



## DUAL PROTECTION

### ***How much reduction in noise level can we expect from dual protection?***



*Howard Leight® Max®*

When earplugs and an earmuff are used together simultaneously, we call this “dual protection” or “double protection.” Dual protection is often the only available method to achieve maximum protection from hazardous noise. Using earplugs and earmuffs concurrently seriously isolates the wearer, so it is warranted only in extreme noise levels.

Dual protection is not required in EU noise standards<sup>1</sup> for general industry, however some companies have adopted internal safety policies requiring dual protection in some work locations or for certain noisy tasks. Dual protection may even be required for a particular employee, specifically when that employee’s audiogram indicates progressive noise-induced hearing loss despite normal protective measures.

At what noise level is dual protection advisable? There is no clear answer, mostly due to the varying amounts of protection each wearer receives from the individual fit of his/her hearing protection. But some research suggests dual protection is overused. One study using continuously monitoring dosimetry (noise measurements taken under the earplug or earmuff) among coal miners found that with properly-fitted hearing protectors, there was no need for dual protection even in ambient noise levels of 107 dBA (8-hour time-weighted average<sup>2</sup>).

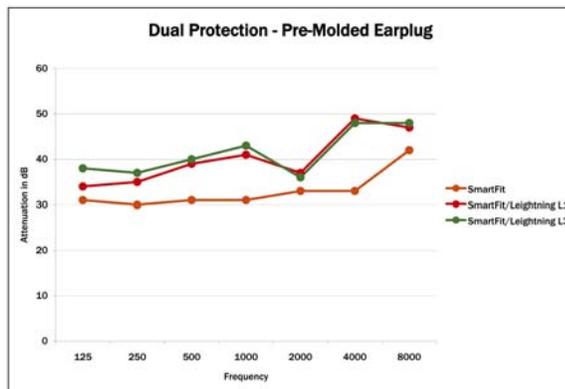
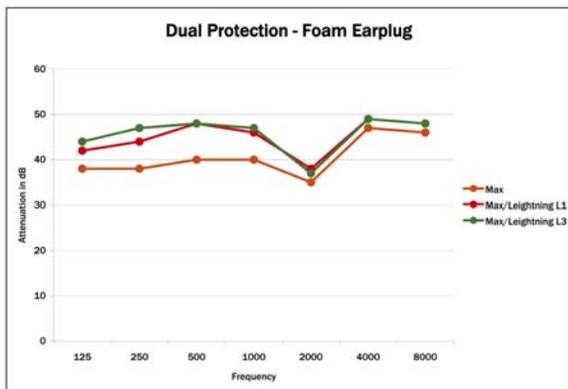
When a high attenuation earplug or earmuff is properly fitted and the user is motivated to use it correctly, some hearing professionals say the need for dual protection is rare: noise levels over 110 dB for equivalent 8-hour exposures, or 140 dB for a peak exposure. At lower noise levels, the effort expended by a safety manager to enforce dual protection is often better-spent in ensuring best fit of single hearing protection.



*Bilson® Lightning® L3*

The amount of attenuation achieved from dual protection is not simply the combined ratings of the earplug and earmuff. There is a ceiling effect that limits the amount of combined protection. Even if wearing a perfectly-fitted earplug and earmuff with ideal attenuation, we would still hear sound transmitted through our bodies and bones to the inner ear. For most people, these bone conduction pathways limit the maximum amount of attenuation obtainable at the ear to 35–50 dB, depending on the frequency of the sound.

In terms of estimating the amount of protection while wearing earplugs and earmuffs concurrently, one commonly-used practice is to just add 5 dB to the higher SNR. But this rule of thumb sacrifices some accuracy. An earmuff typically adds about 4 dB to the overall attenuation of a well-fitted foam earplug, and about 7 dB to a well-fitted pre-molded earplug (attenuation in the low frequencies will be a bit more, and in the high frequencies a bit less). As noted in the graph below, it is not necessary to use the highest-rated earmuff to achieve maximum attenuation from dual protection. In fact, as long as the earplug is fit properly, it makes very little difference which earmuff is used, so long as it has decent attenuation in the low frequencies. An earmuff with moderate attenuation, for example, has just the same effect as a high-attenuation earmuff when either is worn over a well-fitted earplug.



Graph 1. Dual Protection with Foam Earplugs

[Test data from Howard Leight Acoustical Laboratory, San Diego, CA]

When used in combination with a well-fitted foam earplug, the addition of an earmuff adds only a few more decibels of attenuation, mostly in the low frequencies. This increases the SNR by about 4 dB.

Graph 2. Dual Protection with Pre-Molded Earplugs

[Test data from Howard Leight Acoustical Laboratory, San Diego, CA]

When used in combination with a well-fitted pre-molded earplug, the addition of an earmuff adds only a few more decibels of attenuation in the low and high frequencies. This increases the SNR by about 7 dB.

The key to obtaining maximum benefit from dual protection is proper fit, especially the fit of the earplug. When a poorly-fitted earplug is worn with an earmuff, the resulting dual protection is little more than the earmuff alone.

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Footnotes:

- 1 EU Directive 2003/10/EC of the European Parliament on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (noise), 6 February 2003.
- 2 Study by Dr. Kevin Michael, presented at AIHce 2002. "Upstream Prevention of Occupational NIHL Via Individual Exposure Management." Posted at [www.dosebusters.com](http://www.dosebusters.com).

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