

Australian/New Zealand Standard™

Occupational noise management

Part 4: Auditory assessment



AS/NZS 1269.4:2014

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 14 February 2014 and on behalf of the Council of Standards New Zealand on 7 February 2014.
This Standard was published on 24 April 2014.

The following are represented on 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 Commerce, WorkSafe Division, Western Australia
Department of Defence, Australia
Engineers Australia
Ministry of Business, Innovation and Employment, New Zealand
Ministry of Health, New Zealand
National Acoustic Laboratories
New South Wales Nurses Association
New Zealand Audiological Society
WorkSafe, Victoria

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 Standards may also be withdrawn.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.saiglobal.com.au or Standards New Zealand web site at www.standards.co.nz and looking up the relevant Standard in the on-line catalogue.

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 AS/NZS 1269.4.

Australian/New Zealand Standard™

Occupational noise management

Part 4: Auditory assessment

Originated in Australia as part of AS 1269—1976.
Jointly revised and redesignated AS/NZS 1269.4:1998.
Previous edition AS/NZS 1269.4:2005.
Third edition 2014.

COPYRIGHT

© Standards Australia Limited/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, unless otherwise permitted under the Copyright Act 1968 (Australia) or the Copyright Act 1994 (New Zealand).

Jointly published by SAI Global Limited under licence from Standards Australia Limited, GPO Box 476, Sydney, NSW 2001 and by Standards New Zealand, Private Bag 2439, Wellington 6140.

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee AV-003, Acoustics, Human Effects, to supersede AS/NZS 1269.4.

This is Part 4 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
- 1269.2 Part 2: Noise control management
- 1269.3 Part 3: Hearing protector program
- 1269.4 Part 4: Auditory assessment (this Standard)

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.

This Standard lays down requirements and procedures for conducting pure-tone air conduction threshold audiometry that is used to monitor the hearing of individuals exposed to noise at work. Audiometric testing of persons exposed to excessive noise may be used for four distinct purposes as follows:

- (a) The early detection of deterioration of hearing in persons exposed to excessive noise, so that noise management measures can be reviewed and action taken to prevent further deterioration.
- (b) The identification and documentation of existing hearing loss.
- (c) The prompt direction of those individuals who are identified as having a hearing loss to an appropriate rehabilitation program.
- (d) The supply of any special communication or warning system that may be required within the workplace for an individual with a hearing loss.

The procedures in this Standard are not sufficient to diagnose the cause of an individual's hearing threshold loss or for the determination of percentage loss of hearing for compensation purposes. The Standard prescribes the conditions under which audiometry should be carried out, the form of the tests, and by whom the tests should be performed. It recommends the procedure for interpreting the test results and for comparison of a reference audiogram with follow-up (monitoring) audiograms, together with the course of action to be followed when deterioration of thresholds is detected.

The main changes from the 2005 edition of the Standard are replacement of the table of maximum acceptable ambient noise levels for particular makes and models of earphones/enclosure combinations with a method to calculate the maximum permissible ambient noise levels for any earphone/enclosure combination (Appendix C) and deletion of the informative appendix on otoacoustic emissions. The purpose of the change to Appendix C is to replace the device-based specification with a performance-based approach.

