

Hearing Conservation

Module 6 - Hearing Protection Devices (HPD)

TYPES OF HPDS

There are several different types of HPDs, and each is meant for a different noise level or type of job.

The main categories of HPDs are:

- Earmuffs
- Earplugs
- Ear caps and helmets
- Amplitude sensitive devices



EARMUFFS

Earmuffs are rigid molded plastic earcups that seal around the ear using foam or fluid filled cushions.

They are held in place with metal or plastic headbands or a spring-loaded assembly attached to a hard hat.

Earmuffs are lined with acoustical material to absorb high frequency energy. In general, the larger the volume of the portion that covers the ear, the greater the attenuation.

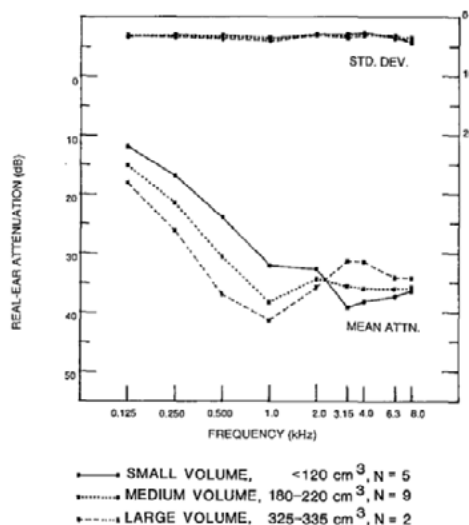
The advantages of earmuffs are:

- One size fits nearly all
- Good for intermittent exposures
- Easily removed/placed
- Easy for supervisors to monitor use

The disadvantages of earmuffs are:

- Not good for long-term wear
- Tight, hot, bulky, and heavy
- Lend themselves to employee modification - drilling holes for ventilation/drainage, reducing attenuation

This figure demonstrates the variability in attenuation for earmuffs. Note: small volume portion that covers the ears provides less attenuation than the medium, and likewise for the medium compared to the large.



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EARPLUGS



In general, earplugs are more comfortable than earmuffs, and therefore, are recommended for extended wear times.

A negative of earplugs, however, is that they are less visible and their use is more difficult to supervise.

To use:

- Workers should be instructed to pull outward and upward on pinna when inserting.
- Use a twisting motion when removing.

CAREFUL!

An airtight seal is possible.

Earplugs may loosen over time and require re-insertion throughout the day and, if a worker's hands are dirty, she or he may need several pairs per day.

Before using earplugs, a worker needs a thorough otoscopic examination to ensure that there is not a significant amount of cerumen. If occluding cerumen is present, the worker runs the risk of impacting it with earplug use.

There are few fit tests used to assess how well earplugs are inserted; these include:

- The Tug test - gently tug back and forth on the handle should cause mild sensation of suction.
- The Hum test - insert one plug, voice sounds louder on that sound. Insert other plug, voice sound equally loud.
- The Loudness test - cup hands over ears and plugs in a noisy environment.

ENVIRONMENTAL NOISE

Environmental noise level should not seem to change. If seal is broken, noise level will seem to increase.

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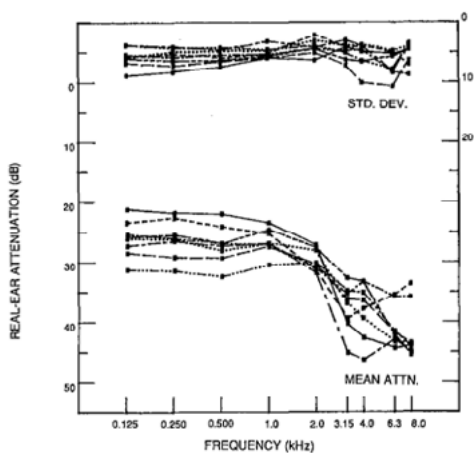
Premolded Earplugs

Premolded earplugs are made out of flexible material such as vinyl or silicone. They come in a variety of sizes and number of flanges.

RULE OF THUMB

When fitting premolded earplugs, if a person's ear canal falls between two sizes, use the larger size.

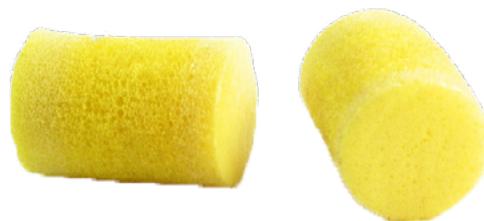
Attenuation for premolded earplugs is relatively constant up to 1 kHz clustering closely around 25 dB, and increasing to about 40 dB at the higher frequencies.



