

Guidelines on Hearing Checks and Audiometry in the Workplace

Required by

The Safety, Health and Welfare at Work (General Application Regulations 2007 (S.I. 299/2007), Chapter 1 of Part 5: Control of Noise at Work.

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1.0 Hearing Checks and Audiometric Screening

1.0 Background and Introduction

The purpose of this document is to assist registered medical practitioners, and/or persons ‘acting on his or her responsibility’, in carrying out “**hearing checks**” in those employees who are exposed to noise above the *upper exposure action value* and also to assist in “**preventive audiometric testing**” in those exposed above the *lower exposure action value* as required by *Safety, Health and Welfare at Work (General Application) Regulations 2007 (S.I. No.299/2007), Part 5 Physical Agents, Chapter 1 Control of Noise at Work*. Throughout the text, these regulations will be referred to as ‘*the Regulations*’.

The essential difference between **hearing checks** and **preventive audiometric testing** is that hearing checks involve a more complete assessment including a medical and noise exposure questionnaire and an examination of the ears. It is important to consider that the Regulations apply minimum standards, and it is possible to provide “hearing checks” to all employees. The purpose of this guidance document is to inform employers and employees of the principles of occupational audiometry.

1.1 Noise

Noise is defined by the Regulations as “any audible sound”. The regulations apply to activities in which employees are exposed to risks to their safety and health arising from exposure to noise during their work and, in particular, the risk to hearing. Noise in the workplace is almost never constant, even when it appears to be so, as the person at work is often moving. In order to make variable noise sensible, the L_{eq} or equivalent constant noise level is used over a defined period of time that is of equal energy to the variable noise. This is an average noise level over a period of time.

1.2 The Effects of Noise

Noise-Induced Hearing Loss (NIHL) can occur in two different ways, it is usually gradual due to prolonged exposure to noise or less commonly caused by an immediate sudden

extremely loud impulsive noise from, for example, guns or cartridge-operated machines.

NIHL represents excessive wear and tear on the inner ear structures. Exposure to noise may also cause Tinnitus, which is a sensation of noises (such as ringing or buzzing) in the ears. This can occur in combination with hearing loss. Employees who are regularly exposed to noise above 80 dB(A) could be at increased risk of damage to their hearing resulting in Noise-Induced Hearing Loss. There is also evidence arising of several other health effects due to noise exposure such as fatigue, sleep problems, increased blood pressure and stress.

1.3 Noise-Induced Hearing Loss (NIHL)

Noise-Induced Hearing Loss (NIHL) is an inner ear hearing loss, caused mainly by damage to hair cells in certain regions of the cochlea, resulting in Sensorineural Hearing Loss (SNHL). That is, NIHL is a form of sensori-neural or “nerve” hearing loss. Detection of hearing loss during Workplace Screening Audiometry cannot be the sole basis for advising someone on the cause of their hearing loss. The question of diagnosis and referral is further detailed in section 1.7.

There are many causes of hearing loss, noise is but one. The pattern of an audiogram may suggest NIHL, however a firm diagnosis can rarely be made without further information, the scope of which is beyond these guidelines. An audiogram is a presentation, in graphical or tabular form, of the hearing threshold levels of the ears of the test subject, determined under specified conditions and by a specified method, as a function of frequency (ISO 8253-1:2010).

1.4 The interactions between noise and work-related ototoxic substances or vibration

When carrying out a risk assessment under Regulation 124 particular attention must be given, as far as technically possible, to any effects on employees’ safety and health resulting from interactions between noise and work-related ototoxic substances, and between noise and vibrations.

Noise is no longer perceived as the only source of work-related hearing damage. Exposure to particular chemicals, such as some solvents, heavy metals, asphyxiants and certain drugs can also affect hearing and are known as ototoxic substances. Ototoxic substances can be ototoxic by themselves or exposure to such chemicals may increase the risk with the added effect of noise.

Vibration refers to rapid back-and-forth or oscillating movement. Vibration can either directly create or indirectly amplify noise, and controlling vibrations often goes hand-in-hand with reducing noise in the workplace.

1.5 The Noise Regulations

The Regulations refer to the “**daily noise exposure level**” ($L_{ex,8h}$ (dB)(A) re: 20 μ Pa). This means the time-weighted average (TWA) of the noise exposure level for a nominal eight-hour working day as defined by international standard ISO 1999: 2013, which covers all noise present at work, including impulsive noise.

High noise levels, even if they are instantaneous can be dangerous and so the Regulations also refer to Peak levels which if exceeded at any time are covered by the requirements of the Regulations.

Regulation 123 refers to an **exposure limit value** and two **action values**.

exposure limit values: $L_{ex,8h} = 87$ dB(A) and $P_{peak} = 140$ dB(C) in relation to 20 μ Pa.

upper exposure action values: $L_{ex,8h} = 85$ dB(A) and $P_{peak} = 137$ dB(C) in relation to 20 μ Pa.

lower exposure action values: $L_{ex,8h} = 80$ dB(A) and $P_{peak} = 135$ dB(C) in relation to 20 μ Pa.

Each value requires specified action to reduce noise risk, detailed in the Regulations. The **exposure limit values** but **not the exposure action values** can take into consideration the person’s effective noise exposure by consideration of the attenuation afforded by hearing protection such as ear defenders and/or ear plugs.

Regulation 123 allows the use of a weekly average in certain circumstances where:

“the weekly noise exposure level as shown by adequate monitoring does not exceed the exposure limit value of 87dB(A),

and

appropriate measures are taken in order to reduce the risk associated with these activities to a minimum.”

Regulation 124 requires risk assessments for noise levels above a lower exposure action value. In the assessment particular attention must be paid to a number of factors including the effects of exposure to noise on employees whose safety and/or health is at particular risk from such exposure, and as far as technically possible any effects on employees’ safety and health resulting from interactions between noise and work-related ototoxic substances and between noise and vibration.

Regulations 126 and 127 specify, in addition to the previous requirements, when the level is above 85dB (A) the employer must:

- Identify the reasons for the excess noise and put in place a programme to reduce it. This could be either of a technical nature or of organisation of work or both.
- Put up clearly visible and legible signs indicating that the noise level in the area is likely to exceed 85dB (A), in accordance with Safety, Health and Welfare at Work (General Application) Regulations 2007, (S.I. 299/2007) Part 7, Chapter 1 Safety Signs at Places of Work.
- Make hearing protection available and ensure that it is worn.

