

Australian/New Zealand Standard™

Occupational noise management

Part 1: Measurement and assessment of noise immission and exposure



AS/NZS 1269.1:2005

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee AV-003, Acoustics, Human Effects. It was approved on behalf of the Council of Standards Australia on 27 January 2005 and on behalf of the Council of Standards New Zealand on 11 February 2005.
This Standard was published on 6 April 2005.

The following are represented on Committee AV-003:

Association of Australian Acoustical Consultants
Association of Consulting Engineers Australia
Australian Acoustical Society
Australian Chamber of Commerce and Industry
Australian Hearing
Department of Consumer & Employment Protection, WorkSafe Division, W.A.
Department of Labour, New Zealand
N.S.W. Rural Fire Service
New South Wales Nurses Association
New Zealand Audiological Society
Royal Institution of Naval Architects
Safety Institute of Australia (Incorporated)
Victorian WorkCover Authority
WorkCover New South Wales

Keeping Standards up-to-date

Standards are living documents which reflect progress in science, technology and systems. To maintain their currency, all Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued. Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments which may have been published since the Standard was purchased.

Detailed information about joint Australian/New Zealand Standards can be found by visiting the Standards Web Shop at www.standards.com.au or Standards New Zealand web site at www.standards.co.nz and looking up the relevant Standard in the on-line catalogue.

Alternatively, both organizations publish an annual printed Catalogue with full details of all current Standards. For more frequent listings or notification of revisions, amendments and withdrawals, Standards Australia and Standards New Zealand offer a number of update options. For information about these services, users should contact their respective national Standards organization.

We also welcome suggestions for improvement in our Standards, and especially encourage readers to notify us immediately of any apparent inaccuracies or ambiguities. Please address your comments to the Chief Executive of either Standards Australia or Standards New Zealand at the address shown on the back cover.

This Standard was issued in draft form for comment as DR 04035.

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

RECONFIRMATION

OF

AS/NZS 1269.1:2005

Occupational noise management

Part 1: Measurement and assessment of noise immission and exposure

RECONFIRMATION NOTICE

Technical Committee AV-003 has reviewed the content of this publication and in accordance with Standards Australia procedures for reconfirmation, it has been determined that the publication is still valid and does not require change.

Certain documents referenced in the publication may have been amended since the original date of publication. Users are advised to ensure that they are using the latest versions of such documents as appropriate, unless advised otherwise in this Reconfirmation Notice.

Approved for reconfirmation in accordance with Standards Australia procedures for reconfirmation on 7 December 2015.

Approved for reconfirmation in New Zealand on behalf of the Standards Council of New Zealand on 18 May 2016.

The following are represented on Technical Committee AV-003:

Accident Compensation Corporation (New Zealand)
Association of Australian Acoustical Consultants
Australian Acoustical Society
Australian Chamber of Commerce and Industry
Australian Council of Trade Unions
Department of Defence (Australian Government)
Engineers Australia
Ministry of Health (NZ)
National Acoustic Laboratories
New South Wales Nurses' Association
New Zealand Audiological Society
Worksafe Division, Department of Commerce, Western Australia
WorkSafe Victoria

NOTES

Australian/New Zealand Standard™

Occupational noise management

Part 1: Measurement and assessment of noise immission and exposure

Originated in Australia as part of AS 1269—1976.
Previous edition AS/NZS 1269.1:1998.
Second edition 2005.
Reissued incorporating Amendment No. 1 (September 2005)

COPYRIGHT

© Standards Australia/Standards New Zealand

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher.

Jointly published by Standards Australia, GPO Box 476, Sydney, NSW 2001 and Standards New Zealand, Private Bag 2439, Wellington 6020

ISBN 0 7337 6548 3

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee AV-003, Acoustics, Human Effects, to supersede AS/NZS 1269.1:1998, *Occupational noise management, Part 1: Measurement and assessment of noise immission and exposure*.

This Standard incorporates Amendment No. 1 (September 2005). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

This is Part 1 in a series of Standards as follows:

AS/NZS

- 1269 Occupational noise management
- 1269.0 Part 0: Overview and general requirements
- 1269.1 Part 1: Measurement and assessment of noise immission and exposure (this Standard)
- 1269.2 Part 2: Noise control management
- 1269.3 Part 3: Hearing protector program
- 1269.4 Part 4: Auditory assessment

The objective of this series of Standards is to provide requirements and guidance on all facets of occupational noise management. It is recommended that the reader refer to all Parts of AS/NZS 1269 to better understand all relevant terminology and objectives of occupational noise management.