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>
FOREWORD.....	4
1 SCOPE.....	5
2 APPLICATION.....	5
3 REFERENCED DOCUMENTS	5
4 DEFINITIONS	6
5 AUDIOMETERS	7
6 ACOUSTICAL ENVIRONMENT FOR AUDIOMETRY.....	8
7 AUDIOMETRY	9
8 AUDIOMETRIC TEST PROCEDURES	12
9 ASSESSMENT OF AUDIOGRAMS	15
10 EVOKED OTOACOUSTIC EMISSIONS	17
11 CHECKLISTS.....	17
APPENDICES	
A MEASUREMENT OF AMBIENT NOISE LEVELS IN AUDIOMETRIC TEST ENVIRONMENTS	22
B MEASUREMENT OF NOISE REDUCTION OF AUDIOMETRIC BOOTHS	27
C MAXIMUM PERMISSIBLE AMBIENT NOISE LEVELS FOR WORKPLACE AUDIOMETRY PROGRAMS	30
D COMPETENCY REQUIREMENTS FOR AUDIOMETRISTS.....	33
E AUDIOMETRIC SYMBOLS FOR AUDIOGRAMS OBTAINED IN WORKPLACE AUDIOMETRY PROGRAMS	34
F ESTIMATED PREVALENCE OF NOISE-INDUCED HEARING LOSS AND PERCENTAGE LOSS OF HEARING IN NOISE-EXPOSED POPULATIONS	35
G EXAMPLES OF MAXIMUM PERMISSIBLE AMBIENT NOISE LEVELS FOR VARIOUS EARPHONE/CUSHION/ENCLOSURE/INSERT EARPHONE/HEADSET COMBINATIONS.....	42

FOREWORD

Other parts of this series of Standards stress the importance of continuous monitoring of all phases of noise reduction and personal protector programs so that noise risks are addressed systematically and kept under constant control. Monitoring techniques include—

- (a) periodic audits of management systems;
- (b) regular inspections of plant, equipment and work processes;
- (c) ongoing monitoring of condition and usage of noise control equipment and personal protective equipment; and
- (d) re-assessments of noise on a regular basis and following any changes that could significantly alter noise exposure.

These techniques provide the information required to ensure that noise control and hearing protector programs are competently implemented, reviewed and, as time and resources permit, improved. For these purposes, checklists to assist in the evaluation of specific program elements are included in the appropriate sections of previous Parts.

If monitoring and evaluation are carried out systematically and any problems disclosed are promptly dealt with, there can be a high degree of confidence that the programs will be effective in minimizing occupational noise-induced hearing loss. However, organizations shall make a final outcome evaluation measure by providing noise-exposed employees with regular hearing tests, the results of which are examined for any signs of developing hearing loss. Such testing is not itself a protective mechanism and is relevant only in the context of a comprehensive noise management program.

Legislative requirements are also relevant in some jurisdictions. Most jurisdictions have workplace health and safety laws with a general requirement for health monitoring of workers exposed to hazards, and a specific regulatory requirement for regular audiometric testing for workers whose noise exposure is such that they need to rely on hearing protectors for risk management.

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard
Occupational noise management

Part 4: Auditory assessment

1 SCOPE

This Standard specifies procedures and requirements for air conduction pure-tone audiometry (without masking) that are applicable to individuals whose hearing sensitivity might be adversely affected by occupational noise exposure and/or ototoxic agents.

2 APPLICATION

The procedures and requirements presented in this Standard are restricted to air conduction pure-tone threshold audiometry by earphones. Other techniques, such as bone conduction pure-tone threshold audiometry, masking and speech audiometry, are not specified. Techniques for computer-controlled audiometry are not specified but may be used. If used, computer-controlled audiometry techniques shall be shown to produce results equivalent to manual audiometry. The specifications in this Standard are not intended for audiological purposes.

3 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

AS IEC

- 60645 Electroacoustics—Audiological equipment
 60645.1 Part 1: Pure-tone audiometers (IEC 60645-1:2001, MOD)
 61672 Electroacoustics—Sound level meters
 61672.1 Part 1: Specifications
 61672.2 Part 2: Pattern evaluation tests
 60942 Electroacoustics—Sound calibrators

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
 1269.3 Part 3: Hearing protector program
 1270 Acoustics—Hearing protectors
 4476 Acoustics—Octave-band and fractional octave-band filters

EN

- 352 Hearing protectors—Safety requirements and testing

* 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.