Regulation 131 requires that appropriate health surveillance must be made available to those employees for whom the risk assessment referred to in Regulation 124 reveals a risk to their health.

In the case of employees whose exposure exceeds an upper exposure action value, the services of a registered medical practitioner (RMP) must be made available to carry out a hearing check, and in the case of employees whose exposure exceeds a lower exposure action value, make available to them preventive audiometric testing.

Regulation 131 also requires that the risk assessment be reviewed where the results of health surveillance show it to be necessary.



1.6 Health Surveillance

Health Surveillance is defined by the Safety, Health and Welfare at Work Act 2005 (No. 10/2005) and means “*the periodic review, for the purpose of protecting health and preventing occupationally related disease, of the health of employees, so that any adverse variations in their health that may be related to working conditions are identified as early as possible*”. Health surveillance is a systematic, regular and appropriate programme to detect early signs of work-related ill-health and then acting upon the results. The aim is to identify and protect employees at increased risk of developing occupational diseases and to check the long-term effectiveness of measures to control risks to health.

Regulation 131 requires the employer to make health surveillance available to their employees, including hearing checks and preventive audiometric testing, when workplace noise levels cannot be reduced below the **lower exposure action level**. Where employees are potentially exposed to noise above the **lower exposure action level**, the employer in consultation with his/her employees must carry out a risk assessment. Where the risk assessment indicates exposure above the **upper exposure action level**, the employer must make available the services of a registered medical practitioner (RMP) to carry out or have carried out on his or her responsibility, a hearing check.

Where exposure exceeds the **lower exposure action level**, the employer must make available to employees preventive audiometric testing.

It is recommended that the RMP carrying out a hearing check should be a competent person by means of his or her training, experience, knowledge and/or qualifications. Ideally the RMP should have a qualification in occupational medicine, but this is not always possible. Preventive audiometric testing can be carried out by an occupational health professional such as an occupational health nurse or audiologist. It is recommended that this healthcare practitioner should be a competent person by means of his or her training, experience and/or qualifications. Ideally the healthcare practitioner should have a qualification in occupational health and/or a qualification in occupational audiometry and preferably both.

The hearing check requires:

- a. Taking of a medical history of the employee, with reference to ear problems, past noise exposures and existing hearing protection use (Appendix I).
- b. Examination of the external auditory canal and the tympanic membrane and recording of same.
- c. The audiometric screening test.

Preventive audiometric testing involves the audiometric screening test only, although it is vital to appreciate that the audiogram is very much less benefit on its own and while the Regulations set down minimum standards, many employers will choose to perform “hearing checks” on all noise-exposed employees.

If audiograms show deterioration in several employees, it indicates the need for review of the risk assessment and control measures. Additional control measures such as noise reduction, increased hearing protection and/or instruction in particular areas of the workplace may be required and documented. Although the element of education to reduce the risk of NIHL, is important, the employer will need to consider if extra measures are advisable in the light of trends from the Audiometric Health Surveillance Programme.

Ultimately, the purpose of hearing checks and audiometric tests is to provide early diagnosis of any hearing loss due to noise and to assist in the preservation of hearing of employees.

1.7 Audiometric Characteristics of Noise-Induced Hearing Loss

The preventive audiometric testing also known as the ‘Workplace Screening Audiometry’ or ‘screening’ involves an assessment of the hearing thresholds using air conduction under headphones, with testing carried out under specified conditions and methods, given in *ISO 8253-1:2010: Pure-tone air and bone conduction audiometry*. Workplace Screening Audiometry alone

cannot be used to classify hearing loss as outer/middle ear (Conductive Hearing Loss, CHL), inner ear/nerve (Sensorineural Hearing Loss, SNHL), or a mixture of both (Mixed Hearing Loss, MHL). It is also important to remember that even NIHL causes can be social, accidental or workplace exposure to noise, and it may be accelerated by other genetic, health and lifestyle factors.

The purpose of Workplace Screening Audiometry is not to diagnose in itself but rather identify those who might have a problem to allow for appropriate further action which may include referral to allow for diagnosis.

NIHL typically results in a “V” or “U” shaped ‘notch’ often starting around 4000 Hz (4 kHz), but sometimes 6000 Hz (6 kHz), then gradually deepening and later spreading to adjacent frequency ranges. There is typically “recovery” or improvement at 8000 Hz (8 kHz). This is the classical difference between the pattern of NIHL and that of Presbycusis (age related hearing loss) where there is usually a further drop at 8 kHz. This difference may become less marked with time and or increasing severity and indeed deciding on whether a hearing loss is noise-induced or due to Presbycusis, or a combination, can be quite difficult.

While there are certain patterns classically seen in an audiogram in NIHL, it is important to realise that an audiogram on its own is not diagnostic. When making a diagnosis of NIHL, which can only be made by an expert, such as a Specialist in Occupational Medicine, the audiogram is considered along with other information such as noise exposure history, personal medical history and clinical findings.



In Noise-Induced Hearing Loss (NIHL), both ears are usually affected similarly. However, if one ear is exposed to significantly more noise, it can result in asymmetrical hearing loss. The ear closest to the noise source typically suffers more damage due to the "head shadow" effect, where the head blocks some of the sound from reaching the other ear. A common example is shooting a gun—if someone shoots from the right shoulder, the left ear is more affected because the sound comes from the gun barrel, and the right ear is somewhat shielded by the head.

In about half of all cases of significant hearing loss, some increase in the frequency of buzzing or ringing in the affected ear(s) will occur that is known as **Noise-Induced Tinnitus (NIT)**.

Permanent damage to the ears is often preceded by periods of **Temporary Threshold Shift, (TTS)**. Unlike NIHL, TTS is reversible. It usually occurs after exposure to loud noise and has been experienced by most people after a disco, concert or something similar. The person is often conscious of diminished hearing, and this is often accompanied by Tinnitus which gradually decreases with time. The effect can last up to 48 hours, but the vast majority has reversed in 16 hours. This effect is of importance in the event of performing a hearing test if the employee has been exposed to loud noise in the last 16 hours. Whether this is because of loud music exposure socially or occupational noise this does not matter as it still has the potential to affect the result of the test.

