboratories where the specimen is structurally isolated from both test rooms, and laboratories where the test specimen is connected to one or both of the test rooms, the radiation from flanking elements being reduced either by use of heavy elements or by use of appropriate linings.

A direct application of the results of laboratory measurements is possible if the flanking transmission is included. For this purpose, the test rooms and coupling of test specimen to the flanking construction must resemble the situation in usual buildings (laboratories with flanking transmission or mockups). The requirements for such laboratories are under consideration.

0.5 Measurement of sound insulation in buildings and of building elements are being covered by a series of standards consisting of the following individual parts:

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 VII	Field 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.

0.6 While preparing this standard, assistance has been derived from ISO/DIS 140/I 'Measurement of sound insulation in buildings and of building elements: Part I Requirements for laboratories' issued by the International Organization for Standardization.

0.7 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 I) specifies requirements for laboratories for sound insulation measurements of building elements. It applies to laboratories with suppressed radiation from flanking elements.

2. TERMINOLOGY

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

3. LABORATORIES FOR AIRBORNE SOUND INSULATION MEASUREMENTS UNDER DIFFUSE CONDITIONS

3.0 The laboratory test facility consists of two adjacent reverberant rooms with a test opening between them in which the test specimen is inserted.

*Rules for rounding off numerical values (*revised*).
†Electrotechnical vocabulary : Part III Acoustics, Sec 8 Architectural acoustics.

3.1 Rooms

3.1.1 Volumes and shapes of the two test rooms should not be exactly the same. A difference in room volumes of at least 10 percent is recommended. The volumes of the test rooms should be atleast 50m³. The ratios of the room dimensions should be so chosen that the natural frequencies in the low-frequency region are spaced as uniformly as possible. If necessary, diffusing elements should be installed in the rooms to obtain a diffused sound field.

NOTE 1 — The volume of the rooms and the size of the test opening as well as the position of the test specimen within this opening are under consideration. Theoretical calculation as well as some experiments have indicated that it may be advisable that the specimen should cover a total side wall or ceiling of the test room, that is, the test opening should extend from wall to wall and/or from ceiling to floor. If the latter is the case, a volume of 50m³ is appropriate in view of the recommended size of the test opening.

NOTE 2 — The reverberation time in the rooms should not be excessively long. Where the reverberation time at low frequencies exceeds two seconds, a check should be made to determine whether the measured reduction index depends on the reverberation time. When such a dependence is found, even with diffusors in the rooms, the room should be modified to reduce the reverberation time to not more than two seconds at low test frequencies.

3.1.2 The background level in the receiving room must be sufficiently low to permit a measurement of the sound transmitted from the source room, considering the power output in the source room and the isolating properties of the specimens for which the laboratory is intended.

3.1.3 In laboratory test facilities for measuring the transmission loss, the sound transmitted by any indirect path should be negligible compared with the sound transmitted through the test specimen. One way to achieve this in such facilities is to provide sufficient structural isolation between source and receiving room. Another method might be to cover all surfaces of both rooms with linings that reduce the radiation sufficiently.

NOTE — A suitable measure to use as a reference value is $\hat{R}$, Max defined in IS : 9901 (Part III)-1981*.

3.2 Test Opening

3.2.1 It is recommended that the size of the test opening should be approximately 10m² for walls, and between 10m² and 20m² for floors, with the shorter edge length not less than 2·3m for both walls and floors.

*Measurement of sound insulation in buildings and of building elements: Part III Laboratory measurements of airborne sound insulation of building elements.

3.2.2 A smaller size may be used if the wavelength of free flexural waves at the lowest frequency considered is smaller than half the minimum dimension of the specimen. The smaller the specimen, however, the more sensitive the results will be to edge constraint conditions and to local variations in sound fields.

3.2.3 A smaller size may also be appropriate for tests of windows, doors and similar components. Test openings for doors shall be so arranged that the lower edge is situated directly above the floor of the test rooms according to the conditions in the field.

NOTE — Test openings should be so arranged that the test specimen can be installed in a manner as similar as possible to the actual construction with a careful simulation of normal connections and sealing conditions at the perimeter and at joints within the partition.

4. LABORATORIES FOR IMPACT SOUND INSULATION OF FLOORS AND FLOOR COVERINGS

4.1 Receiving Room — The volume of the receiving room should be at least 50m³. The ratios of the receiving room dimensions should be so chosen that the natural frequencies in the low-frequency region are spaced as uniformly as possible. If necessary, diffusing elements should be installed in the receiving room to obtain a diffuse sound field.