IEC

60645 Electroacoustics—Audiometric equipment
 60645-1 Part 1: Equipment for pure-tone audiometry

61672 Electroacoustics—Sound level meters

61672-1 Part 1: Specifications

61672-2 Part 2: Pattern evaluation tests

60942 Electroacoustics—Sound calibrators

ISO

1999 Acoustics—Estimation of noise-induced hearing loss

4869 Acoustics—Hearing protectors

4869-1 Part 1: Subjective method for the measurement of sound attenuation

8253 Acoustics—Audiometric test methods

8253-1 Part 1: Pure-tone air and bone conduction audiometry

NAL

80 NAL Report No. 80: Criteria for Assessing Hearing Conservation Audiograms

4 DEFINITIONS

For the purpose of this Standard the definitions given in AS/NZS 1269.1 and those below apply.

4.1 Air conduction

The transmission of sound through the external and middle ear to the inner ear.

4.2 Audiogram of a subject

Presentation, in graphical or tabular form, of the hearing threshold levels of the subject's ears, determined under specified conditions and by a specified method, as a function of frequency.

4.3 Audiometric recording

A display of the responses of a subject to the signals emitted by an audiometer.

4.4 Automatic recording audiometer

A pure-tone audiometer in which hearing level variations are under the test subject's control and are recorded automatically.

4.5 Computer-controlled audiometer

A pure-tone audiometer in which the test procedure is controlled by computer. For the purpose of this Standard a computer is considered as any electronic device that has a program controlling the test procedure.

4.6 Hearing level

The hearing level of a pure tone at a specified frequency, for a specific type of earphone and for a specified manner of application, is the sound pressure level of the signal set up by the earphone in a specified coupler or artificial ear minus the appropriate reference equivalent threshold sound pressure level.

4.7 Hearing threshold level

The hearing threshold level of a given ear at a specified frequency is the threshold level at that frequency, derived by a specified method from an audiometric recording, expressed as hearing level (dB HL).

4.8 Manual audiometer

A pure-tone audiometer in which the signal presentations, frequency and hearing level selection and recording of the responses of the subject are performed manually.

4.9 Pure-tone audiometer

An electroacoustic instrument, equipped with earphones, which provides pure tones of specified discrete frequencies at known hearing levels.

4.10 Significant threshold shift

A threshold shift greater than or equal to 15 dB at 500, 1000, 1500 or 2000 Hz, or greater than or equal to 20 dB at 8000 Hz in either ear; a change in mean threshold greater than or equal to 10 dB at 3000 and 4000 Hz, or greater than or equal to 15 dB at 6000 Hz in either ear; or a change in average threshold at 3000, 4000 and 6000 Hz greater than or equal to 5 dB in either ear.

5 AUDIOMETERS

5.1 General requirements

Audiometers shall be constructed and calibrated at least to the requirements of Type 4 monitoring air conduction pure-tone manual and automatic recording audiometers as specified in AS IEC 60645.1 (IEC 60645-1). They shall be maintained and regularly calibrated according to the requirements of Clause 5.3. Computer-controlled audiometers shall be constructed so that they meet the requirements concerning monitoring air conduction pure-tone manual audiometers and give results equivalent to those obtained by manual pure-tone audiometry.

5.2 Specific requirements

5.2.1 *Frequencies and sound pressure levels of test tones*

Audiometers shall be provided with test tones of at least the following frequencies: 500, 1000, 1500, 2000, 3000, 4000, 6000 and 8000 Hz. The hearing levels shall cover the range from 0 dB to 90 dB and preferably from -10 dB to +100 dB.

5.2.2 *Pulsing of test tones*

The test tones of automatic recording audiometers shall be pulsed according to the specification given in AS IEC 60645.1 (IEC 60645-1).

5.2.3 *Attenuation rate of automatic recording audiometers*

For automatic recording audiometers the preferred attenuation rate shall be 5 dB/s. If another rate is used, it shall be 2.5 dB/s.

