

Australian Standard[®]

**ACOUSTICS—DETERMINATION OF
SOUND POWER LEVELS OF NOISE
SOURCES**

**Part 6—PRECISION
METHODS FOR
ANECHOIC AND
HEMI-ANECHOIC
ROOMS**

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PREFACE

This standard was prepared by the Association's Committee on Techniques for Measurement. It supersedes AS 1217—1972, Methods of Measurement of Airborne Sound Emitted by Machines.

This standard is based on ISO 3745—1977, Acoustics—Determination of Sound Power Levels of Noise Sources—Precision Methods for Anechoic and Hemi-anechoic Rooms.

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STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard
for
ACOUSTICS—DETERMINATION OF SOUND POWER LEVELS OF NOISE SOURCES

PART 6—PRECISION METHODS FOR ANECHOIC AND HEMI-ANECHOIC ROOMS

FOREWORD

This standard is one of a series setting out various methods for determining the sound power levels of machines and equipment. These basic documents specify only the acoustical requirements for measurements appropriate for different test environments as shown in Table A.

In the application of these basic documents, it is necessary to decide which one is most appropriate for the conditions and purposes of the test. The operating and mounting conditions of the machine or equipment to be tested must be in accordance with the general principles stated in the basic documents.

Guidelines for making these decisions are provided in AS 1217.1. If no sound test method is specified for a particular machine, the mounting and operating conditions shall be fully described in the test report.

TABLE A
BASIC STANDARDS SPECIFYING VARIOUS METHODS FOR DETERMINING THE SOUND POWER LEVELS OF MACHINES AND EQUIPMENT

AS number	Classification of method	Test environment	Volume of source	Character of noise	Sound power levels obtainable	Optional information available
AS 1217.2	Precision	Reverberation room complying with specified requirements	Preferably less than 1 percent of test room volume	Steady, broad-band	In one-third octave or octave bands	A-weighted sound power level
AS 1217.3				Steady, discrete-frequency, or narrow-band		
AS 1217.4	Engineering	Special reverberation test room		Steady, broad-band narrow-band, or discrete-frequency	A-weighted and in octave bands	Other weighted sound power levels
AS 1217.5	Engineering	Outdoors or in large room	Greatest dimension less than 15 m	Most	A-weighted and in one-third octave or octave bands	Directivity information and sound pressure levels as a function of time; other weighted sound power levels
AS 1217.6	Precision	Anechoic or hemi-anechoic room	Preferably less than 0.5 percent of test room volume	Most		
AS 1217.7	Survey	No special test environment	No restrictions; limited only by available test environment	Most	A-weighted	Sound pressure levels as a function of time; other weighted sound power levels

SYNOPSIS

Test environment. Free field (anechoic room) or free field over a reflecting plane (hemi-anechoic room).

Type of source. Device, machine, component, subassembly.

Size of noise source. Volume of the source preferably less than 0.5 percent of test room volume.

Character of noise radiated by the source. Most types. For exceptions, see Clause 1.2.2.1.

Accuracy. Precision (standard deviation for determining sound power levels for 1 kHz octave band is less than or equal to 0.5 dB for anechoic rooms and less than or equal to 1.0 dB for hemi-anechoic rooms).

Quantities to be measured. Sound pressure levels (weighted and in frequency bands) over a prescribed surface.

Quantities to be calculated. Weighted sound power level (A is required; other weightings are optional);

sound power levels in frequency bands; directivity characteristics of the source (optional).

SECTION 1. SCOPE AND GENERAL

1.1 SCOPE. This standard sets out in detail two laboratory methods for determining the sound power radiated by a device, machine, component or sub-assembly using a laboratory anechoic room having prescribed acoustical characteristics. While other methods could be used to measure the noise emitted by machinery and equipment, the methods specified in this standard are particularly useful for rating the sound output of sources which produce steady noise and for which directivity information on the source may be desired.

