Buyers Guide:
Selection of hearing protection

Who is this guide for?

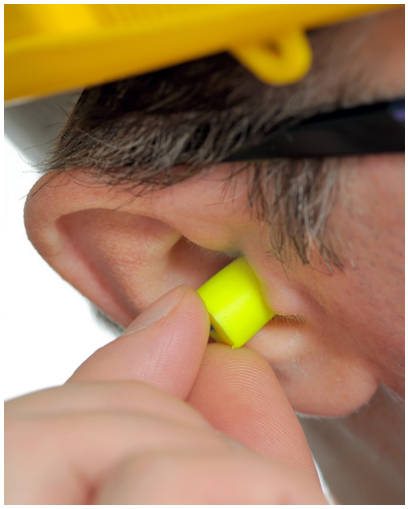
This document is a short guide to help you with the selection of hearing protection. The guide is aimed at anyone responsible for managing and controlling noise at work. This might be someone with a health and safety role, or it might be someone who's job it is to procure and provide the correct level of hearing personal protective equipment (PPE).

What is involved?

The selection of hearing protection for noise at work is a simple process as long as you have the right equipment and are competent in its use.

There are three key methods for predicting the overall attenuation, or the effectiveness of hearing protection, at your disposal. Each method is slightly different and ranges from the simplest to a highly accurate form of calculation.

"a simple process as long as you have the right equipment"



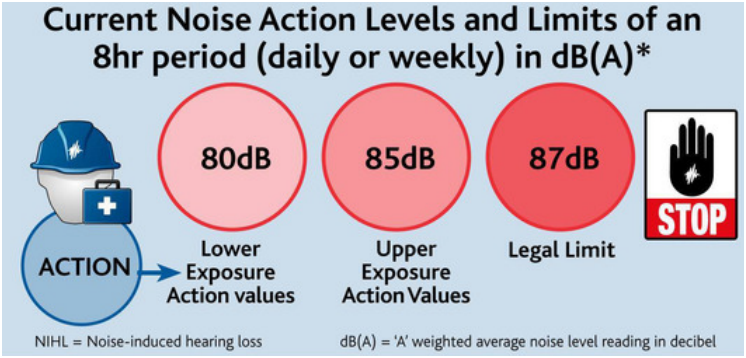
What is hearing PPE?

Hearing PPE consists mostly of ear defenders (or ear muffs) and ear plugs. In the case of ear defenders the protection comes from acoustic foam that covers and surrounds the ears. The foam absorbs sound energy by increasing air resistance and reducing the amplitude of the waves. The process of losing sound energy is called attenuation. It is the attenuation data that you need to look at when selecting hearing PPE.

There are also attenuating ear plugs that offer good levels of protection. In extremely high noise areas (e.g. for ground staff on airports) a combination of ear defenders and ear plugs may be required.

Why is it needed?

Under noise at work regulations employers have a duty to protect their employees' hearing from excessive noise at their place of work. Excessive noise can lead to a number of permanent hearing related conditions the most notable of which are Noise-Induced Hearing Loss (NIHL) - a permanent type of hearing loss caused by prolonged exposure to high levels of noise - and Tinnitus.



Employers have to make hearing protection available when noise levels reach or exceed 85dB(A) - the Upper Exposure Action Value - hearing PPE should aim at least to get noise below 85 dB at the ear.

Three methods of hearing PPE selection

The three key methods of hearing protection selection are:

1. **SNR** (Single Number Rating)
2. **HML** (High, Medium, Low parameters)
3. **Octave Band Analysis**

Hearing PPE must meet European standard European EN 352. Look out for CE markings, ISO and EN/BS codes

Practical example for selecting hearing protection

The scenario: *You have taken a number of* ***noise measurements*** *using a* ***Class 2 Sound Level Meter*** *in a woodworking shop and need to recommend hearing protection to people who work on various pieces of equipment. You now have a number of options as 'recommended' by your national governing body for occupational health and safety using their Hearing Protection Calculators.*

You are looking at two hearing protection options, one has an ***SNR value of 19*** *and the second has* ***HML values of: H = 29 M = 23 L = 15.***