Hearing damage due to noise occurs at the time of exposure or within a very short time thereafter. Once the person is removed from the loud noise environment, NIHL will not progress further as a result of that noise. Noise damage is not progressive without more noise. This is an important point because, for example, if an audiogram shows a significant deterioration from the previous test and there has not been significant occupational noise exposure in the interim, the loss **cannot** be occupational.

Further information about 'diagnostic audiometry' and NIHL is available in the Green Book, 'Hearing Disability Assessment', published by Department of Health & Children in 1998.

1.8 Baseline Audiometry and Pre-employment audiometry

A **Baseline** audiogram is carried out prior to employment at pre-employment stage, immediately after commencing employment or prior to placement in the noisy area. A Baseline audiogram provides invaluable information in establishing if subsequent audiograms show recently acquired hearing loss. The medical and occupational related noise exposure history taken at this Baseline stage may also be very important in future testing results.

Pre-employment audiometry can enable pre-existing notches or other hearing problems to be detected prior to any noise-exposure in the workplace. Early NIHL will only cause slight difficulty in certain listening environments like noisy crowds or large groups. Many people with mild, slowly progressive high frequency hearing loss are unaware of gradual hearing changes. Having existing hearing loss should not be used as an automatic reason for exclusion from a noisy workplace. It is important for the employer to be aware of their responsibilities under Equality Legislation as well as Health and Safety Legislation.

In general, the questions which need to be answered are:

- Can this person do the job safely?
- Can this person be safe in this working environment? For example, fire alarms, adequate hearing defenders.
- Are there any special precautions, adaptations necessary which would enable this person to do the job safely? For example, visible alarms, vibrating alarms.
- Are there special measures needed for continued monitoring of this person?

1.9 Principles of Audiometry

An audiometer gives calibrated noise signals of variable intensity, at different frequencies ranging between 250Hz or 500Hz, up to 8 kHz, into the headphones used for testing hearing. Audiometry should be conducted according to ISO 8253-1:2010: *Acoustics - Audiometric test methods Part 1: Pure-tone air and bone conduction audiometry*.

The employee's response to a 'barely audible' tone forms the basis of the test, so it is 'subjective'; this can be unsatisfactory if he/she is not participating fully either because of inadequate instructions, noisy conditions, inattention or medico-legal factors affecting test compliance.

A suitably soundproofed setting must be provided for testing. Persons must be correctly instructed and monitored during the test to ensure continued attention and compliance. Many audiometers have a facility for talking via microphone and headphones to the person in the test booth. This should be used if responses to audiometric tones seem exceptionally poor or are inconsistent.

1.10 Noise Health Surveillance Information to Employees

Where a risk exists and hearing checks and preventive audiometric testing are made available by the employer, employees can decide if they wish to avail of them. Employers need to consider the relative risk of NIHL in their workplace, by having suitable noise surveys carried out and decide whether to make the health surveillance 'available' or a 'condition of employment'. Detailed noise surveys (looking at various areas of the workplace) should be available to the person conducting hearing checks if requested.



2.0 Technical Requirements

2.1 Testing Facilities and Equipment

ISO 8253-1:2010 Acoustics - Audiometric test methods Part 1: Pure-tone air and bone conduction audiometry outlines the criteria which should be met to prevent test tones being masked by ambient sound levels and to allow measurement of hearing thresholds down to 0dB. This standard also covers what is required for calibration of equipment.

While it is acknowledged that occupational audiograms cannot always be performed in ideal conditions, Workplace Screening Audiometry must still be conducted in a quiet environment, as specified by ISO 8253-1:2010. The proposed test setting is therefore analysed using a third-octave band noise analysis by a qualified person in acoustic measurement. For potential sources of intermittent noise interference, unless a sound level meter (IEC61672-1 class 1) indicates that the ambient noise levels are continuously below 30 dB(A), an audiometric soundproof booth is likely required to ensure acceptable listening conditions.

Although noise-excluding headsets have been recommended as an alternative method to reducing the effects of ambient noise, variations in fit may mean that it is not possible to be certain of the attenuation achieved. Information should be obtained on the attenuation of the headsets, tested according to *ISO 4869-1:2018 Acoustics — Hearing protectors*

Part 1: Subjective method for the measurement of sound attenuation, which can be used to determine acceptable background levels.

An Audiometric booth should be sited in a quiet place away from traffic or intermittent noise sources. The suppliers of the soundproofed booth will provide advice on situating the booth, an initial calibration certificate, and a regular inspection/calibration certificate to ensure that the sound environment continues to be satisfactory. It is recommended that mobile testing facilities pay careful attention to daily equipment inspection, background noise monitoring, and more frequent calibration, in accordance with ISO 8253-1:2010, this is due to the risk of varying noise levels, environmental conditions, and the potential for vibration or shock during transport.

Most audiometers used for workplace screening are supplied with 'Audiocups' or MX41/AR cushions, which exclude more noise than standard EAR cushions. These Audiocups are normally fitted to circumaural (over ear) headphones for example the TDH39, DD45 or the most recent Dd65 headphones. When these are fitted to the audiometer, the additional attenuation supplied can be subtracted from the ambient noise level in the booth to obtain the actual 'test environment' level which is further explained in ISO 8253-1:2010. Suppliers of audiometers can advise on the use of headphones. Once calibrated, the headphones must remain with that audiometer and cannot be changed without re-calibration. Please note that the audiometer must be recalibrated after changing the headphones. Suppliers of audiometric booths and audiometers will generally offer calibration services for their equipment.