The objective of this Part is to provide requirements and guidance on the types of noise assessment which may be required, the general objectives of an assessment and the instrumentation and procedures needed to carry it out.

The objective of this revision is to confirm the existing Standard with a few minor changes.

Where the number of an IEC Standard is provided in brackets after an Australian Standard number the IEC Standard applies to New Zealand only and the Australian Standard applies to Australia only.

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the appendix to which they apply. A ‘normative’ appendix is an integral part of a Standard, whereas an ‘informative’ appendix is only for information and guidance.

CONTENTS

	<i>Page</i>
1 SCOPE.....	4
2 REFERENCED DOCUMENTS.....	4
3 DEFINITIONS.....	5
4 MEASURES OF NOISE EMISSION, IMMISSION AND EXPOSURE	7
5 OBJECTIVE OF NOISE ASSESSMENTS.....	9
6 TYPES OF NOISE ASSESSMENT.....	10
7 INSTRUMENTATION AND CALIBRATION	11
8 NOISE MEASUREMENT PROCEDURES.....	13
9 NOISE EVALUATION	17
10 CHECKLISTS	20
APPENDICES	
A COMPETENCY REQUIREMENTS FOR PEOPLE UNDERTAKING DETAILED NOISE ASSESSMENTS	23
B TOPICS RECOMMENDED FOR INCLUSION IN A TRAINING COURSE FOR NOISE ASSESSMENT.....	24
C RECOMMENDED PROCEDURES FOR MEASUREMENT OF SOUND PRESSURE LEVELS FROM HEADPHONES OR INSERT EARPHONES	27
D GENERAL INFORMATION ON AUXILIARY MEASURING DEVICES.....	30
E PROCEDURE FOR DETERMINATION OF $E_{A,T}$, $L_{Aeq,T}$ AND $L_{Aeq,8h}$	33
F RELATIONSHIP BETWEEN $L_{Aeq,8h}$ AND $E_{A,T}$ VALUES	41
G NOISE ASSESSMENT REPORT PROFORMA	42

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard
Occupational noise management

Part 1: Measurement and assessment of noise immission and exposure

1 SCOPE

This Standard sets out requirements for, and provides guidance on, the types of noise assessments which may be necessary and suitable noise measuring instruments to carry them out. The procedures for noise measurement are also included.

The type and detail of assessments carried out will depend on the use that is to be made of the information obtained.

The type of measuring instruments and procedures to be used for the measurement of noise levels will depend on such factors as the type of workplace, type of noise, work patterns and information required.

2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

1259 Acoustics—Sound level meters*

1259.1 Part 1: Non-integrating

1259.2 Part 2: Integrating—Averaging

1591 Acoustics—Instrumentation for audiometry

1591.5 Part 5: Wide band artificial ear

2533 Acoustics—Preferred frequencies for measurement

2680 Acoustics—Performance for tape recording equipment for use in acoustical measuring systems

AS IEC

61672 Electroacoustics—Sound level meters

61672.1 Part 1: Specifications

61672.2 Part 2: Pattern evaluation tests

AS ISO

1999 Acoustics—Determination of occupational noise exposure and estimation of noise-induced hearing impairment

AS/NZS

1269 Occupational noise management

1269.0 Part 0: Overview and general requirements

1269.2 Part 2: Noise control management

1269.3 Part 3: Hearing protector program

2243 Safety in laboratories

2243.5 Part 5: Non-ionizing radiations—Electromagnetic, sound and ultrasound

* The AS 1259 series has been superseded by AS IEC 61672, Parts 1 and 2 but remains available for existing users. Following the completion of the AS IEC 61672 series, the AS 1259 series will be withdrawn.

