Hellberg
Since 1962

Hellberg Safety AB
Hearing education & selection guide

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Introduction

Noise induced hearing loss is the most common reported occupational disease. About **800 million people** around the world are affected by hearing loss.

The financial cost of hearing loss has been estimated to be 78 billion euro per year in Europe, between 90 and 135 billion euro in the United States and 6.7 billion euro in Australia.

Over 30% of all workers are exposed to hazardous noise levels and one in four manufacturing workers exposed to loud noise does not use hearing protectors.

Why protect your hearing?

Our hearing is **one of the most important senses** we have. It is our link to the environment and is vital for how we communicate with others.

Our hearing is not designed for many of the sounds we are exposed to today.

Exposure to noise, as we call unwanted sounds, **can damage your hearing.**

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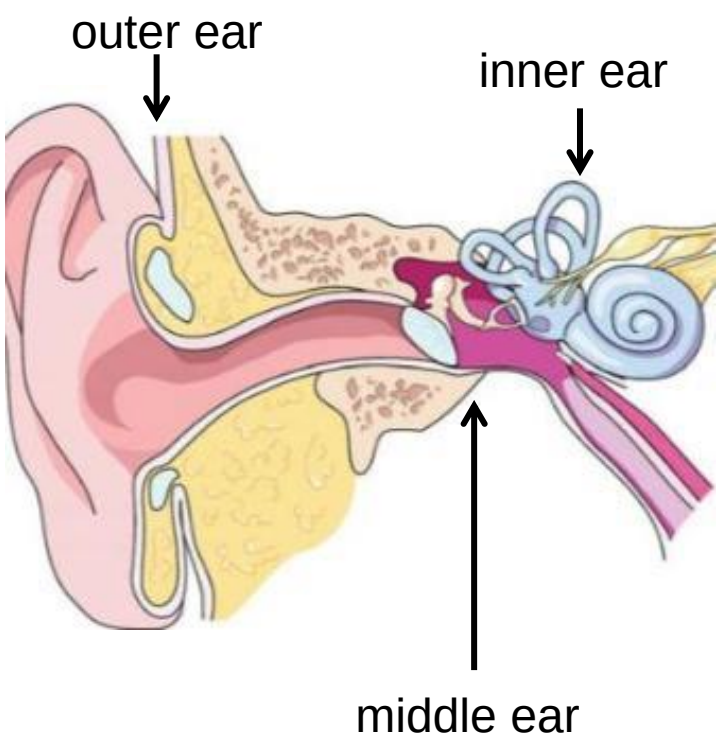
How hearing works

Outer ear – The main job of the outer ear is to collect sound waves and direct them into the middle ear.

Middle ear –Is the area where sound waves are translated into mechanical energy that are then transferred to the fluids of the inner ear.

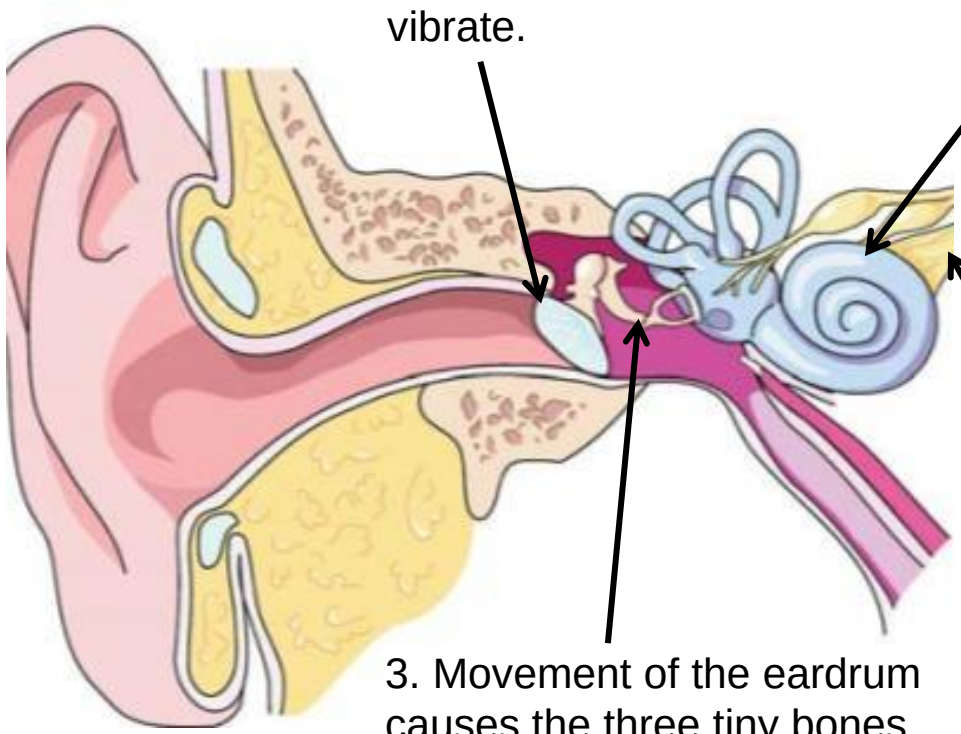
Inner ear (cochlea) – Each ear has a small, fluid-filled structure called the cochlea that contains about 20,000 hair cells. These tiny hair cells are responsible for translating sound vibrations into electrical impulses.