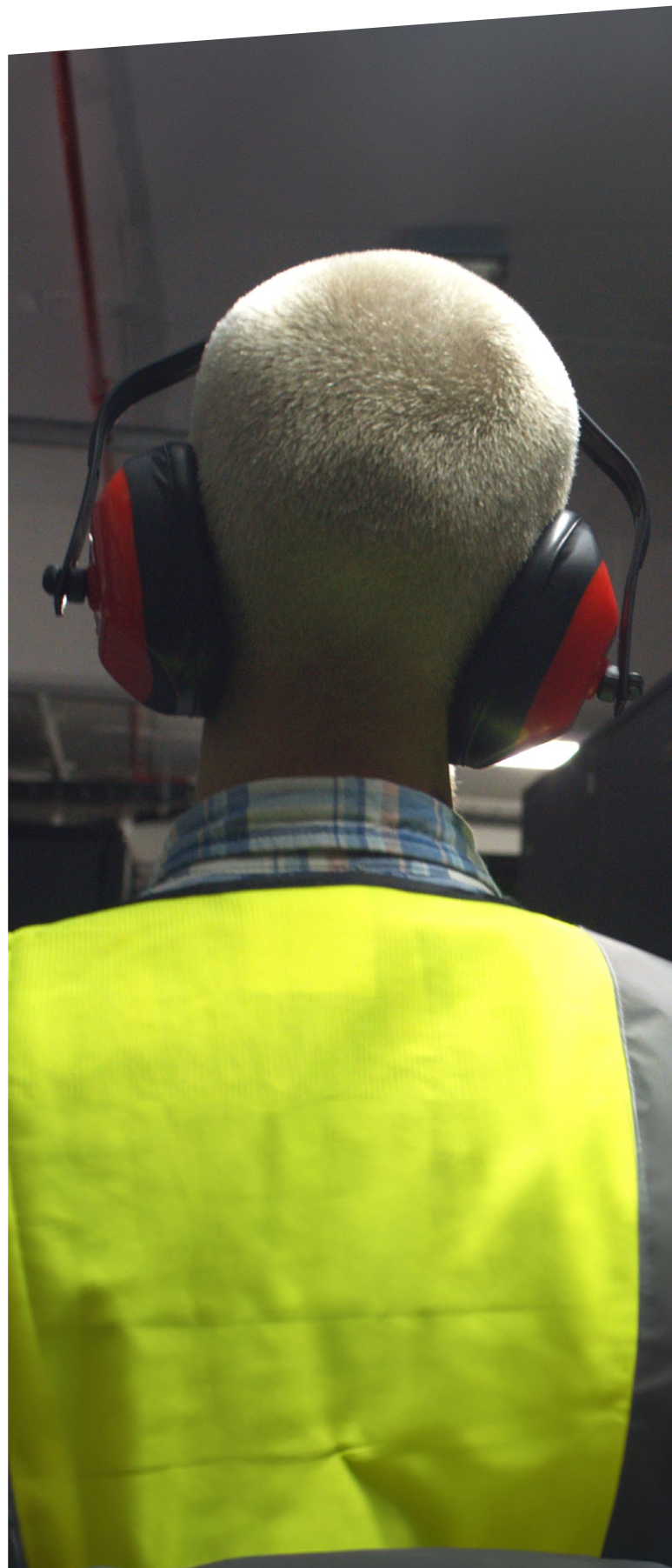
2.2 Calibration

Correct calibration of audiometers and related equipment is highly important for reliable and consistent test results. Calibration ensures consistency of test settings so that audiograms carried out in different companies/workplaces can be compared directly, and in compliance with ISO 8253-1:2010.

Audiometric booths should be calibrated regularly (at least once every 2 years) depending on the use and condition. Audiometers and the headsets require more frequent calibration, at least annually or more often if the machinery is moved or frequently used.

Calibration certificates should be kept conveniently for reference. It is recommended that a calibration check label be attached to the equipment, giving the date on which the next objective test is due. Calibration certificates of compliance should be kept for inspection by the Health and Safety Authority, hereon referred to as the Authority.

The audiometer tester should inspect equipment at the start of every day that it is in use, for visual or audible faults such as loose plugs, damaged cables, intermittent sound, noisy switching mechanisms, or changes in sound quality. These can be detected by the tester checking tones at or above their own hearing thresholds at various test frequencies. Thresholds should not vary without obvious reason, between usages. The tester should record their own hearing thresholds (using automatic audiometry) in the soundproof booth at intervals, as a check on calibration, and remind themselves of the nature of the experience, and become more aware of possible sources of interference which might exist. All recommended checks for audiometry equipment are detailed by the ISO 8253-1:2010. An electro-acoustic ear simulator, such as ER75 can also perform objective checks on audiometric equipment. The Ear Simulator responds at a predetermined level on an automatic Audiometer, and if the response deviates by more than 10dB, the test should be repeated or the audiometer returned to the manufacturer for calibration.



2.3 Preparation of Employee

Employees need to be advised of a planned audiometric test, so that they can have a 'quiet time' of 16 hours before the audiometric test. Ideally employees should be tested at the beginning of the day, having avoided loud social (for example, night clubs or concerts, using power tools or gunfire) noise exposures the day before. This reduces the likelihood of Temporary Threshold Shift (TTS). In practice this may not be possible. In these circumstances it is essential that the employee has worn adequate hearing protection at all times that day, perhaps over and above what is normally required. Employees using hearing protection should be told to bring it along to the audiometric testing. The tester must record the fact that because of the workplace conditions TTS is a possibility and consider repeating the test at another time if abnormal.

History-taking should be carried out prior to the test, normally by means of questionnaire (sample in Appendix I). This covers general noise history including occupational and hobbies, family and illness history, accidents, previous ear disease or symptoms, and the use of certain drugs known to affect hearing. The employee should sign and date the form for verification. Note that adults often do not remember or know details of childhood illnesses or drug treatments, so there are limitations to the reliability of questionnaires.

The otoscopic examination is usually carried out next, and findings for example wax/clear/inflamed/dull tympanic membranes should be recorded. If significant amounts of wax are present such as, more than 50% of the tympanic membrane is obscured, it may be better to advise removal of wax prior to performing the test. Alternatively, the test can be performed and repeated if results are abnormal or if it shows a drop from previous tests.

Similarly, if a current ear infection is observed it may be better to defer the test. Ensure proper cleaning and disinfecting procedures are carried out of the otoscopic equipment after each employee.

At this point, a short inspection of hearing protection to ensure good working order and that earplugs are inserted correctly, can be performed with the employee.

Employees should be instructed first in how to respond to audiometric signals, BEFORE being asked to remove glasses, earrings, hair bands or hearing aids. The instructions will vary slightly depending on whether the audiometer is AUTOMATIC or MANUAL. It is good practice to have a printed instructions for reference.

After instruction the tester puts the headphones on the employee carefully

RIGHT ear = RED headphone,
LEFT ear = BLUE headphone.

Finally, make sure the booth door is fully closed and ensure an airtight seal to obtain the full soundproofing effects of the booth. Occasionally with claustrophobic individuals it is not possible to close the booth. The decision whether to proceed will depend on ambient test conditions but in any event, this should be recorded in the records.