- 2399 Acoustics—Specifications for personal sound exposure meters
- 4476 Acoustics—Octave-band and fractional-octave-band filters
- IEC
- 60711 Occluded—ear simulator for the measurement of earphones coupled to the ear by ear inserts
- 60942 Electroacoustics—Sound calibrators
- 60959 Provisional head and torso simulator for acoustic measurements on air conduction hearing aids
- 61672 Electroacoustics—Sound level meters
- 61672.1 Part 1: Specifications
- 61672.2 Part 2: Pattern evaluation tests
- ISO
- 266 Acoustics—Preferred frequencies
- 1999 Acoustics—Determination of occupational noise exposure and estimation of noise-induced hearing impairment

3 DEFINITIONS

For the purpose of this Standard, the definitions given in AS/NZS 1269.0 and those below apply.

3.1 A-weighted noise exposure

The time integral of the squared, instantaneous A-weighted sound pressure over a particular time period ‘ T ’ in pascal-squared-hours (Pa^2h) (Symbol: $E_{A,T}$).

It is given by the following equation:

$$E_{A,T} = \int_{t_1}^{t_2} p_A^2(t) dt \quad \dots 3(1)$$

where

$E_{A,T}$ = the A-weighted noise exposure

$p_A^2(t)$ = the square of the A-weighted sound pressure as a function of time for an integration period T starting at t_1 and ending at t_2 . p_A is in pascals and T is in hours.

NOTE: For practical purposes a noise exposure of $1.0 \text{ Pa}^2\text{h}$ corresponds to $L_{Aeq,8h}$ of 85 dB(A).

3.2 Eight-hour equivalent continuous A-weighted sound pressure level

In decibels, is that steady sound pressure level which would in the course of an 8 h period deliver the same A-weighted sound energy as that due to the actual noise on any particular representative working day. (Symbol: $L_{Aeq,8h}$).

NOTES:

- 1 For the basis of $L_{Aeq,8h}$ calculations, see Clause 9.3.
- 2 $L_{Ceq,8h}$ is a similar quantity, but refers to the C-weighted sound energy.
- 3 $L_{Aeq,8h}$ is numerically equal to $L_{EX,8h}$ as defined in ISO 1999 and AS ISO 1999.

3.3 Equivalent continuous weighted sound pressure level

In decibels, is the value of the steady continuous frequency-weighted sound pressure level that, within a measurement time interval, T , has the same mean square sound pressure as the sound under consideration whose level varies with time during the interval T . The frequency weightings used shall be A, C or unweighted as appropriate. (Symbol: $L_{Xeq,T}$)

The time interval for every $L_{Xeq,T}$ measurement should be stated.

$L_{Xeq,T}$ is given by the following equation:

$$A1 \quad \left| \quad L_{Xeq,T} = 10 \log_{10} \left[\frac{1}{T} \int_{t_1}^{t_2} \left(\frac{p_X(t)}{p_o} \right)^2 dt \right] \right. \quad \dots 3(2)$$

where

T = the period in hours over which the average is taken starting at t_1 and ending at t_2

p_X = the frequency-weighted sound pressure in pascals

p_o = the reference sound pressure 20 μ Pa

NOTES:

- 1 The above definition for $L_{Xeq,T}$ is commonly referred to as L_{eq} .
- 2 For steady continuous sound, L_{Xeq} is numerically equal to L_{pX} .

3.4 Exposure to noise

Exposure to noise is determined at the person's ear position without taking into account any protection that may be afforded by personal hearing protectors.

3.5 Partial noise exposure

The exposure of a person to noise over a specified time interval, typically the time spent at a specified workstation, or while performing a specified task.

3.6 Peak sound pressure level

In decibels, is 10 times the logarithm to the base 10, of the ratio of the square of the maximum instantaneous sound pressure to the square of the reference sound pressure (20 μ Pa). (Symbol: L_{peak})

NOTE: L_{peak} is not the same as the maximum r.m.s. level and is either unweighted or C-weighted according to the appropriate legislation.

3.7 Reference sound source

A device which generates a sinusoidal sound pressure of specified level and frequency when used with a particular model of microphone in a specified manner.

3.8 Representative working day

A working day during which the noise exposure is representative of the person's long-term occupational noise exposure.

NOTE: The representative working day should be made up of segments proportioned in accordance with the person's long-term occupational noise exposure in such a manner that where the exposures differ markedly from day to day, the segments utilized should take such variability into account.

3.9 Sound level or weighted sound pressure level

In decibels, is 10 times the logarithm to the base 10 of the ratio of the square of a given sound pressure, obtained with a standardized frequency-weighting and a standardized exponential time-weighting during a stated time period, to the square of the reference pressure. (Symbol: $L_{X,F}$ or $L_{X,S}$ (see Note)).