How hearing works

1. Sound waves enter the ear canal.

2. Sound waves strike the eardrum which starts to vibrate.



3. Movement of the eardrum causes the three tiny bones, the hammer, anvil and stirrup vibrate.

4. This movement makes fluids in the cochlea flow causing the hair cells in the cochlea to move and communicate with the hearing nerve.

5. The hearing nerve then sends the information to the brain with electrical impulses, where they are interpreted as sound.

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About sound

Machines, music instruments and the human voice box cause vibrations/sound waves in the air that we perceive as sounds.

DECIBEL

Decibel (dB) is the unit used to measure the sound pressure level.

The lowest level distinuishable by the human ear is 0dB. Anything above 120 dB is likely to cause pain.

FREQUENCY

The number of sound waves per second is called frequency and is measured in Hertz (Hz).

The most common sounds, like that of human speech are found in the High to Middle frequency range. (800-4000Hz).

Middle to High frequency noise are the most damaging to your hearing and should therefore be your primary concern.

What is dB(A) and dB(C)?

dB (A)

The human ear is more sensitive to sound in the middle and high frequency range (e.g. 500 Hz to 4000 Hz) than to sound at very low frequencies.

In order for the sound level meter to mimic the response of the human ear, an A-weightning filter is incorporated in the meter. The sound pressure level is expressed in dB(A).

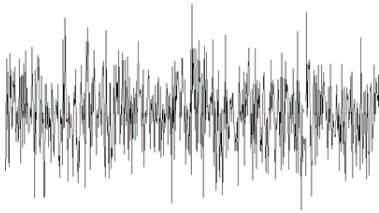
dB (C)

Sound level meters also contain a C-weighting filter, which influences only the highest and lowest frequencies and provides an almost flat response.

Peak noise levels are measured using the C-weighting filter and expressed as dB(C).

About noise

Noise - sounds we experience as unpleasant or disturbing



CONTINUOUS NOISE

Steady continuous noise does not vary over time. Fluctuating continuous noise change level or frequency over time.

INTERMITTENT NOISE

Noise is intermittent if it stops an starts at intervals.

IMPULSIVE NOISE

Is characterized as a short pulse (<1sec) with very fast rise time and a level of at least 20dB above the continuous noise level. Impulse noises are very dangerous to hearing.

The brain needs at least 0,3 seconds to identify a sound at the right level. Shorter duration is perceived lower than the actual level to our brain. The hearing organ reacts a lot faster. We do not realize that these noises are harmful to our hearing and we often disregard the need for protection.

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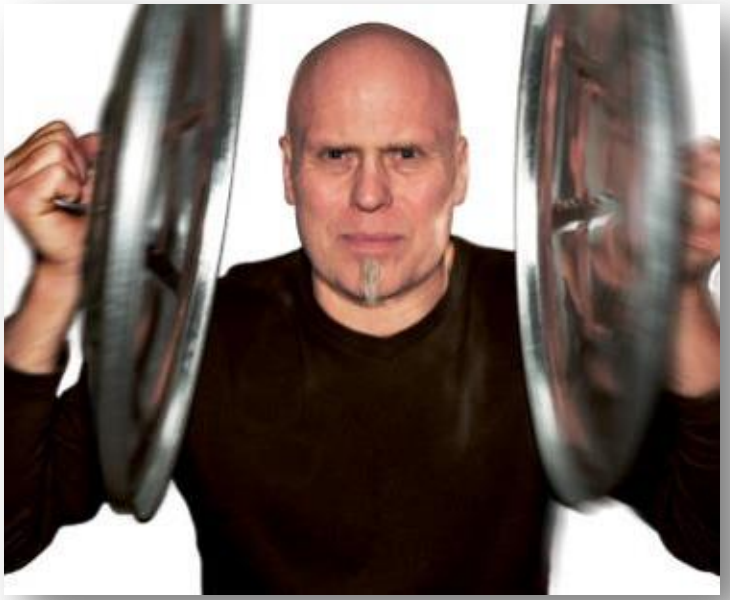
Hearing loss

Hazardous noise affects the functioning of the inner ear leading to **impaired hearing ability.**

Hearing may be restored after a period of time away from the noise but with further exposure **the hair cells will gradually die** and the hearing loss will become permanent.