2.4 Automatic Audiometry

Almost all industrial settings use an automatic audiometer. Once started, the automatic audiometry will present pure tones in a computer-controlled manner, evaluate each response and decide whether a 'rising threshold' response has been obtained. According to the principles of audiometry; 'rising threshold' means the lowest tone heard when the signal volume is being increased. The machine can be set to run a different set of frequencies or present a different signal type (pulsed or continuous tone are usually offered). Most machines will run in the order 1, 2, 3, 4, 6 and 8 kHz then 500 Hz, (plus 250 Hz if set), (followed by (1 kHz) repeat & so on if required) in one ear, then the same sequence in other ear. Start with the better ear if the option is available.

Some machines have a separate 'familiarisation tone sequence' with louder signals to demonstrate the type of sounds. This can be run BEFORE the threshold test to familiarise a person with the tones that will be presented during the test. It is important that the operator of the audiometer checks that the person being tested is continuing to listen to the tones. As soon as the test is complete, let the person out of the booth as the soundproofed, enclosed environment is unpleasant for most.

2.5 Manual Audiometry

Some audiometers can be controlled by the operator throughout the test, which may lead to a quicker test time for an experienced operator. The instructions/sequence of signals is basically the same as with the automatic audiometer. The person operating the audiometer has more flexibility in presenting occasional 'louder' signals if people's responses seem erratic. Also, for people who do have a known hearing loss, the operator can raise the signal immediately to an appropriate level, whereas the computer-controlled test will not have this advanced level of sophistication and will give gradually increasing signals; thus, taking longer.

It is important that the tester has the ability to perform manual audiometry as sometimes the automatic audiometer is unable to identify a threshold at one or more frequencies because of inconsistency in the employee's responses. In these circumstances it is usually possible to establish a threshold by the use of manual testing.

2.6 Interpretation of Audiogram

The initial assessment of an audiogram will normally be made by the person conducting the test. An experienced medical specialist such as a specialist occupational physician or otolaryngologist (ENT) will not normally require assistance in assessing an audiogram. On average, men have slightly worse high frequency hearing than women (ISO 7029:2017) but this may not show in 5dB step audiometry until about the age of 30.

The categorisation system detailed below exists simply to allow for simple triage by a non-specialist of an audiogram. It allows, for example, for an occupational health nurse to identify those who might need further assessment, those who might require repeat testing and those who can safely be allowed routine follow up.

It is NOT a diagnostic tool. It does not for example differentiate NIHL from hearing loss for any other reason.

It is also NOT a means for assessing disability for compensation or other purposes and should never be used for that reason.

Whilst the system will identify most employees who require follow up it is important to remember that these are guidelines only and if a tester has any concerns for any reason with regard to an employee, they should request further assessment or advice regardless of the classification.

2.7 The Classification System

The Categorisation system has **4 separate** steps.

1

Categorisation of hearing level

Calculate the appropriate sum value for the hearing levels obtained at **1, 2, 3, 4 and 6 kHz** frequencies so that a single value is obtained for each ear. This sum of frequencies has been chosen as being representative of the effects of NIHL. Although this scheme recommends a sum of hearing levels at specific frequencies, it is important that audiometry is still conducted at 0.5 and 8 kHz.

Table 1 provides details of the four categories. Whilst table 2 provides the relevant warning and referral thresholds for these sums taking into account the age and gender of the individual.

Check Table 2 to see if the person exceeds the table value given for their age and gender. If the sum for each ear is **BELOW** the Warning level, that individual is placed in Category 1 (acceptable hearing ability).

If the sum for either ear **EXCEEDS** or **EQUALS** the listed figure for the Warning level for the relevant age and gender the individual is categorised as Category 2 (mild hearing impairment). The individual should be advised of results. Normally it is not necessary to refer all of these cases but they, of course, can be at the discretion of the responsible doctor. The Warning level corresponds with the 20th percentile i.e. hearing level normally experienced by 1 person in 5. It may indicate developing NIHL.

If the sum for either ear **EXCEEDS** or **EQUALS**, the listed figure for the Referral level for the relevant age and gender the individual is categorised as Category 3 (poor hearing). The individual should be advised of results and should be referred for review by a medical specialist in Occupational Medicine or Otolaryngology (ENT). The Referral level corresponds with the 5th percentile i.e. hearing level normally experienced by 1 person in 20. It may indicate significant NIHL.

2

Categorisation based on rapid hearing loss

If a previous hearing test on the individual is available within the last 3 years, it is necessary to look at the **RATE OF CHANGE**. For this we add the sum of the hearing thresholds at **3, 4, 6 kHz** only in each ear. If the difference between the sums in these frequencies is 30dB or more this is designated as Category 4 (rapid hearing loss). The individual should be advised of results and should be referred for review by a medical specialist in Occupational Medicine or Otolaryngology (ENT).

It is of course possible that a single audiogram can satisfy the criteria for Category 2 or 3. This in effect does not matter as it will require review by a specialist in any event. For statistical analysis the audiogram can be classified as the highest number or if preferred can have dual classification i.e. **Category 3 and 4**.

3

Classification on unilateral hearing loss

In this step add the sum of the hearing thresholds at **1, 2, 3, 4 kHz** only for both ears. If the difference between the ears is greater than 40dB, the individual should be advised of results and should be referred for review by a medical specialist in Occupational Medicine or Otolaryngology (ENT). This type of loss is rarely occupational but should be assessed urgently, to rule out pathology such as an acoustic neuroma.

4

Overview of audiograms

When a number of hearing tests are performed it is advisable that a group review of results be made by a medical practitioner experienced in such an assessment to ensure no relevant patterns emerge which were not identified by individual assessments. For example, it might be noted that one group such as maintenance employees, is showing more rapid loss than another even though no individual shows excessive loss. This however may be very relevant in preventing NIHL in the workplace.