NOTE: X is one of the standardized frequency weightings A, C or unweighted and F and S are standardized exponential time weightings as defined in AS 1259.1 and AS IEC 61672.1.

3.10 Sound pressure level (L_p)

A1 Sound pressure levels, in decibels, is 10 times the logarithm to the base 10 of the square of the ratio of the sound pressure to the reference sound pressure. In air the reference pressure is 20 μPa . The sound pressure level is defined by the following equation:

$$L_p = 10 \log_{10} \left(\frac{p}{p_o} \right)^2 \quad \dots 3(3)$$

where

p = the r.m.s. sound pressure in pascals,

p_o = The reference sound pressure, 20 μPa

3.11 Total daily noise exposure

Is the total of a person's partial noise exposures over a working day.

4 MEASURES OF NOISE EMISSION, IMMISSION AND EXPOSURE

4.1 Measures of emission (of a source)

The acoustic energy emitted by a sound source is measured either in absolute terms as *emission sound power* in units of watts (or milliwatts, microwatts or similar), or in relative terms as *emission sound power level* in units of decibels relative to a reference quantity of 1 picowatt.

Another common emission measure is *emission sound pressure level*, the sound pressure level measured at a specified location (such as the operator position in the case of a machine) in precisely defined acoustical conditions.

In practice, emission sound power level and emission sound pressure level are commonly used to indicate the noise emitted by items of industrial equipment. It is becoming increasingly common for manufacturers to include noise emission details of their products in product specifications. This is now required by law in several jurisdictions.

Standardized noise emission quantities are valuable to purchasers because they enable specific noise limits to be stated in tender specifications. Noise emission information provided by manufacturers and suppliers enables purchasers to assess the potential noisiness of competing items prior to purchase and has fundamental value in making and justifying a final purchasing decision.

4.2 Measures of immission and exposure

4.2.1 General

Immission and exposure magnitudes may be expressed directly in units of sound pressure (Pa) and squared sound pressure $\times$ time (Pa^2h) respectively, or indirectly as immission and exposure levels in decibels relative to specified reference values.

NOTE: Key terms and units to indicate emission, immission and exposure are given in Table 1.

4.2.2 Immission (at a location)

Immission over time interval T is generally measured in terms of equivalent continuous sound pressure level, $L_{Xeq,T}$. The weighting X and the time of commencement and duration of T depend on the purpose of the measurement. A-weighting is used for most purposes. Peak sound pressure levels are measured unweighted or C-weighted. T typically refers to the duration of a machine operating cycle, task or process, or the length of time a person is present at a particular workstation.

NOTE: Where more detailed information is required about the characteristics of the noise, more refined measures of noise immission may be used, e.g. immission sound pressure levels in octave or third-octave-bands.

4.2.3 Exposure (of a person)

Exposure measures indicate the amount of noise to which people are exposed in the course of their daily work.

NOTE: Exposure magnitude is not reduced by the wearing of personal hearing protectors. A person wearing hearing protectors in a sound field is in a situation of protected exposure, not of non-exposure. The term ‘effective exposure level’ is defined in AS/NZS 1269.3 and can be used to estimate the reduced level of risk when hearing protectors are worn.