5.3 Maintenance and calibration

5.3.1 *General*

It is essential that the audiometer, when in service, complies with and is calibrated in accordance with at least the requirements for Type 4 audiometers, as specified in AS IEC 60645.1 (IEC 60645-1). If headphones are changed on the audiometer the audiometer shall be recalibrated.

5.3.2 *Check procedures*

5.3.2.1 *General*

A listening check according to Clause 5.3.2.2 shall be performed at the beginning of each day of testing. A subjective test according to Clause 5.3.2.3 shall be performed at least once a week, but preferably daily.

5.3.2.2 *Listening check*

An experienced tester with normal hearing shall listen carefully for distortions, attenuator and tone-switch transients and other unwanted sound from the audiometer at a minimum of three attenuator settings, separated by at least 20 dB, at all test frequencies. If any unwanted sounds from the audiometer are heard, the audiometer shall be withdrawn from service for inspection and repair.

5.3.2.3 *Subjective calibration check*

Take an audiogram of a person having known stable hearing, with hearing threshold levels not exceeding 25 dB at each test frequency, and compare the test results with the known audiogram. If the results indicate hearing threshold level differences that equal or exceed 10 dB at any frequency the audiometer shall be withdrawn from service and subjected to an objective calibration check or basic calibration.

5.3.3 *Basic calibration*

A basic calibration shall be performed at least yearly by an independently audited laboratory with full traceability to National Standards. Basic calibration shall be performed more often if deemed necessary as a result of the periodic checks given in Clause 5.3.2.

The procedure shall be such that after its application the audiometer is calibrated in accordance with the requirements for Type 4 instruments given in AS IEC 60645.1 (IEC 60645-1).

When the instrument is returned after basic calibration, it shall be checked according to Clause 5.3.2.3.

6 ACOUSTICAL ENVIRONMENT FOR AUDIOMETRY

6.1 General

The outcome of measurement of the acoustical environment in which audiometry is carried out is referred to as the 'ambient noise level', both in the case where audiometry is carried out without an audiometric booth and where audiometry is carried out within an audiometric booth. In the case where audiometry is carried out in an audiometric booth, the term external ambient noise level refers to the outcome of measurement of the acoustical environment surrounding the booth.

6.2 Measurement of ambient noise level

The procedure set out in Appendix A shall be followed in measuring the octave-band noise levels of the ambient noise in audiometric test environments. The measurements shall be made at a time when conditions are representative of those existing when audiometric tests are carried out.

6.3 Maximum permissible ambient noise levels (MPANL)

The ambient octave-band noise levels at the position in the audiometric test environment that will be occupied by the listener's head during the audiometric test shall not exceed the values as specified by the procedure given in Appendix C.

In some locations, it is necessary to use an audiometric booth to achieve the maximum permissible ambient noise levels. If an audiometric booth is not used, the ambient octave-band noise levels in the audiometric test environment shall be measured as specified in Appendix A and the results shall be recorded and kept. If an audiometric booth is used, the ambient octave-band noise levels in the booth shall be measured as specified in Appendix A and details of the levels shall be recorded and kept.

Noise reduction of audiometric booths shall be determined as set out in Appendix B.

7 AUDIOMETRY

7.1 General

Audiometric testing shall be made available to all persons likely to be exposed to noise above the noise exposure criteria as set by the relevant statutory authorities or by the organization's noise policy, whichever is the lower, or ototoxic agents as listed in Appendix C of AS/NZS 1269.0:2005. The test subject should be made fully aware of the reason why audiometry is being made available. One purpose of audiometry is to inform test subjects of any changes in their pure-tone thresholds. Audiometry is desirable because there are uncertainties in occupational noise management programs, e.g. error in noise exposure measurements and variability in the effectiveness of hearing protectors. Audiometry may assist in the early detection of inadequacies in the occupational noise management program and therefore enables early remedial action to be taken.

Where audiometric testing is carried out it shall be in accordance with the requirements concerning audiometers, audiometric test environments and audiometric test procedures of this Standard. It shall be the responsibility of a particular individual within an organization to manage the audiometric program.