Table 1 - Catergorisation Scheme

Category	Calculation	Action
1. Acceptable hearing ability Hearing within normal limits	Sum of hearing levels at 1, 2, 3, 4 and 6 kHz.	None
2. Mild hearing impairment Hearing within 20th percentile, ie. Hearing level normally experienced by 1 person in 5. May indicate developing NIHL.	Sum of hearing at levels 1, 2, 3, 4 and 6 kHz. Compare value with figure given for appropriate age band and gender in Table 2.	Warning
3. Poor hearing Hearing within 5th percentile, ie. Hearing level normally experienced by 1 person in 20. Suggests significant NIHL.	Sum of hearing at levels 1, 2, 3, 4 and 6 kHz. Compare value with figure given for appropriate age band and gender in Table 2.	Referral
4. Rapid hearing loss Reduction in hearing level of 30dB or more, within 3 years or less. Such a change could be caused by noise exposure or disease.	Sum of hearing levels at 3, 4 and 6 kHz.	Referral

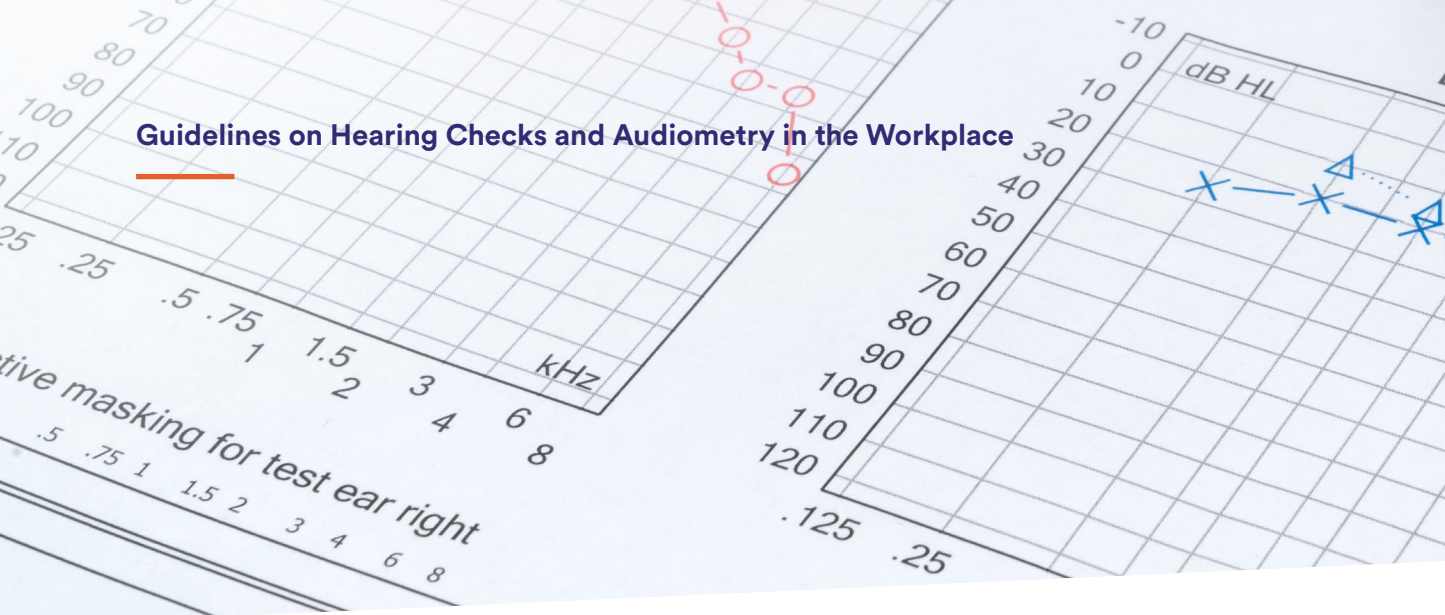
HSA Guidelines on Hearing Checks and Audiometry 1st Ed, as adapted from HSE UK Controlling Noise at Work L108 2nd Ed.

Table 2 - Classification of Audiograms into Warning and Referral Levels

Sum of hearing levels 1,2,3,4 and 6 kHz

Age	Male		Female	
	Warning	Referral	Warning	Referral
18-24	51	95	46	78
25-29	67	113	55	91
30-34	82	132	63	105
35-39	100	154	71	119
40-44	121	183	80	134
45-49	142	211	93	153
50-54	165	240	111	176
55-59	190	269	131	204
60-64	217	296	157	235
65	235	311	175	255

HSA Guidelines on Hearing Checks and Audiometry 1st Ed, as adapted from HSE UK Controlling Noise at Work L108 2nd Ed.



3.0 Administration

3.1 Review Schedules for Different Categories and Exposure Levels

Frequency of Tests:

First Hearing Test

This should be made available within 12 months of the employee being exposed above lower exposure action level. However, where practical a baseline (PRE-EMPLOYMENT) is preferable.

Further Tests

Category 1 (Normal)

A second screen should be conducted within a year of initial screening, and thereafter at the recommended intervals (below) of not more than five years (three year maximum if upper exposure action level (85dB Lex) is exceeded, or yearly if noise greater than 95 dB Lex.

However, to fully utilise the categorisation system, a minimum of three yearly intervals is recommended for all employees requiring audiograms.

Other Categories

The same minimum review schedule as above, but with discretion to shorten review times if employees are showing signs of NIHL, if they are being referred, or, for example, if a treatable or temporary condition is affecting the employee at an initial test (wax, ear infection) and an early repeat test is indicated after treatment.

It is usually appropriate that referral Categories (Categories 3 & 4) are tested annually or perhaps more frequently if an occupational element is suspected.

Warning category (Category 2) is often tested every two years or more frequently if indicated.

3.2 Keeping of Records

Regulation 131 requires an employer to ensure that a **health record** of each of his or her employees who undergoes health surveillance is made and maintained and that the record or a copy is kept available to permit appropriate access later. The audiometric questionnaire, the results of the otoscopic examination and the results of the audiogram are all considered **medical records** and should be managed accordingly considering any confidentiality and General Data Protection Regulations. The employees' consent is required prior to forwarding results of testing to anyone else including their General Practitioner.

An employer's occupational health department will usually store the medical records whereas the health record which does not contain medical information, can be maintained by the employer. Otherwise, the external provider who conducted the tests can be responsible for medical record keeping on behalf of the employer.

The registered medical practitioner (RMP) or health care professional responsible for screening should keep a copy of the hearing check records for the duration of employment plus seven years.

Employers should keep the health record as long as an individual remains in their employment and to permit appropriate access at a later date considering issues may arise many years after exposure to noise has ceased. If the personnel involved change during that time, ideally the hearing check records, and responsibility should be forwarded to a new Registered Medical Practitioner (RMP). If the employer ceases to trade, the Authority must be notified forthwith in writing and all health records made available to the Authority by the employer.

Employers will require anonymised grouped data on the hearing of the workforce to advise them of the effectiveness of the noise controls measures in place; this can be done by maintaining the confidentiality of individual personal and medical information.

