

AS 1259.2—1990

Australian Standard®

Acoustics—Sound Level Meters

Part 2: Integrating—averaging

This Australian Standard was prepared by Committee AV/2, Acoustics, Instrumentation and Measurement Techniques. It was approved on behalf of the Council of Standards Australia on 24 January 1990 and published on 14 May 1990.

The following interests are represented on Committee AV/2:

Association of Consulting Engineers Australia
Australian Acoustical Society
Australian Environment Council
Civil Aviation Authority
Confederation of Australian Industry
CSIRO, Division of Building, Construction and Engineering
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Australian Standard[®]

Acoustics—Sound level Meters

Part 2: Integrating—averaging

First published in part as AS Z37—1967.
AS Z37—1967 revised and redesignated
AS 1259.1—1976.
AS Z38 first published 1967.
Revised and redesignated AS 1259.2—1976.
AS 1259.3 first published 1976.
AS 1259.1—1976, AS 1259.2—1976 and
AS 1259.3—1976
revised, amalgamated and redesignated
AS 1259—1982.
AS 1259—1982 revised in part as AS 1259.2—1990.

PUBLISHED BY STANDARDS AUSTRALIA
(STANDARDS ASSOCIATION OF AUSTRALIA)
1 THE CRESCENT, HOMEBUSH, NSW 2140



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PREFACE

This Standard was prepared by the Standards Australia Committee on Acoustics–Instrumentation and Measurement Techniques. It is identical with and has been reproduced from IEC 804 (1985), *Integrating–averaging sound level meters* and incorporates *IEC Amendment No 1 of September 1989 to the IEC 804*.

This Standard is one of a series which deals with sound level meters, the series being arranged as follows:

Part 1: Non–integrating

Part 2: Integrating–averaging (this Standard)

For the purpose of this Australian Standard, the IEC text should be modified as follows:

<i>Reference to International Standard</i>		<i>Australian Standard</i>	
IEC		AS	
651	Sound level meters	1259	Acoustics–Sound level meters
537	Frequency weighting for the measurement of aircraft noise (D–Weighting)	1259.1	Non–integrating
50(801)	International electrotechnical vocabulary (IEV), Chapter 801: Acoustics and electroacoustics	1633	Acoustics–Glossary of terms and related symbols
ISO			
266	Acoustics–Preferred frequencies for measurements	2533	Acoustics–Preferred frequencies for measurements

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STANDARDS AUSTRALIA

**Australian Standard
Acoustics—Sound level meters****Part 2: Integrating—averaging****1. Scope****1.1 General**

This standard describes instruments for the measurement of frequency weighted and time averaged sound pressure levels. Optionally, sound exposure levels may be measured. This standard is consistent with the relevant requirements of IEC Publication 651: Sound Level Meters, but specifies additional characteristics which are necessary to measure the equivalent continuous sound pressure level, L_{eq} , of steady, intermittent, fluctuating and impulsive sounds.

Note. — Standardization of an instrument for the measurement of the equivalent continuous sound pressure level and optionally the sound exposure level does not imply that these quantities completely characterize the psychological and physiological effects of sound on man.

Though a complete integrating sound level meter is specified, the combination of a conventional sound level meter that satisfies IEC Publication 651 and an accessory or "plug-in" that provides the averaging capability is admissible if the complete system satisfies this standard.

The instrument is called "integrating-averaging sound level meter", but the short form "integrating sound level meter" or "averaging sound level meter" may also be used. In this standard, "integrating sound level meter" is used.

There are some important differences between the time averaging characteristics of an integrating sound level meter and those of a conventional sound level meter. These differences are discussed in Appendix A.

1.2 Types

This standard specifies integrating sound level meters of four degrees of accuracy, designated Types 0, 1, 2 and 3.

For each type, the specification for directional characteristics and frequency weighting and amplifier characteristics are identical to those of IEC Publication 651. Averaging and indicator specifications differ from IEC Publication 651 and it should be noted that they are identical for Types 2 and 3 instruments.

The mark "R" on the instrument, if any, indicates that this instrument is calibrated for diffuse field (see Sub-clauses 2.3.3 and 9.1).

1.3 Characteristics specified

1.3.1 This standard specifies the following characteristics and test methods for integrating sound level meters:

- a) integrating and averaging characteristics;
- b) indicator characteristics;
- c) overload sensing and indicating characteristics.

1.3.2 Integrating sound level meters shall also comply with the requirements in IEC Publication 651 as follows:

- a) directional characteristics
- b) frequency weighting characteristics
- c) sensitivity to various environments

1.4 Tolerances

The specifications for Types 0, 1, 2 and 3 integrating sound level meters have the same centre values and differ only in the tolerances allowed. Tolerances broaden as the type number increases.

1.5 Tests specified

This standard specifies electrical and acoustical tests to verify compliance with the characteristics specified (see Sub-clause 1.3).

2. Object and general requirements

2.1 Object

The object of this standard is to ensure specified accuracy and stability of an integrating sound level meter and to reduce to the practical minimum any differences in equivalent measurements taken with instruments of various makes and models which satisfy the requirements of this standard.

2.2 Applications

The Type 0 integrating sound level meter is intended as a laboratory reference standard. Type 1 is intended for laboratory use and for field use where the acoustical environment can be closely specified and/or controlled. The Type 2 integrating sound level meter is suitable for general field applications. Type 3 is intended primarily for field noise survey applications.