TABLE 1
KEY TERMS AND UNITS USED TO INDICATE EMISSION,
IMMISSION AND EXPOSURE

Event	Related absolute quantities and units		Related relative quantities and units	
	Absolute quantities	Absolute units	Relative quantities	Relative units
Emission	Emission sound power	W (watts), pW (picowatts)	Sound power level, L_{WX}	dB re 1 pW
	Equivalent continuous emission sound pressure over time interval T	Pa (pascals)	Equivalent continuous emission sound pressure level, $L_{Xeq,T}$	dB re 20 μ Pa
	Peak emission sound pressure	Pa	Peak emission sound pressure level, L_{peak}	dB re 20 μ Pa
Immission	Weighted sound pressure	Pa	Weighted sound pressure level, $L_{X,F}$ or $L_{X,S}$	dB re 20 μ Pa
	Equivalent continuous sound pressure over time interval T	Pa	Equivalent continuous sound pressure level, $L_{Xeq,T}$	dB re 20 μ Pa
	Peak sound pressure	Pa	Peak sound pressure level, L_{peak}	dB re 20 μ Pa
Exposure	Partial noise exposure	Pa^2h	Partial noise exposure level, $L_{Xeq,Ti}$	dB re $4 \times T_i \times 10^{-10} \text{ Pa}^2\text{h}$
	Total daily noise exposure	Pa^2h	Total daily noise exposure level, $L_{Xeq,T}$	dB re $4 \times T \times 10^{-10} \text{ Pa}^2\text{h}$
			Normalized total daily noise exposure level, $L_{Xeq,8h}$	dB re $3.2 \times 10^{-9} \text{ Pa}^2\text{h}$
	Peak exposure pressure	Pa	Peak exposure level, L_{peak}	dB re 20 μ Pa
Protected exposure			Effective exposure level, $L_{(eff)Aeq,8h}$	dB re $3.2 \times 10^{-9} \text{ Pa}^2\text{h}$

NOTES:

- A1 | 1 The letter X in a symbol above stands for one of the standardized frequency weightings A, C or unweighted as defined in AS IEC 61672.1 for Australia and IEC 61672-1 for New Zealand. Where X is not included, unweighted is implied. The letters F and S refer to standardized time-weightings defined in the same Standard.
- 2 The reference quantity for normalized total daily noise exposure level is $3.2 \times 10^{-9} \text{ Pa}^2\text{h}$ $[(20 \mu\text{Pa})^2 \times 8 \text{ h}]$.
- 3 Exposure level as used in this Standard is not the same as the standardized quantity sound exposure level (SEL), which is not used in this Standard. SEL is based on a reference quantity of $1 \text{ Pa}^2\text{s}$. The following are all exposure measures:

- (a) *Partial noise exposure* If a person is exposed to different noises at different workstations or tasks over the day, each exposure is referred to as a partial noise exposure. The sum of all partial noise exposures is the person's total daily noise exposure.

The magnitude of a partial noise exposure in Pa^2h may be measured directly with a personal sound exposure meter but in practice is often derived from a measurement of immission sound pressure level made with a sound level meter. In this case the Pa^2 value corresponding to the measured immission level is obtained and multiplied by T_i , the number of hours of exposure to that level, to obtain the Pa^2h value.

- (b) *Partial noise exposure level* The magnitude of partial noise exposure may also be expressed as a partial noise exposure level in decibels relative to a reference noise exposure value of $4 \times T_i \times 10^{-10} \text{ Pa}^2\text{h}$.
- (c) *Total daily noise exposure* Adding the Pa^2h values of a person's partial noise exposures gives the Pa^2h value of their total daily noise exposure.
- (d) *Total daily noise exposure level* As with partial noise exposure, the magnitude of total daily noise exposure may be expressed as a level in decibels relative to a reference noise exposure value of $4 \times T \times 10^{-10} \text{ Pa}^2\text{h}$.
- (e) *Normalized total daily noise exposure level* This is that steady sound pressure level which would, over a specified 'normal' duration (typically 8 h), deliver the same sound energy as that delivered by an actual total daily noise exposure.

NOTE: Normalizing is the process of converting the level of an exposure incurred over an actual duration to a level of equal exposure incurred over a specified 'normal' duration, such as a 'normal' 8 h shift. The purpose is to enable exposure levels incurred over different durations to be referred to a common time base for direct comparison with one another and with regulated exposure levels (see Item 4.2.3(f)).

- (f) *Eight-hour equivalent continuous A-weighted sound pressure level* $L_{\text{Aeq},8\text{h}}$ is a particular case of *normalized total daily noise exposure level*. It is commonly used for prescriptive purposes in occupational noise regulations in Australia and New Zealand.

5 OBJECTIVE OF NOISE ASSESSMENTS

The general objectives of these assessments are as follows:

- (a) To determine the exposure to noise of all people likely to be exposed to excessive noise. For the purpose of this Standard, the exposure to noise of each person is established in terms of—
- (i) eight-hour equivalent continuous A-weighted sound pressure level ($L_{\text{Aeq},8\text{h}}$) or A-weighted noise exposure ($E_{\text{A},T}$); and
 - (ii) the peak sound pressure level (L_{peak}).
- (b) To obtain more specific information that will help decide what measures to take to reduce noise.
- (c) To check the effectiveness of any control measures which have been applied.
- (d) To assist in the selection of appropriate hearing protectors where other control measures are not practicable, or will take some time to plan and implement.

