Australian Standard®

# ACOUSTICS—METHOD FOR LABORATORY MEASUREMENT OF AIRBORNE SOUND ATTENUATION OF CEILINGS (TWO-ROOM METHOD)

The following scientific, industrial and governmental organizations and departments were officially represented on the committee entrusted with the preparation of this standard:

Australian Acoustical Society
Confederation of Australian Industry
CSIRO, Division of Building Research
Department of Science and Technology
Environment Protection Authority, Victoria
Experimental Building Station
Institution of Engineers, Australia
Public Works Department, Western Australia
Royal Australian Institute of Architects
Royal Melbourne Institute of Technology
Universities

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# PREFACE

This standard was prepared by the Association's Committee on Architectural Acoustics and is one of a series for the evaluation of the sound-insulating properties of building elements. It is intended to enable measurement of the performance of an isolated ceiling system under laboratory conditions. Others in the series deal with the laboratory measurement of airborne sound transmission loss of building partitions (AS 1191), the field measurement of the reduction of airborne sound transmission in buildings (AS 2253), and the determination of sound transmission class and noise isolation class of building partitions (AS 1276).

This standard prescribes parameters for the test rooms used for measurement, the range of frequencies to be measured, the manner in which sound fields are to be generated, and the characteristics of the filters to be used. It is intended to ensure that the results will be meaningful and reproducible in other laboratories. Definitions are given of the quantities measured. The requirements for the statement of results are also prescribed. An appendix provides additional explanatory material to the various clauses of the standard.

The results obtained from this test are not normalized. For this and other reasons the results cannot be used for comparison with the results obtained when wall partitions are tested according to AS 1191 or AS 2253.

The dimensions of the test arrangement in this standard have been specified within close limits for the following reasons:

(a) It is not possible to identify unambiguously the sound path in the plenum.

(b) It is not generally possible to determine how much of the ceiling participates in the transmission process.

(c) The test arrangement is designed to measure the performance of the test ceiling and assess its merit as a sound insulator including the effect of any sound absorbing lining.

(d) There is no generally acceptable method for transforming the results of this test to larger rooms and to other situations for the following reasons:

(i) In large source rooms with absorptive ceilings and other distributed absorption, no uniquely defined sound field can be described.

(ii) In large receiving rooms, the sound field continues to decrease with distance from the partition, rather than levelling off at the reverberant field level, as predicted by statistical theory, with the effect that the average energy density in the receiving room is less than the theoretically predicted value.

This standard requires reference to the following Australian Standards:

| | |
|---|---|
| AS 1045 | Method of Measurement of Absorption Coefficients in a Reverberation Room |
| AS 1191 | Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions |
| AS 2253 | Methods for Field Measurement of the Reduction of Airborne Sound Transmission in Buildings |
| AS Z41 | Octave, Half Octave and One-third Octave Band Pass Filters Intended for the Analysis of Sound and Vibrations |

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# Australian Standard

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# ACOUSTICS—METHOD FOR LABORATORY MEASUREMENT OF AIRBORNE SOUND ATTENUATION OF CEILINGS (TWO-ROOM METHOD)

## SECTION 1. SCOPE AND DEFINITIONS

**1.1 SCOPE.** This standard sets out the method for the measurement of the attenuation by ceilings of airborne sound between two rooms with a plenum space above. It provides a means of evaluation of the sound isolating performance of a ceiling system under laboratory conditions.

The airborne sound attenuation is defined in terms of the level difference in a randomly incident sound field; such a field is intrinsic to the test procedure.

NOTES

1. This method utilizes a laboratory space arranged so that it simulates a pair of horizontally adjacent, typically small offices or rooms sharing a common suspended ceiling system, plenum space, and dividing wall. The dividing wall extends to the underside of the ceiling system, which may be continuous or discontinuous at its intersection with the dividing wall. Plenum dividers may be installed above the dividing wall.
2. In the prescribed configuration, special design features ensure that the only significant sound transmission path is by way of the ceilings and the common plenum space. The facility is to be used for measuring the noise reduction, room-to-room, of the ceiling/plenum system.
3. Within the construction limitations given in Clause 2.5, the quantity being measured by this method is the sound attenuation of a suspended ceiling installed in the prescribed laboratory environment.
4. The sound pressure level difference obtained from the prescribed test facility and test method is useful for rating and comparing, under standardized conditions, the sound isolation performance of ceiling materials mounted in specified suspension systems.
5. The basic procedures can be extended to the study of the additional sound isolation that may be achieved by ancillary systems. These could include the application of materials used either as plenum barriers or as cladding for all or part of the ceiling.
6. The facility may also be used to study the simulated field performance or an integrated system comprising plenum, ceiling (including any fittings and building services such as luminaires and air-conditioning registers), and dividing wall. The latter may incorporate a variety of components such as doors, transoms, glazed sections or bookcases.

**1.2 DEFINITIONS.** For the purpose of this standard, the following definitions apply:

**1.2.1 Average sound pressure level** ($L$)—ten times the common logarithm of the ratio of the average of the mean square sound pressures to the square of the reference sound pressure; the average is taken over the entire room, with the exception of those parts where the direct radiation of the sound source or the near field of the boundaries, such as walls, floor or ceiling, is of significant influence. It is expressed as follows:

$$L = 10 \log_{10} \frac{p_1^2 + p_2^2 + \ldots + p_n^2}{n p_0^2} \text{ dB}$$

where

$p_1, p_2 \ldots$ = r.m.s. sound pressures at $n$ different positions in the room

$p_o$ = reference sound pressure.

**1.2.2 Average sound pressure level difference** ($D$)—the difference between the average sound pressure level in the room containing the sound source and the average sound pressure level in the receiving room. It is expressed as follows:

$$D = L_{p_1} - L_{p_2} \text{ dB}$$

where

$L_{p_1}$ = average sound pressure level in the source room, in decibels

$L_{p_2}$ = average sound pressure level in the receiving room, in decibels.

**1.2.3 Ceiling attenuation class (CAC)**—the single number derived from the average sound pressure level differences, to provide a convenient way of describing the performance of the system tested.

**1.2.4 Plenum space**—the whole of the void space above the suspended ceilings between two rooms.

NOTE: The measurements of a plenum space are to the lower face of the ceiling and thus include the thickness of any sound-absorbing material either adhered to walls or laid on the back of the ceiling.