The purpose of audiometry is to determine the test subject's hearing threshold levels as accurately as practicable. Reference audiometry is used to establish the status of the test subject's hearing thresholds, while monitoring audiometry is used to establish any subsequent deviations from that reference.

The results of audiometry are influenced by learning, practice and motivation. It is therefore important to give the test subject sufficient practice in carrying out the tasks of audiometry and to encourage positive motivation towards the test before reference audiometry is performed.

The test-retest variability of audiometric results can be reduced by averaging thresholds across adjacent frequencies. Three is the optimum number of frequencies to include in the average. Audiometric test results are also influenced by the placement of the headphones on the subject's head. Relative to the accuracy of single audiograms, the accuracy of audiometric data is greatly improved by recording the average of two or more audiograms, the headphones being completely removed and refitted on the subject between tests.

The attendance of test subjects for periodic monitoring audiometry provides a useful opportunity to examine the condition of hearing protectors and to ensure that they are being worn correctly. Test subjects should therefore be requested to bring their hearing protectors with them whenever they have their hearing tested.

The occurrence of tinnitus in noise-exposed people may be an early sign of noise-induced damage to the inner ear. The onset of noise-induced tinnitus often occurs early in the careers of noise-exposed people and may precede measurable effects on threshold sensitivity. The presence or absence of tinnitus shall therefore be recorded when audiometry is carried out and, if new tinnitus is present, appropriate action shall be taken (see Clause 9.4).

The test subject and the tester should be comfortably seated during audiometric testing and should not be disturbed or distracted by events unrelated to the test procedure or by people in the surroundings. If manual audiometry is employed the subject shall be clearly visible to the tester but shall not be able to see or hear when the audiometer settings are being changed or the test tone is switched on or interrupted.

After completion of audiometric testing, each test subject's hearing threshold, the need for hearing protection, and the best type of hearing protector for the job should be discussed with that person. Proper fitting of the hearing protector should be ensured at the completion of the examination. Instructions should be repeated at each subsequent attendance for audiometry.

7.2 Tester

The person who carries out the audiometry shall have received proper training in basic pure-tone audiometry. Appendix D sets out the competency requirements for audiometrists.

NOTE: The level of training, education and experience required of the tester may be specified by the relevant statutory authority and may include a licence, approval or accreditation system with associated time-frames.

Assessment of competency shall include the means to test knowledge of relevant legislation and codes of practice, as well as this Standard's audiometric test procedure and factors affecting the accuracy of results.

7.3 Non-routine test subjects

If audiometry, as specified in this Standard, is unable to be carried out on a test subject, then the test subject shall be referred to a person who is competent to conduct full audiological assessments. This person shall have had at least 5 years postgraduate experience and have the necessary testing facilities to be able to adequately assess the test subject.

Special care should be taken when testing non-English-speaking persons or those speaking English as a second language to ensure that instructions are fully understood. This may involve the use of an interpreter.

7.4 Reference audiometry

Reference audiometry shall be carried out during pre-employment medicals or as soon as possible after commencement of employment.

NOTE: It should be carried out prior to the commencement of duty in noisy areas.

Reference audiometry shall be in accordance with the following:

- (a) *Prerequisites* Reference audiometry shall be immediately preceded by a period of quiet (noise exposure which is unlikely to produce temporary threshold shift) of not less than 16 h. The tester shall obtain and record information concerning the noise exposure of the test subject in the 16 h prior to the test. The medical and occupational history of the test subject, particularly in relation to ear disease and noise exposure, shall be obtained and recorded.
- (b) *Acoustical environment conditions* Acoustical environment conditions shall comply with those specified in Clause 6.
- (c) *Test frequencies* The test frequencies shall be 500, 1000, 1500, 2000, 3000, 4000, 6000 and 8000 Hz.
- (d) *Test procedure* The test procedure shall be in accordance with Clause 8 of this Standard.
- (e) *Requirements* Reference audiometry shall be repeated whenever a significant permanent deterioration or improvement in thresholds has been detected by means of monitoring audiometry (see Clause 9.5).
- (f) Reference audiograms shall be assessed in accordance with Clause 9.2.