Noise induced hearing loss often leads to **tinnitus or hyperacusis.**

Other dangers are high blood pressure, stress, negative social effects, headache, depressions and irritation.



You might not notice
the hearing damage at first

By being aware of the early signs you
can identify the problem quickly

Who is at risk?

Do you feel **the need to shout** in order to be heard one metre away?

Do you often have to **ask people to repeat things** they have just said?

Do you experience **ringing in the ears** or dull hearing after a day at work?

Do you have **to turn up the volume** on your car radio or television after a day at work?

If you answered **yes** to any of the questions your hearing may be at risk

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ANSI, EN and AS/Nzs standards

Legislations and regulations require you to wear hearing protection in a noisy environment and place limits on sound exposure.

EUROPEAN STANDARD (EN)

For a hearing protector to be categorised as Personal Protective Equipment in the EU it must meet the relevant European Standard EN352.

AMERICAN NATIONAL STANDARD (ANSI)

In North America hearing protectiors must meet the requirements of ANSI S3. 19-1974.

AUSTRALIA/NEW ZEALAND (AS/Nzs)

For Australia and New Zealand products must meet the requirements in the Australian Standard 1270.

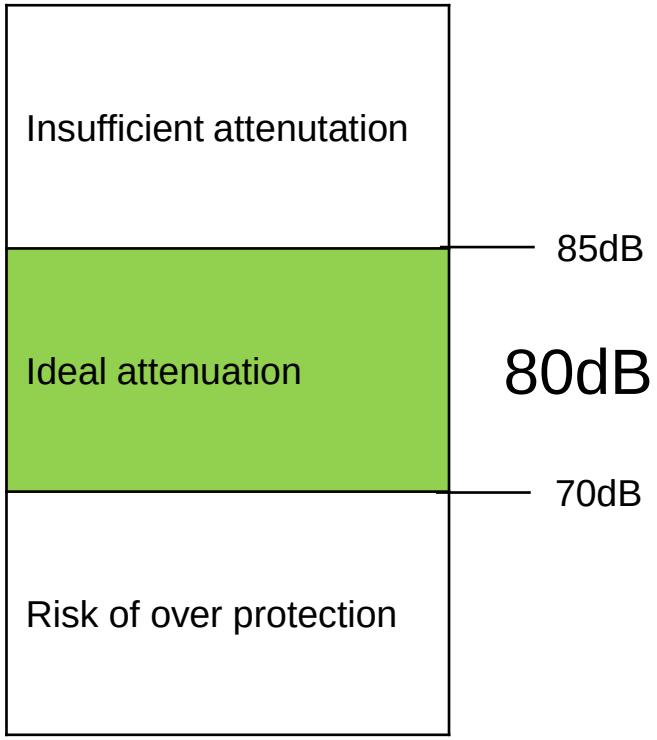
Below selection guide is based on the ANSI standard. Find out which levels apply in the country where you are using the hearing protection as national deviation in the legislations may apply.

Step 1 – Determining your noise level

The primary criterion for selecting a hearing protector is that the level of noise entering our ears must be reduced to below the legal limits 85dB (A).

We recommend that the calculated level under the hearing protector should be around 80dB (A) because of the following reasons:

- The real world sound attenuation of hearing protectors may be affected due to incorrect fitting, selection, misuse and maintenance.
- The key is to provide enough attenuation but not to overprotect the wearer. Overprotection can lead to a sense of isolation and disurb the wearers ability to hear useful sounds e.g. a workmate and warning signals. The risk that the wearer take the hearing protector off is also higher.