The methods specified in this standard yield physical data that may be used for the following purposes:

- (a) Rating apparatus according to its sound power output.
- (b) Establishing sound control measures.
- (c) Predicting the sound pressure levels produced by a device in a given enclosure or environment.

Techniques for utilizing the physical data for these special purposes are not included in this standard.

The determination of the sound power radiated by a sound source in a completely free field or in a free field above a reflecting plane is based on the premise that the reverberant field produced by the source is negligible and that the total radiated power is obtained from the mean square sound pressure averaged in time and in space over a hypothetical sphere or hemisphere surrounding the source. The radius of the sphere or hemisphere is chosen so that its surface is in the far radiation field of the source.

1.2 FIELD OF APPLICATION.

1.2.1 General. This standard specifies two laboratory methods for determining the sound power level of a source. It gives requirements for the test room, as well as the source position, operating conditions and instrumentation. Techniques are specified for obtaining an estimate of the surface sound pressure level from which the weighted sound power level of the source as well as the sound power level in octave or one-third octave bands may be calculated. It is intended to prescribe techniques for acoustical measurements that may be used in test codes for particular types of equipment.

1.2.2 Types of noise. This standard applies to sources which produce sound that is uniformly distributed in frequency over the frequency range of interest and is relatively steady for at least 30 s. The spectrum of the sound may also include prominent discrete-frequency components or narrow bands of noise. The procedures specified in this standard may also be applied to sources that emit non-steady noise as defined in AS 1633, with the exception of an isolated burst of sound energy, or of a train burst with a repetition rate less than 10 per second (see Appendix J for guidelines on the detection of impulsive noise).

1.2.3 Size of source. This standard applies primarily to small sound sources, i.e. sources whose volumes are preferably less than 0.5 percent of the volume of the test room used for the measurements. This restriction is necessary to ensure that the hypothetical sphere or hemisphere surrounding the sources lies in the far radiation field of the source.

1.3 REFERENCED DOCUMENTS. The following standards are referred to in this standard:

- AS 1217 Acoustics—Determination of Sound Power Levels of Noise Sources,
Part 1—Guidelines for the Use of Basic Standards and for the Preparation of Noise Test Codes
Acoustics—Determination of Sound Power Levels of Noise Sources,
Part 2—Precision Methods for Broad-band Sources in Reverberation Rooms
Acoustics—Determination of Sound Power Levels of Noise Sources,
Part 3—Precision Methods for Discrete-frequency and Narrow-band Sources in Reverberation Rooms
Acoustics—Determination of Sound Power Levels of Noise Sources,
Part 4—Engineering Methods for Special Reverberation Test Rooms
Acoustics—Determination of Sound Power Levels of Noise Sources,
Part 5—Engineering Methods for Free-field Conditions over a Reflecting Plane
Acoustics—Determination of Sound Power Levels of Noise Sources
Part 7—Survey Methods
- AS 1259 Sound Level Meters
- AS 1633 Glossary of Acoustic Terms
- AS 2533 Acoustics—Preferred Frequencies for Measurement
- AS Z41 Octave, Half Octave and One-third Octave Band Pass Filters Intended for the Analysis of Sound and Vibrations
- ISO 2204 Acoustics—Guide to International Standards on the Measurement of Airborne Acoustical Noise and Evaluation of its Effects on Human Beings

1.4 MEASUREMENT UNCERTAINTY.

Measurements made in compliance with this standard tend to result in standard deviations which are equal to or less than those given in Tables 1.1 and 1.2. The standard deviations of Tables 1.1 and 1.2 reflect the cumulative effects of all causes of measurement uncertainty, excluding variations in the sound power of the source from test to test.

The major cause of uncertainty in determining sound power in an anechoic room is the spatial irregularity of the sound field due to the directivity of the source. In a hemi-anechoic room, the spatial irregularity may be increased owing to the superposition of the sound field of the actual source and that of the image source. The directivity pattern of a source located above a reflecting plane is generally more complicated than that of the same source in a free field. Moreover, the near field extends to greater distance, and the radius of the test hemispheres is usually larger than the radius of the test sphere that would be required in a free field.