7.5 Monitoring audiometry

The main purpose of monitoring audiometry is to detect threshold shift which may be temporary or permanent. Temporary threshold shift is an early indicator of the likelihood of permanent threshold shift. Monitoring audiometry shall be in accordance with the following:

- (a) *Prerequisites* The tester shall obtain and record information concerning the noise exposure of the subject in the 16 h prior to the test, including information concerning the use of hearing protectors and if the workplace noise was typical.

- (b) *Acoustical environment conditions* Acoustical environment conditions shall comply with those specified in Clause 6.
- (c) *Test frequencies* The test frequencies shall be 500, 1000, 1500, 2000, 3000, 4000, 6000 and 8000 Hz.
- (d) *Test procedures* The test procedure at individual frequencies shall be in accordance with Clause 8.
- (e) *Requirements* Monitoring audiometry shall be carried out within 12 months of initial reference audiometry.

In the absence of significant threshold shift or change in the work situation, it should then be sufficient to repeat the test at yearly intervals, but high risk groups may require more frequent testing.

NOTE: At high exposure levels (e.g. $L_{Aeq,8h} > 100$ dB(A)) more frequent audiometric testing may be desirable.

Monitoring audiometry shall be scheduled well into or at the end of the work shift so that comparison with the reference audiogram will reveal any temporary threshold shift due to inadequacies in the use of hearing protectors.

- (f) Monitoring audiograms shall be assessed in accordance with Clause 9.3.

7.6 Recording of results

7.6.1 General

Clauses 7.6.2 and 7.6.3 specify the minimum amount of information that shall be obtained, recorded and reported, where appropriate, for each person tested.

7.6.2 Reference audiometry

The following details shall be recorded:

- (a) General details, i.e. name of employer, name of tester, date of test, make, model, identification number and calibration expiry date of audiometer and type of earphone/cushion/enclosure/insert earphone/headset combination used and compliance with permissible ambient noise level requirements.
- (b) Personal particulars of test subject, e.g. name, address, date of birth and sex.
- (c) Medical history, e.g. diseases affecting hearing, ear or head injuries, family history of deafness, recent earache or discharge, tinnitus and any other condition that might affect the ear or hearing.
- (d) Noise exposure history, e.g. details of noise exposure in present and past employment, noise exposure in military service, recreational and other non-work noise exposure and use of hearing protectors during any present or past noise exposure.
- (e) Details of any noise exposure in the 16 h prior to the test.
- (f) If obtained, results of examination of the state of ear canals, state of tympanic membranes, state of nose and throat and any other relevant conditions.
- (g) Reference audiogram. The audiometric symbols that shall be used on audiograms obtained in occupational noise management programs are provided in Figure E1 of Appendix E.
- (h) A signed record of the test subject's agreement or refusal to release audiometric results to the employer.

7.6.3 *Monitoring audiometry*

The following details shall be recorded:

- (a) General details, i.e. name of employer, name of tester, date of test, make, model, identification number and calibration expiry date of audiometer and type of earphone/cushion/enclosure/insert earphone/headset combination used and compliance with permissible ambient noise level requirements.
- (b) Personal particulars of test subject, e.g. name, address, date of birth and sex.
- (c) Updated medical history.
- (d) Recent noise exposure history, i.e. details of noise exposure in 16 h prior to the test including information on use of hearing protectors and if the workplace noise was typical.
- (e) If obtained, results of examination of the state of ear canals, state of tympanic membranes, state of nose and throat and any other relevant conditions.
- (f) Monitoring audiogram. The audiometric symbols that shall be used on audiograms obtained in occupational noise management programs are provided in Figure E1 of Appendix E.
- (g) Comparison of monitoring audiogram with current reference audiogram.
- (h) A signed record of the test subject's agreement or refusal to release audiometric results to the employer.