Step 1 - Attenuation data

The image below shows an attenuation data chart with explanations of the different terms

Frequencies (octave bands) when the earmuff's attenation have been measured

Noise reduction rating
A simplified description of the earmuff's attenuation. SNR in Europe and SLC80 in Australia and New Zealand

41003-001 SECURE 3H, **ANSI S-3.19-1974**, Weight 9.7 Ounce, CSA A									
Frequency Hz	125	250	500	1000	2000	3150	4000	6300	8000	NRR
Mean Attenuation	18.1	24.8	33.5	42.8	37.3	36.2	38.0	39.0	38.9	28
Std. dev	2.3	2.3	2.8	2.8	2.8	2.1	3.3	1.8	2.4	

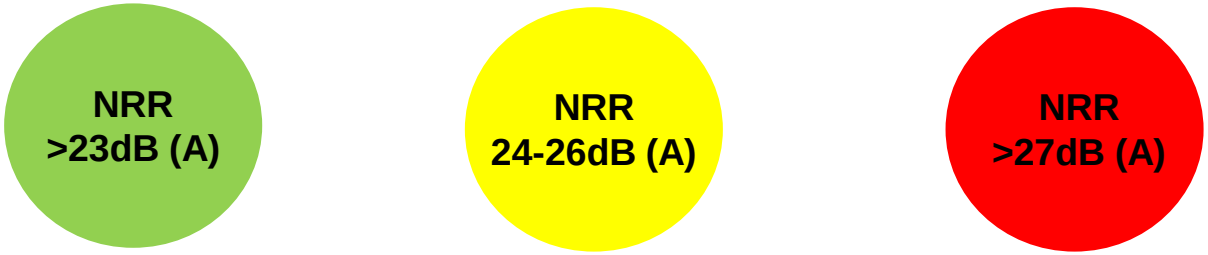
The earmuff's average attenuation at a given frequency

Difference/deviation in attenuation between different test individuals

Step 1 - Selection example

EXAMPLE

- If you use a chainsaw the dB level is 105dB (A).
- Recommended level under the earcup should be around 80dB (A).
- You need a hearing protector with an attenuation of around NRR 25dB (105-80=25).
- The suitable earmuff is a yellow coded earmuff (Secure 2)



Consider selecting a lower protection level...

..when the exposure time is shorter than 4 hours
The earmuffs protection level is based on noise exposure over an 8 hour working day. If the exposure is shorter you should consider selecting a lower protection level.

...when you need to hear important information (from colleagues, machine sounds, warning signals)?
Consider selecting a lower protection level or use a level dependent earmuff.

...if you suffer from a hearing loss
With a hearing impairment you may already have difficulty understanding speech in noisy environment. If you select the highest attenuation for hearing protectors, you may find it even more difficult to communicate or hear warning alarms.

Consider selecting a higher protection level...

...if the noise consists of mainly low-frequency noise
If the noise consists of mainly low frequency noise you should consider selecting a higher protection level as the low frequency noise is more difficult to block out.

...if you need to wear safety glasses, face masks etc
When combining hearing protection with safety glasses, face masks etc. ensure performance is not adversely effected. If you are uncertain seek additional advice and guidance or select an earmuff with a slightly higher protection level.

...if there any other noise sources nearby
Additional noise sources add to the noise exposure.

Step 2 Identify earmuff style

Headband
For general purpose use.

Cap attachable
Make sure that the helmet you choose is approved in combination with the selected earmuff.

Neckband
Can be worn with bump caps, sun protection hats or helmets without attachment slots.

Step 3 Identify other requirements

Active Level dependent (LD)
For when the noise is intermittent, when you move in and out of noisy areas and need to hear warning signals. The LD earmuff protects against impulsive or intermittent hazardous noise whilst allowing situational awareness.

Relax AM/FM radio
For when you are working with monotonous or stationary work tasks. Employees that wear radio earmuffs are more productive and motivated on the job.

React Level dependent + AM/FM radio.

Common noise sources

To the right are examples of different noise sources with its approximate sound pressure level in dB(A) and frecuency range.

These examples should only be seen as a guidance as large variations may occur. The distance and surroundings will also affect the noise level.