Typical applications for the integrating sound level meter are:

- a) measurement of industrial noise that could produce hearing damage or be annoying;
- b) measurement of community noise (traffic, residential, industrial sites, airports) that may be annoying or violate regulations;
- c) measuring the average sound pressure level around a noisy product or other sound source, in which case the integrating capability may be used to determine an average in space as well as time.

The integrating sound level meter is well suited for measurement of the equivalent continuous sound pressure level of impulsive sounds. Such impulsive sounds have high peak amplitude and duration as short as 1 ms.

Note. — The measurement of impulses with durations below 1 ms should be regarded as an extrapolation because testing is not required below 1 ms.

Integrating sound level meters intended for field use shall meet rigorous environmental specifications.

Integrating sound level meters are usually designed to be hand-held or bench mounted. It is anticipated, however, that units to be worn on a person may also become available.

2.3 General requirements

2.3.1 Frequency weighting

An integrating sound level meter shall have the frequency weighting characteristic designated A as specified in IEC Publication 651.

Other frequency weighting characteristics such as the C-weighting or Lin (Flat) weighting, specified in IEC Publication 651 or D-weighting as specified in IEC Publication 537: Frequency Weighting for the Measurement of Aircraft Noise (D-weighting), are optional.

2.3.2 Averaging

The integrating sound level meter shall be capable of measuring the equivalent continuous A-weighted sound pressure level (Sub-clause 3.3). Optionally, the integrating sound level meter may be capable of measuring sound exposure level (Sub-clause 3.4).

2.3.3 Calibration

The requirements of this standard may be applied to either free field calibration (Sub-clause 3.13) or diffuse field calibration (Sub-clause 3.14). If the instrument is calibrated for use in a diffuse field, it shall be marked "R" (see Sub-clause 11.1).

2.4 Method of use

Integrating sound level meters are used to measure many types of sound, under different conditions and for a variety of reasons. For each application, the measurement technique should be chosen and controlled carefully to obtain valid and consistent results. It is important to recognize that the method of use may have as much effect on a measurement as the quality of the instrument itself; errors will often result if the effect of the environment and (especially for hand-held instruments) the presence of the observer are ignored.

3. Definitions

3.1 For the definition of terms used in this standard, reference should be made to IEC Publication 50(801): International Electrotechnical Vocabulary (IEV), Chapter 801: Acoustics and Electroacoustics. Certain additional terms are given in IEC Publication 651 or are defined below.

3.2 *Frequency weighted sound pressure level*, in decibels (dB), is twenty times the logarithm to the base ten of the ratio of a weighted sound pressure to the reference sound pressure. The reference sound pressure is 20 μ Pa. The frequency weighting shall be indicated.

3.3 *Equivalent continuous A-weighted sound pressure level* (also average A-weighted sound pressure level) is defined as follows:

$$L_{Aeq,T} = 10 \lg \left\{ \left(\frac{1}{T} \int_{t_1}^{t_2} p_A^2(t) dt \right) / p_0^2 \right\} \quad \text{dB}$$

where:

$L_{Aeq,T}$ is the equivalent continuous A-weighted sound pressure level re 20 µPa, determined over a time interval $T = t_2 - t_1$

$p_A(t)$ is the instantaneous A-weighted sound pressure of the sound signal

p_0 is the reference sound pressure of 20 µPa.

Notes 1. - When, optionally, a frequency weighting other than A is used, the frequency weighting used shall be included explicitly in the title and the formula of the quantity, for example equivalent continuous C-weighted sound pressure level:

$$L_{Ceq,T} = 10 \lg \left\{ \left(\frac{1}{T} \int_{t_1}^{t_2} p_c^2(t) dt \right) / p_0^2 \right\} \quad \text{dB}$$

if no frequency weighting is used, the quantity is simply called equivalent continuous sound pressure level.

2. - For the definition of the average A-weighted sound pressure level, see Appendix B.

3.4 *A-weighted sound exposure level* is defined as follows:

$$L_{EA,T} = 10 \lg \left\{ \left(\int_{t_1}^{t_2} p_A^2(t) dt \right) / (p_0^2 \cdot T_0) \right\} \quad \text{dB}$$

Where:

$L_{EA,T}$ is the A-weighted sound exposure level, re $4 \times 10^{-10} \text{ Pa}^2 \cdot \text{s}$, determined over a time interval $T = t_2 - t_1$

p_0 is equal to 20 µPa
 T_0 is equal to 1 s

Note. - The expression $\int_{t_1}^{t_2} p_A^2(t) dt$ is the A-weighted sound exposure, E_{AT} .

The quantity $(p_0^2 \cdot T_0)$ is the reference sound exposure and is equal to $4 \times 10^{-10} \text{ Pa}^2 \cdot \text{s}$.

The A-weighted sound exposure level is related to the equivalent continuous A-weighted sound pressure level as follows:

$$L_{EA,T} = L_{Aeq,T} + 10 \lg (T/T_0) \quad \text{dB}$$

3.5 *Linearity range* is the difference, in decibels, between the upper and lower r.m.s. levels of continuous sinusoidal signals applied to the input within which the linearity requirements given in Sub-clause 6.2 are met.

3.6 *Pulse range* is the greatest level difference, in decibels, between the peak signal level of a tone burst and the r.m.s. level of a continuous low level signal for which the specifications given in Sub-clause 6.2 are met.