8 AUDIOMETRIC TEST PROCEDURES

8.1 General

The following test procedure shall be used for both reference and monitoring audiometry. The same type of audiometer and audiometry should be used to obtain all audiograms for an individual. If the headset of the audiometer is changed the audiometer shall be recalibrated. Measurements of hearing threshold levels shall not be undertaken until the test subject has been familiarized or re-familiarized with audiometry.

The ambient noise levels shall not exceed the maximum permissible ambient noise levels calculated by the method given in Appendix C for the earphone/cushion/enclosure/insert earphone/headset combination being used.

8.2 Preparation for testing

Subjects shall be present at least 5 min in advance of testing to avoid errors due to excessive physical exertion. A way of achieving this is to perform the administrative matters for the subject upon their arrival.

Before testing, the following actions shall be undertaken:

- (a) Spectacles, hats, earrings, hearing aids or anything which may interfere with the proper placement of the earphones, shall be removed.
- (b) Hair shall be moved aside from between the earphones and the ear canal.
- (c) The earphones shall be fitted by the tester to ensure proper seal and comfortable fit and subjects shall be instructed not to touch the earphones thereafter. To obtain a proper seal, the positions of the headphones relative to the headband shall be adjusted so that they are appropriately located over the ears of the subject.
- (d) Subjects shall be instructed to avoid unnecessary movements, to obviate extraneous noise.

8.3 Instruction of subject

It is essential for audiometric testing that relevant briefing in the test procedure be given unambiguously and that it is fully understood by the test subject. The briefing shall include—

- (a) the response task while a sound is heard (response task can be, for example raising a finger, a hand or pressing a button);
- (b) an indication of the need to respond as soon as possible;
- (c) an indication that the sounds may be very faint;
- (d) the pitch sequence of the sounds and which ear will be tested first; and
- (e) an indication that the test may be interrupted by the subject him or herself in case of any disturbing events.

After the briefing, the subject shall be asked if he or she has understood. If there is any doubt, the briefing shall be repeated.

8.4 Manual audiometry

Manual audiometry shall be carried out as follows:

- (a) Tell the test subject that he or she is going to hear a series of music-like tones through the earphone (right or left), and instruct the subject to listen carefully and signal each time one of those sounds is heard no matter how faint.
- (b) Place the earphones over the ears, with the red phone over the right ear and the blue over the left. Make sure that the earphones are level with the entrance to the ear canal, and that the headset will stay securely in place.
- (c) Where one ear is known to be significantly better than the other, commence by testing that ear.
- (d) *For Australia only* Test using the following technique:
 - (i) Commence testing at 1000 Hz.
 - (ii) With the hearing level dial set at 0 dB hold the interrupter switch in the ON position and turn the hearing level dial at a moderate speed so that the level of the sound is gradually increased. As soon as the subject responds, release the interrupter switch.
 - (iii) Turn the hearing level dial down 10 dB; present a short (about 1 s) burst of tone.
If the subject responds reduce the tone level a further 10 dB and present another tone. Repeat this procedure until the subject fails to respond.
 - (iv) When the subject fails to respond, increase the level of the tone by 5 dB and test again, presenting a total of three tone bursts. If the subject responds to only one of these three tone bursts, turn the hearing level dial up another 5 dB and present another three bursts.
 - (v) If the subject responds to two of the tone bursts, decrease the level of the tone by 5 dB and again present three tone bursts. The lowest level at which two out of three bursts are heard is taken as the subject's threshold hearing level.
 - (vi) Test frequencies in this sequence, 1000, 1500, 2000, 3000, 4000, 6000, 8000, 500 Hz, then retest at 1000 Hz. On retest, the levels at 1000 Hz should agree within ± 5 dB; if not, the result of the first test at 1000 Hz should be discarded.