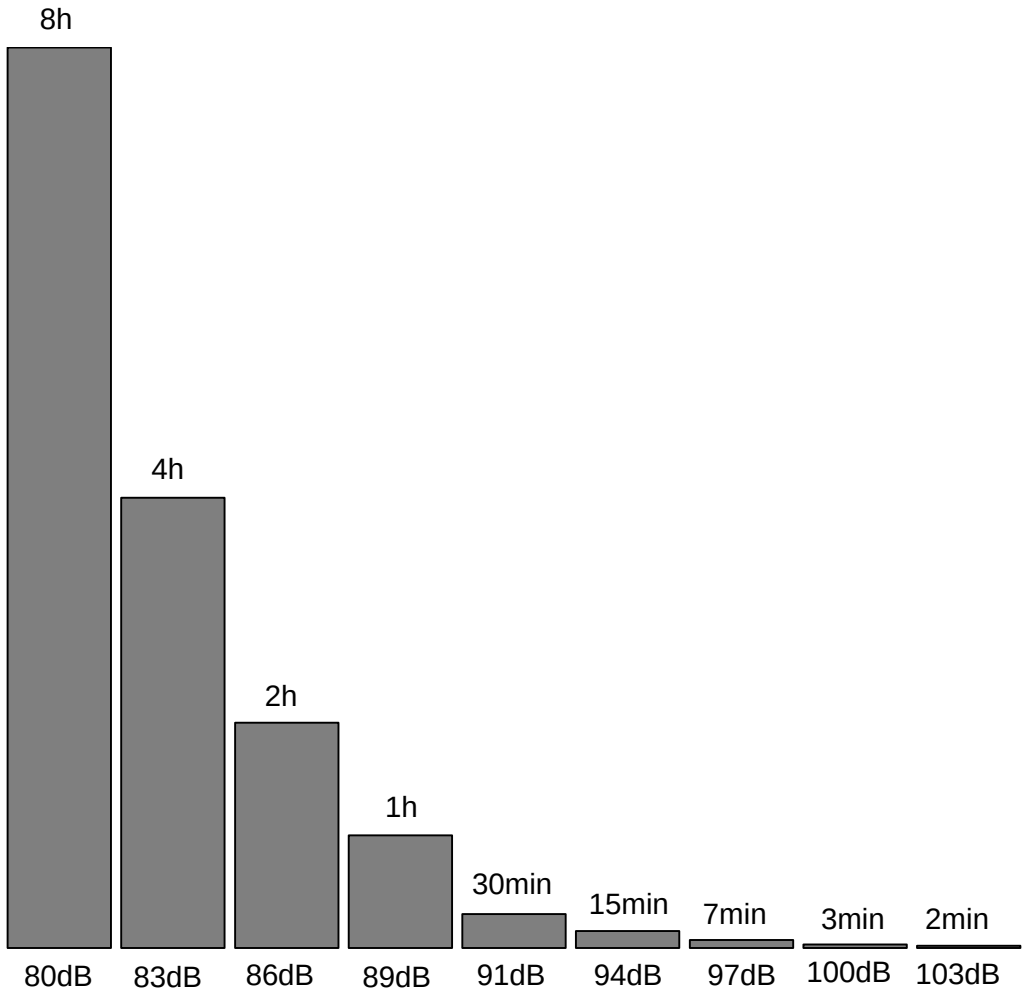
Noise source	dB(A)	Frequency
Ground vibrating machinery	95 dB (A)	Low
Bulldozer	96 dB(A)	Low
Folding machine	95 dB(A)	Mid to High
Road grader	96 dB(A)	Mid to High
Asphalt paver	101 dB(A)	Mid to High
Power drill	102 dB(A)	Mid to High
Chainsaw	105 dB(A)	Mid to High
Lawn mover	95 dB (A)	Mid to High
Circular saw	107 dB(A)	Mid to High
Concrete drill	108 dB(A)	Mid to High
Angle grinding (in metal)	110 dB (A)	Mid to High
Air compressor	94dB (A)	Mid to High
Welding	95dB (A)	Mid to High
Building/stripping forms	95dB (A)	Mid to High

Exposure times

When measuring a sound to find out what hearing protection to use, you need to consider the **exposure time**

85 db(A) during 8 hours is the maximum noise quota you may be exposed to during the working day.

The figure shows different exposure times for different sound levels. For example 2 minutes in 99dB may cause the same damage as 8hours in 80 dB.



Remember

Hearing protectors must be worn **all the time** in noisy environments.

A hearing protector with and attenuation of 30db will only give a protective effect of 12db if removed 30 minutes during an 8 hour working day.

If the noise exposure exceeds 105dB (A) the worker should consider wearing a combination of ear muffs and ear plugs. The extra attenuation is max 6dB over that provided by the better of the individual protectors.

Every increase of 3dB represents a doubling of sound intensity and around 8-10dB is perceived to be twice as lound. High frequencies are perceived louder than low frequencies.

It is as important to protect yourself from noise during your spare time as it is during your work day.

Hellberg®

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