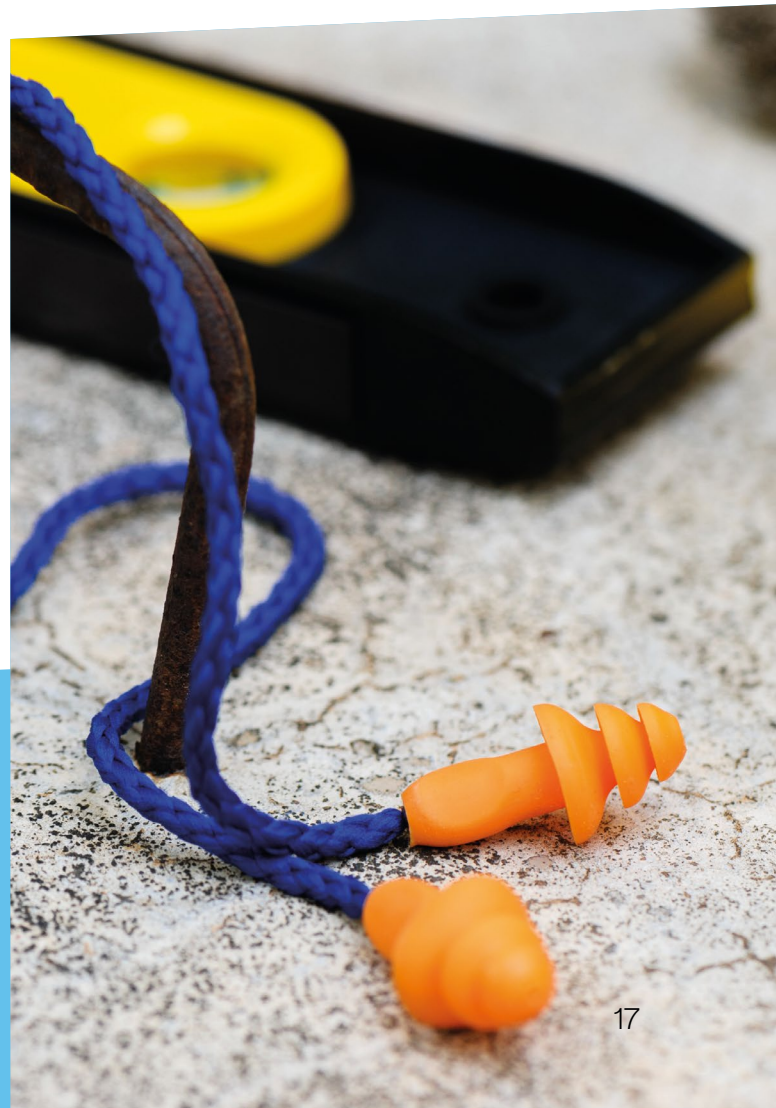
If your noise health surveillance program is contracted out to an external provider, you should ensure they are competent and agree the terms of the contract including procedures for feedback of grouped results and record-keeping.

3.3 Advice to Employees

Employees can ask for the information contained in their own hearing check records to be made available, provided they give reasonable notice to the RMP. The results should be explained by the doctor or health care professional to the employee in terms that the employee understands. The employee is entitled to a copy of their individual test if requested.

3.4 Advice to Employers

Employees should consent to employers being informed of an individual's category prior to testing. The RMP where one exists at the workplace, must always be advised of individual categorisation and results to enable an appropriate assessment of individual risk factors. Grouped, anonymised information of the audiometric results can provide useful information to the employer about the overall effectiveness of the hearing conservation program. It is essential that the results of the testing are acted upon when required. Employers need enough information to establish whether specific areas of risk exist in the workplace, and whether action such as referral is required. Employers should NOT have access to medical information on the employee including that which may be included in any questionnaire without the consent of the employee. The RMP or health care professional in charge of the record is responsible for ensuring confidentiality is respected.



4.0 References

List of References:

- A Short Guide to Health Surveillance in the Workplace, 2024, Health and Safety Authority.
- Combined exposure to noise and ototoxic substances, 2009, European Agency for Safety and Health at Work.
- Controlling Noise at Work, 3rd Ed 2021, Health and Safety Executive, UK, ISBN 978 0 7176 6567 9, HSE Books.
- Hearing Disability Assessment: Report of the Expert Hearing Group, 1998, Department of Health and Children.
- Industrial Audiometry by Bryan & Tempest, 4th Ed., & Examples of Industrial Audiometry.
- ISO 1999: 2013, Acoustics Estimation of noise-induced hearing loss.
- ISO 4869-1:2018 Acoustics—Hearing protectors Part 1: Subjective method for the measurement of sound attenuation.
- ISO 7029:2017 Acoustics — Statistical distribution of hearing thresholds related to age and gender.
- ISO 8253-1:2010, Acoustics Audiometric test methods.
 - Part 1: Reference equivalent threshold sound pressure levels for pure tones & supra-aural earphones.



Appendix I: Sample Audiometric Questionnaire

The following questions are completed before testing to be used only in relation to your hearing test. Please let the tester know if you are unsure about anything. Please let the tester know if you have any questions or need any clarifications.

Personal Details:

Surname Name: Forename:

Date of Birth:

Gender:

Home Address:
.....
.....

Family Doctor's Name and Address:
.....
.....

Employment Details:

Staff Number: Department:

Job Title/role: Number of years with Company:

Previous Noise Exposure:

1. Name any noisy areas you work in, in your current job:
.....

2. Are ear protectors always available at work?

3. Do you wear ear protection in noise? Always ☐ Sometimes ☐ Rarely ☐

4. Type used: Ear Plugs ☐ Ear Caps ☐ Earmuffs ☐

5. Have you worked in previous noisy jobs? If yes, where, and when?
.....
.....

6. If yes, did you wear hearing protection?
if yes, what type?

7. Do you work with any drugs, metals or solvents?
if so what type?

Guidelines on Hearing Checks and Audiometry in the Workplace

Medical History

8. Have you ever had a hearing test before? Yes ☐ No ☐

If you have, please state where and approximately when?

9. Do you think you might have a hearing problem? If yes, describe any times you have difficulty:

10. Do you wear a hearing aid? Yes ☐ No ☐

11. Do any family members have hearing problems or use hearing aids? Yes ☐ No ☐

If yes, please give further details?