6 TYPES OF NOISE ASSESSMENT

6.1 Assessment of exposure to noise

6.1.1 General

An assessment of exposure to noise is necessary where exposure to excessive noise is known or likely to occur. The form of assessment required will depend on such factors as whether previous assessments have been carried out, whether new plant or engineering noise controls have been introduced (causing changes in noise levels) and the use to which the information obtained will be put.

6.1.2 Preliminary assessment

If no previous assessment has been carried out or previous assessments are more than 5 years old then a preliminary assessment shall be carried out. The aims of this assessment are to document the noise environment, or changes to the noise environment and to establish whether or not the workplace is considered to contain excessive noise. If the workplace is considered not to be noisy then the areas of the workplace covered should be noted. If high noise levels are noted then the noise sources should be documented and, where practicable, simple noise controls should be introduced. A detailed assessment is required where more complex noise sources are present, if there is any doubt about whether the noise levels are excessive or if the noise levels are excessive. In all cases the method of evaluation shall be stated to allow for comparison with other reports and the report shall be signed off by senior management.

NOTE: A preliminary assessment is often referred to as a walk-through audit.

6.1.3 Detailed assessment

A detailed assessment is required in areas where there is a likelihood of exposure to excessive noise. The detailed assessment shall provide results in the form of $L_{Aeq,8h}$ or $E_{A,T}$ and the L_{peak} for persons likely to be subject to exposure to excessive noise. The measurements and evaluations of noise exposure shall be carried out by a competent person (see Appendix A) in accordance with Clauses 7, 8 and 9. The assessment should also provide preliminary information for future engineering control and also information for selection of hearing protectors (see Clauses 6.2 and 6.3).

NOTE: Appendix B provides details of the topics recommended for inclusion in a training course for noise assessment.

6.1.4 Follow-up assessments

Assessments shall be followed up by other assessments, as appropriate, to document the current status of noise exposures at the workplace. These follow-up assessments take the following forms:

- (a) *Five-year assessment* An assessment shall be carried out at least every five years, to monitor changes in noise exposure due to various factors, e.g. deterioration of equipment, changes in work procedures, introduction of new production processes and effectiveness of engineering noise controls.
- (b) *Supplementary assessment* An assessment of only part of the workplace shall be carried out, e.g. in areas where new plant has been introduced, where work practices have changed, in new vehicles which may have been purchased and in areas where regular monitoring is required to check changes in noise exposure due to seasonal or workload related factors.

The measurements and evaluations shall be carried out in a manner allowing comparison with previous assessments.

6.2 Assessment for noise reduction

Where the results of an assessment indicate the likelihood of exposure to excessive noise, then further investigations are needed to identify the sources of noise and to determine priorities for noise reduction. These investigations shall be carried out by a competent person preferably with appropriate expertise in engineering noise control and may require the use of special instrumentation. Upon identification of the major sources of excessive noise, reference shall be made to AS/NZS 1269.2.

6.3 Assessment for personal hearing protector program

Where an assessment of noise exposure (see Clause 6.1) indicates exposure to excessive noise and where legislation or the organization's noise policy requires the issue of hearing protectors, measurements shall be carried out by a competent person in those areas where people are exposed to excessive noise, with a view to establishing sound attenuation requirements for hearing protectors.

This shall involve measurement as described in Clause 8.5 and calculation of sound attenuation requirements in accordance with AS/NZS 1269.3.

In general, if the noise can be described as broadband noise, then the classification method is suitable. However, if the noise is narrowband in character with significant tonality or has significant high or low frequency components or where $L_{Aeq,8h}$ exceeds 110 dB(A), then the octave-band method shall be used. If the noise has significant impulsive components, then the peak sound pressure level shall be measured in order to select appropriate hearing protectors (see AS/NZS 1269.3).

6.4 Assessment of noise exposure from headphones or insert earphones

It may be necessary to measure the noise exposure of a person wearing headphones or insert earphones.

NOTE: Appendix C provides a procedure for measuring the noise exposure of a person wearing headphones or insert earphones.