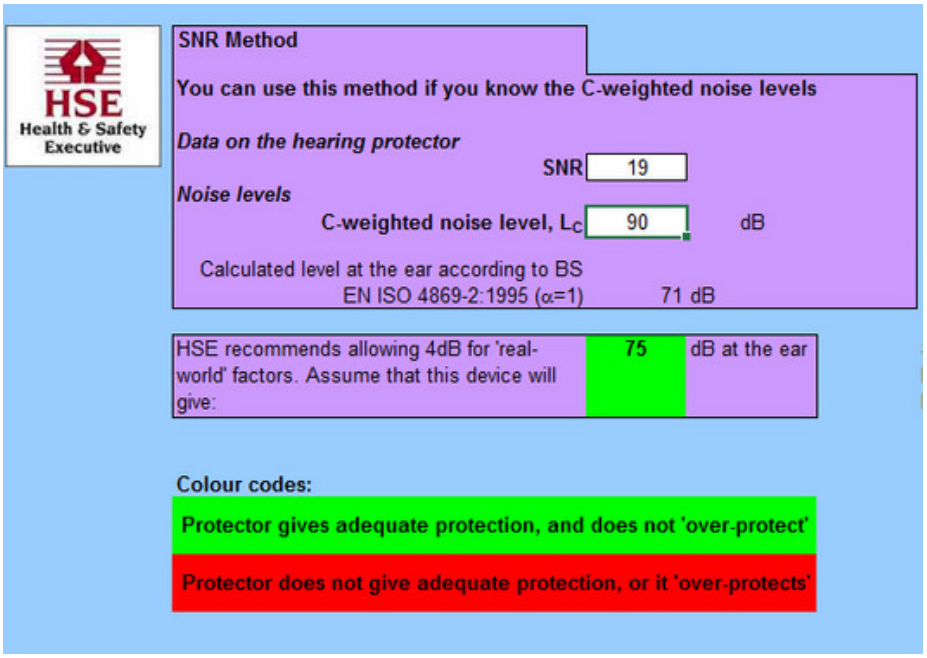
So let's start by looking for hearing protection for the woodworking shop's Planer and Router that have been measured as:

- ***Planer:*** *LAeq of 90 dB and LCeq of 95 dB*
- ***Router:*** *LAeq 95 dB and LCeq of 97 dB*

1. Hearing protection using the SNR method

If you use the SNR method for the Planer, you need the measured LCeq (average noise level measured) plus the SNR number given on the hearing protection's technical specification.
Subtract the SNR number from the average noise level. In this worked example: 90dB - 19 = 71dB at the ear.
Refer to the example below in the UK Health & Safety Executive (HSE) Hearing Protection Calculator.

The HSE also recommends that you allow 4dB for 'real-world' factors, such as imperfect fit and the directional nature of noise, so you can assume that the current hearing protection will reduce the 90dB noise level to 75dB (or 71dB + 4dB).



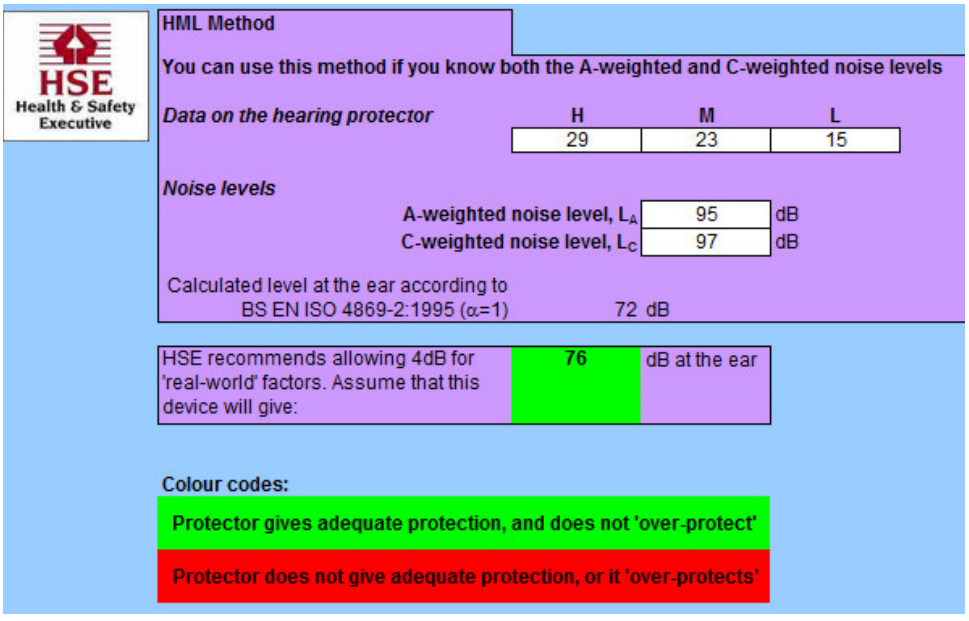
If the box with the end result in is **Green**, then the protection you are using is adequate.