NOTE 1 — The volume of the receiving room and the size of the test opening as well as the position of the test specimen within this opening are under consideration. Theoretical calculation as well as some experiments have indicated that it may be advisable that the specimen should cover the total ceiling of the receiving room, that is, the test opening should extend from wall to wall. If the latter is the case, a volume of 50m³ is appropriate in view of the recommended size of the test opening.

NOTE 2 — The reverberation time in the receiving room should not be excessively long. Where the reverberation time at low frequencies exceeds two seconds, a check should be made to determine whether the measured impact sound insulation depends on the reverberation time. When such a dependance is found, even with diffusors in the room, the room should be modified to reduce the reverberation time to not more than two seconds at low test frequencies.

4.1.1 The background level in the receiving room must be sufficiently low to permit a measurement of the transmitted impact sound, considering the properties of the tapping machine and the isolating properties of the specimens for which the laboratory is intended.

4.1.2 The airborne sound insulation between the receiving room and the source room must be sufficiently high that the sound field measured in the receiving room is only that generated by the impact excitation of the test floor.

4.2 Test Opening — It is recommended that the size of the test opening for floors should be between $10m^2$ and $20m^2$, with the shorter edge length not less than 2·3m.

NOTE — When measuring reduction in impact sound pressure level by floor coverings according to IS : 9901 (Part VIII)-1981 , special precautions with respect to the test opening may not be necessary.

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

BUREAU OF INDIAN STANDARDS

Headquarters:
Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002
Telephones: 323 0131, 323 3375, 323 9402
Fax : 91 11 3234062, 91 11 3239399, 91 11 3239382

Telegrams : Manaksanstha
(Common to all Offices)

Central Laboratory:	Telephone
Plot No. 20/9, Site IV, Sahibabad Industrial Area, SAHIBABAD 201010	8-77 00 32
Regional Offices:	
Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002	323 76 17
*Eastern : 1/14 CIT Scheme VII M, V.I.P. Road, Maniktola, CALCUTTA 700054	337 86 62
Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160022	60 38 43
Southern : C.I.T. Campus, IV Cross Road, CHENNAI 600113	235 23 15
†Western : Manakalaya, E9 Behind Marol Telephone Exchange, Andheri (East), MUMBAI 400093	832 92 95
Branch Offices:	
'Pushpak', Nurmohamed Shaikh Marg, Khanpur, AHMEDABAD 380001	550 13 48
‡Peenya Industrial Area, 1st Stage, Bangalore-Tumkur Road, BANGALORE 560058	839 49 55
Gangotri Complex, 5th Floor, Bhadbhada Road, T. T. Nagar, BHOPAL 462003	55 40 21
Plot No. 62-63, Unit VI, Ganga Nagar, BHUBANESHWAR 751001	40 36 27
Kalaikathir Buildings, 670 Avinashi Road, COIMBATORE 641037	21 01 41
Plot No. 43, Sector 16 A, Mathura Road, FARIDABAD 121001	8-28 88 01
Savitri Complex, 116 G. T. Road, GHAZIABAD 201001	8-71 19 96
53/5 Ward No. 29, R. G. Barua Road, 5th By-lane, GUWAHATI 781003	54 11 37
5-8-58C, L. N. Gupta Marg, Nampally Station Road, HYDERABAD 500001	20 10 83
E-52, Chitaranjan Marg, C-Scheme, JAIPUR 302001	37 29 25
117/418 B, Sarvodaya Nagar, KANPUR 208005	21 68 76
Seth Bhawan, 2nd Floor, Behind Leela Cinema, Naval Kishore Road, LUCKNOW 226001	23 89 23
Patliputra Industrial Estate, PATNA 800013	26 23 05
T. C. No. 14/1421, University P. O. Palayam, THIRUVANANTHAPURAM 695034	6 21 17
NIT Building, Second Floor, Gokulpat Market, NAGPUR 440010	52 51 71
Institution of Engineers (India) Building, 1332 Shivaji Nagar, PUNE 411005	32 36 35

*Sales Office is at 5 Chowringhee Approach, P. O. Princep Street, CALCUTTA 700072 — 27 10 85

†Sales Office is at Novelty Chambers, Grant Road, MUMBAI 400007 — 309 65 28

‡Sales Office is at 'F' Block, Unity Building, Narashimaraja Square, BANGALORE 560002 — 222 39 71

Printed at New India Printing Press, Khurja, India