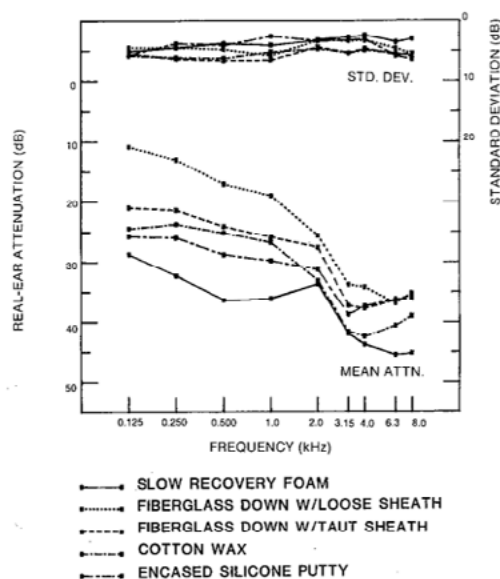
- 0-FLANGE, 1-SIZE, OPEN END
- 0-FLANGE, 8-SIZE, HOLLOW
- 1-FLANGE, 1-SIZE, CONICAL
- 1-FLANGE, 5-SIZE, V-51R
- 2-FLANGE, 2-SIZE, HOLLOW
- 3-FLANGE, 1-SIZE, SOLID
- 3-FLANGE, 3-SIZE, SOLID
- 5-FLANGE, 1-SIZE, SOLID

Formable Earplugs

Formable earplugs are available in several types of materials, including cotton, wax, silicone putty, and the most common, slow recovery foam.



As you can see from the figure, there is a wide variety of attenuation between the various types of formable earplugs. Note that well-placed slow recovery foam earplugs provide the greatest amount of attenuation.



- SLOW RECOVERY FOAM
- FIBERGLASS DOWN W/LOOSE SHEATH
- FIBERGLASS DOWN W/TAUT SHEATH
- COTTON WAX
- ENCASED SILICONE PUTTY

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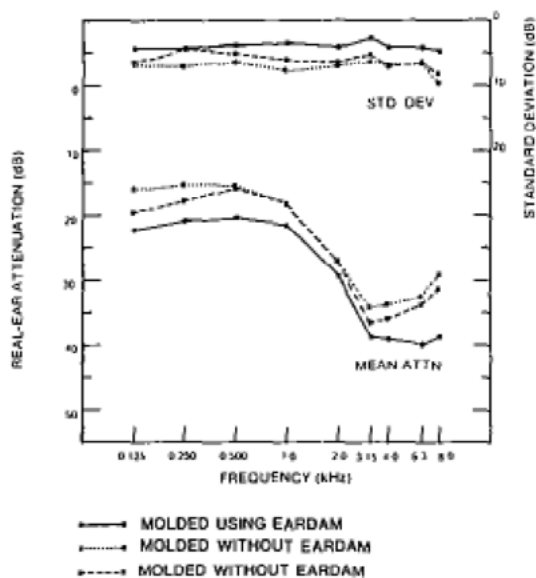
Custom Molded Earplugs

Custom molded earplugs require an earmold impression to make. Custom plugs are the easiest type of earplug to insert and remove for most people.



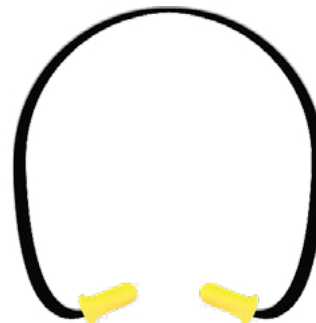
Custom molded plugs are available in a variety of materials, including acrylic, soft silicone, and hypoallergenic plastics.

This figure displays the attenuation values for custom earmolds created with and without an eardam. Although it is not standard practice to make any earmold impression without placing an eardam first, note that the mold which used an eardam provides the greatest amount of attenuation.



EAR CAPS

Ear caps are worn on the surface of the external ear canal and are generally attached to a tension band.



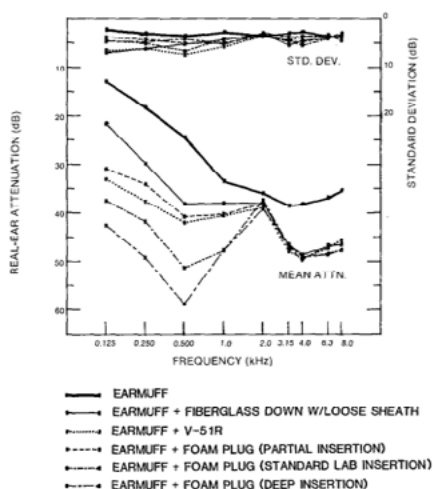
They are good for temporary hearing protection, but are not as comfortable as earplugs. They also do not provide as much attenuation as earplugs or earmuffs.

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DOUBLE HPDS

Double HPDs are required when 8-hour time weighted averages (TWAs) are greater than 105 dB.

Note: double HPDs in the form of an earmuff and a foam earplug inserted at three different depths provide greater attenuation than either device alone.



AMPLITUDE SENSITIVE DEVICES

Amplitude sensitive devices provide minimal attenuation of low sound levels. Attenuation increases with increasing sound level, and may be passive or active.

They are good for gunfire; however, their performance is questionable for industrial noise.

NEGATIVE EFFECTS OF HPDS

HPDs can:

- Interfere with communication in the workplace. This can be even more complex or compounded for workers who have hearing loss.
- Interfere with warning indicators, alarms, and signals.
- Affect localization and depth perception, which can impact safety for certain types of jobs