7 INSTRUMENTATION AND CALIBRATION

7.1 General

This Clause provides a guide to the instruments that may be used. The most common instruments are integrating-averaging sound level meters, personal sound exposure meters (PSEMs), and non-integrating sound level meters. The basic non-integrating sound level meter incorporates a microphone, an amplifier, an A-weighting network and an analog or digital meter. Integrating-averaging sound level meters and PSEMs also incorporate an integrating network to enable direct measurement of $L_{Aeq,T}$ or $E_{A,T}$ respectively.

7.2 Integrating-averaging sound level meter

An integrating-averaging sound level meter provides a direct reading of $L_{Aeq,T}$ irrespective of the characteristics of the noise. The $L_{Aeq,8h}$ can be evaluated from a set of readings of $L_{Aeq,Ti}$ and related exposure times (see Clause 9).

Integrating-averaging sound level meters shall comply with the relevant requirements of AS IEC 61672 series (or available superseded AS 1259 series) for Australia or IEC 61672 series for New Zealand. The meters shall be at least Class 2/Type 2 and preferably Class 1/Type 1. If a Class 2/Type 2 meter is used, allowance should be made for the reduced accuracy of this type of instrument, e.g. in marginal situations above or below the exposure standard and specifically where high precision is required.

7.3 Personal sound exposure meter (PSEM)

A PSEM (also called noise dose meters or dosimeters) is an instrument which integrates the noise to which an individual person is exposed and provides a measure of its magnitude.

PSEMs are specifically designed to be worn on the person, and shall comply with the requirements of AS/NZS 2399. Methods of calculating $L_{Aeq,8h}$ or $E_{A,T}$ from the noise exposure data provided by a PSEM are given in Clause 9.

Hand held sound level meter measurements made by competent people are preferred to measurements using PSEMs. PSEMs are inherently affected by confounding effects. These include—shouting across microphones, tapping the microphones, taking the meter off for short periods, not directing the microphone at the noise source. PSEMs also rely on employees who are untrained and unskilled carrying out their own noise measurements, often in uncontrolled and unreported areas.

Despite these potential confounding effects, the information provided by modern PSEMs can be a useful component in identifying noise exposure of the person.

Where PSEMs are used, for example in small spaces or in single cab vehicles, the operator should be carefully monitored by a competent person to ensure confounding effects are not introduced or at least minimized.

7.4 Non-integrating sound level meter

Non-integrating sound level meters shall comply with the requirements of AS IEC 61672 series (or available superseded AS 1259 series) for Australia, or IEC 61672 series for New Zealand. They provide a reading of the A-weighted sound pressure level. Such instruments shall only be used for a preliminary assessment and where the range of fluctuation of sound levels does not exceed 6 dB(A) when measured in the 'S' time-weighting mode at the measurement location.

7.5 Instruments for the measurement of peak sound pressure level

Peak sound pressure level measurements shall be performed with at least Class 2/Type 2 instruments for preliminary assessments. A Class 1/Type 1 or better instrument shall be used for detailed and follow-up assessments. Instruments shall comply with the requirements of AS IEC 61672 series (or available superseded AS 1259 series) for Australia, or IEC 61672 series for New Zealand. The tester shall ensure that the instrument is capable of accurately recording peak sound pressure levels of at least 140 dB.

7.6 Reference sound sources

Reference sound sources used for field reference level setting of auxiliary instruments and for testing the sound measuring instruments shall comply with at least Class 2 specifications in accordance with IEC 60942 for New Zealand and AS IEC 60942 for Australia.

7.7 Octave-band filters

Octave-band filters shall comply with the Type 1 requirements given in AS/NZS 4476. The nominal centre frequencies of the frequency bands shall correspond to those of AS 2533 for Australia and ISO 266 for New Zealand.

7.8 Auxiliary instruments

All auxiliary instruments used for the measurement of noise levels shall comply with and maintain the relevant precision requirements of AS IEC 61672 series (or available superseded AS 1259 series) for Australia, or IEC 61672 series for New Zealand for at least Class 2/Type 2 and preferably Class 1/Type 1 instruments.

NOTE: General information for various auxiliary instruments is given in Appendix D.

7.9 Auxiliary equipment

Auxiliary equipment such as windscreens, or extended frequency or level response microphones with particular characteristics may be required.