If the box with the end result in is **Red** then the hearing protection is either:
- **inadequate** (does not reduce noise at the ear enough), or it is
- **over protective** (reduces noise at the ear too much affecting the wearers ability to hear warning sounds and instructions from colleagues.

When to use this method: with noise that is not tonal or dominated by low frequencies.

2. Hearing protection using the HML method

Using the HML method you need both the measured LAeq and LCeq plus the H, M and L numbers from the hearing protection's technical specification. These represent the value for the attenuation (noise reduction) at high, medium and low frequencies. So, if we go back to the Router in the woodworking shop and use the HSE's HML hearing protection calculation sheet, you need to enter the three values:



As before, if the box with the end result in is **Green**, then the protection you are using is adequate. And
if it is **Red** then it is inadequate or too over protective.

When to use this method:
HML takes some account of the frequency content of noise but is not suitable for very tonal or very low frequency noise.

3. Hearing protection using Octave Band Analysis

For really noisy equipment with measured LAeqs consistently in the mid 90 dB then the best method to use for hearing protection selection is Octave Band Analysis. This method is meant to be the most accurate way of measuring the effectiveness of hearing protection as it is looking at the actual frequencies of noise experienced by a worker. For this, you will need a sound level meter that is capable of measuring noise at octave bands centre frequency (in Hertz (Hz)) such as the Pulsar Nova Model 46 (or Model 44 with Octave bands added). In this case, the Pulsar software that is supplied with this type of equipment will do all the work for you. Once you have downloaded the noise measurements onto a computer, the Pulsar Analyzer Plus software (provided as standard) will analyse the data and automatically generate a list of suitable hearing protection such as the one below.

Pulsar Nova Model 46 showing octave bands. Octave band filters can be added to other models of the Pulsar Nova sound meters.

Manufacturer	Product	Assumed Level	Type	Approval	Notes
Moldex	Spark Plugs 7800	70.1	Insert	EN 352-2	Disposable Earplugs
Moldex	Spark Plugs Cord 7801	70.1	Insert	EN 352-2	Disposable Earplugs
Sperian Protection	Leightning L3 Hi Vis Ear Muff	70.1	Muff	EN 352-1	Ear Muff Overhead
Sperian Protection	Leightning L3 Ear Muff	70.1	Muff	EN 352-1	Ear Muff Overhead
3M	EAR Ultrafit X pre-moulded plugs	70.1	Insert	EN 352-2	Reusable Earplugs
3M	Optime 3 Ear muff - overhead	70.2	Muff	EN 352-1	Ear Muff Overhead
3M	Peltor Optime 3 EarDef OverHead HiVisYel	70.2	Muff	EN 352-1	Ear Muff Overhead
3M	Peltor Optime 3 Ear Defs Neckband	70.4	Muff	EN 352-1	Ear Muff Neckband
3M	Peltor Optime3 EarDef Hmt Champ+	70.6	Muff	EN 352-3	Ear Muff Helmet Mounted
3M	Peltor Optime 3 Ear Def Clip On	70.6	Muff	EN 352-3	Ear Muff Helmet Mounted
M S A	Left/Right High Muff	71.6	Muff	EN 352-1	Ear Muff Overhead
Uvex	Com4-fit Disposable foam plug	71.9	Insert	EN 352-2	Disposable Earplugs
Uvex	50prs Uvex Com-4 Fit Earplugs	71.9	Insert	EN 352-2	Disposable Earplugs
Uvex	200 prs Uvex Com4-Fit Ear Plugs	71.9	Insert	EN 352-2	Disposable Earplugs
Uvex	100 prs UvexCom4FitCordedEarPlug	71.9	Insert	EN 352-2	Disposable Earplugs

Source: Pulsar Analyzer Plus Software

When to use this method:

Octave band analysis can be used for all noise including tonal and low-frequency noise.

Summary

- You should select hearing protection so that daily exposure is reduced to at least below 85dB at the ear, but ideally, you should aim for between 75 and 80 dB.
- If the noise you are intending to protect against is not tonal or dominated by low frequencies then the SNR method is fine for the selection of the appropriate level of hearing protection.
- The HML method takes some account of the frequency content of the noise but, if it is very tonal and/or has a large low frequency content, then Octave Band Analysis should be used for the selection of hearing protection.
- Avoid protectors that result in less than 70 dB at the ear as this is 'over-protection' and can result in other health and safety consequences such as missed alarms and hazard warnings.

As a minimum you will need the following equipment:

An integrating Class 2 Sound level meter, for example the Pulsar Nova Model 44, that can 'measure' LAeq and LCeq simultaneously.

For further assistance with noise meters and hearing PPE please contact us
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