



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 U.S. OSHA regulations for general industry, but it is required in mining operations governed by the Mine Safety & Health Administration¹ (MMSA) for noise exposures over 105 dBA (8-hour time-weighted average). Similarly, a guideline document from NIOSH² (the advisory and research body supporting OSHA) recommends dual protection for any exposures over 100 dBA (8-hour time-weighted average). This recommendation may seem overly cautious, but it is based on the observation that, in large part, noise-exposed workers do not wear their hearing protectors properly.

Some companies have adopted internal safety policies requiring dual protection in specific work locations or for certain noisy tasks. OSHA has even affirmed an employer’s right to require double protection for a particular employee,³ specifically when that employee’s audiogram indicates progressive noise-induced hearing loss despite normal protective measures.

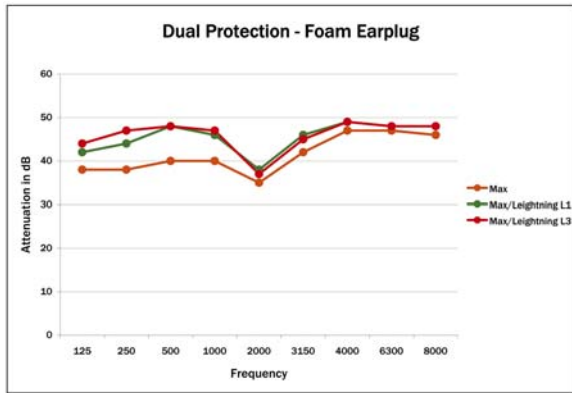
At what noise level is dual protection advisable? There is no clear answer, mostly due to the varying amounts of protection each wearer receives from the individual fit of his/her hearing protection. But some research suggests dual protection is overused. One study using continuously monitoring dosimetry (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 TWA.⁴ 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. 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.

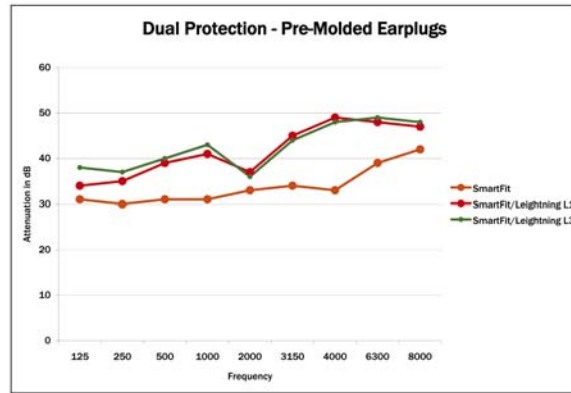
In terms of estimating the amount of protection while wearing earplugs and earmuffs concurrently, OSHA recommends simply adding 5 dB to the higher NRR. But this rule of thumb sacrifices some accuracy. An earmuff typically adds about 4 dB to the NRR of a well-fitted foam earplug, and about 7 dB to a well-fitted pre-molded earplug. These are overall numbers; 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 NRR 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 NRR 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.

– Brad Witt, MA, CCC-A
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Footnotes:

- ¹ Mine Safety & Health Administration, 30 CFR Part 62. "Health standards for occupational noise exposure: Final rule."
- ² National Institute for Occupational Safety & Health, Publication No. 98-126:1998. "Criteria for a recommended standard: Occupational noise exposure: Revised criteria, 1998."
- ³ OSHA Interpretations, posted at www.osha.gov. Interpretation letter dated 5/8/84, "Can the employer mandate a combination of a plug and a muff?"
- ⁴ Study by Dr. Kevin Michael, presented at AIHce 2002. "Upstream Prevention of Occupational NIHL Via Individual Exposure Management." Posted at www.dosebusters.com

Sound Source™ is a periodic publication of the Bacou-Dalloz Hearing Safety Group, addressing questions and topics relating to hearing conservation and hearing protection. It does not provide important product warnings and instructions. Bacou-Dalloz recommends all users of its products undergo thorough training and that all warnings and instructions provided with the products be thoroughly read and understood prior to use. It is necessary to assess hazards in the work environment and to match the appropriate personal protective equipment to particular hazards that may exist. At a minimum, a complete and thorough hazard assessment must be conducted to properly identify the appropriate personal protective equipment to be used in a particular work environment. ▲ FAILURE TO READ AND FOLLOW ALL PRODUCT WARNINGS AND INSTRUCTIONS AND TO PROPERLY PERFORM A HAZARD ASSESSMENT MAY RESULT IN SERIOUS PERSONAL INJURY, ILLNESS OR DEATH. For further information on this or other hearing conservation topics, contact Technical Support at 800/977-9177. © 2007 Bacou-Dalloz Hearing Safety Group