12. Do you ever have any ringing in your ears? Yes ☐ No ☐

13. Do you ever have any dizziness? Yes ☐ No ☐

14. Have you ever had ear trouble such as wax, ear infections, blockages in the ear? Yes ☐ No ☐

If yes, describe:

15. Do you have any noisy hobbies or any noisy part-time work that you do? Yes ☐ No ☐

If yes please outline.....

16. Do you regularly use a motorbike, attend motor-racing or use guns? Yes ☐ No ☐

17. Do you smoke? Yes ☐ No ☐

if yes, how many a day?

18. Have you had a cold in the last fortnight? Yes ☐ No ☐

19. Have you been in loud noise in the last 16 hours, for example at disco/music pub/in band/
working in noise or with power tools)? Yes ☐ No ☐

if yes, what type?

20. Tick any of the following illnesses that you have had:

Head/Neck Injury, ☐ Bacterial Meningitis, ☐ Mumps/Measles, ☐ Scarlet/Rheumatic Fever, ☐
Epilepsy, ☐ TB Treated, ☐ Kidney Infection, ☐ Ear/ Nose /Throat /Specialist Appointment ☐

Declaration: The information I have given is complete and correct; withholding information may interfere with the hearing assessment & make it invalid. I can ask for an explanation of my results after the test. I understand that my employer will see the classification of my audiogram but is not entitled to any medical information given here without my permission.

Signed: Witness Signature:

Date:

Appendix II: Worked Example of Categorisation of Sample Audiograms

WORKED EXAMPLE 1: 34-year-old male.

Baseline							
	500 Hz	1k Hz	2k Hz	3k Hz	4k Hz	6k Hz	8k Hz
Right	0	15	25	40	55	45	30
Left	5	10	30	40	60	50	35

Step 1:

Add 1, 2, 3, 4 and 6 kHz for each ear.

This gives us:

Sum Right: 180

Sum Left: 190

Compare to Table 2 for age and gender.

Age	Warning	Referral
30-34	82	132

The figures exceed the Referral level so this audiogram is categorised as Category 3 and should be referred for specialist opinion.

Step 2: Not applicable for baseline.

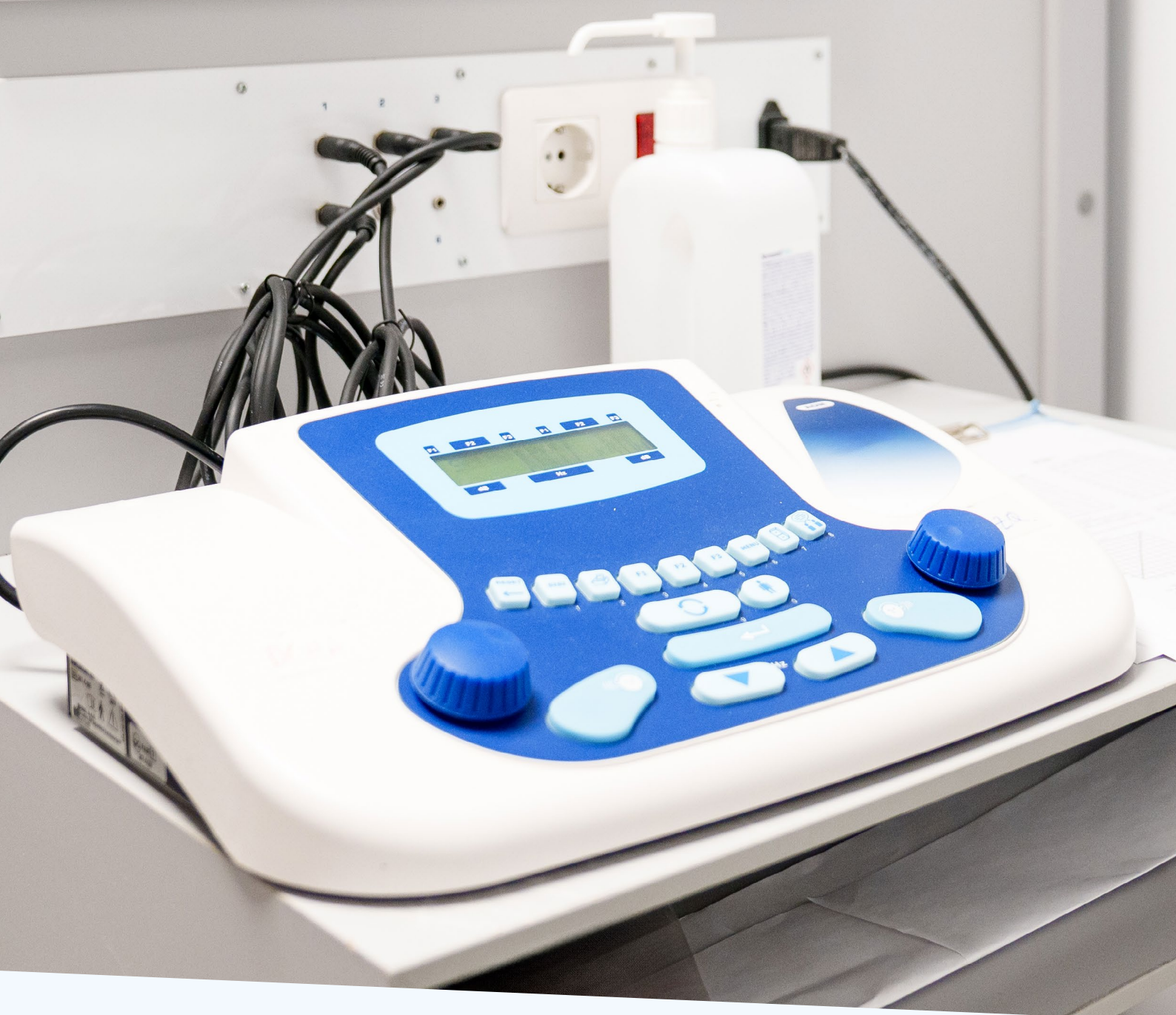
Step 3: We add the results for the frequencies 1, 2, 3, 4 kHz only for both ears.

Right	135
Left	140

In this case the difference is 5 dB, which is less than 40, so there is no need to classify as unilateral hearing loss.

Step 4: This overview of results is not applicable for a single test result.





Further Information & Resources

For further information,
please see the HSA Website.

Contact our HelpDesk:
Email: contactus@hsa.ie
Phone: **0818 289 389**
or visit: www.hsa.ie



HSA

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