

Use and Selection of Hearing Protection

How can I protect my hearing at work?

The surest method of preventing occupational deafness is to reduce noise at the source by engineering methods. However, in certain workplace conditions, there is very little or nothing one can do to reduce noise at the source. In such workplaces, workers wear hearing protectors to reduce the amount of noise reaching the ears.

What are some things I should know about selecting hearing protection devices?

People should wear a hearing protector if the noise or sound level at the workplace exceeds 85 decibels (A-weighted) or dB(A). When effective hearing protectors are worn properly, they can reduce the risk of damaging your hearing.

If hearing protection is required, then a complete hearing conservation program should be instituted. Such a hearing conservation program should include noise assessment, hearing protector selection, fit testing, employee training and education, audiometric testing, maintenance, inspection, record keeping, and program evaluation.

The effectiveness of hearing protection is reduced greatly if the hearing protectors do not fit properly or if they are worn only part time during periods of noise exposure. To maintain their effectiveness, they should not be modified. Remember, radio headsets are not substitutes for hearing protectors and should not be worn where hearing protectors are required to protect against exposure to noise.

Select hearing protection that is:

- Correct for the job. Refer to the Canadian Standards Association (CSA) Standard Z94.2-02 "Hearing Protection Devices - Performance, Selection, Care and Use" or contact the agency responsible for occupational health and safety legislation in your jurisdiction for more information.
- Capable of providing adequate protection. Check the manufacturer's literature.
- Comfortable enough to be accepted and worn during all exposure to noise.

What types of hearing protectors are available?

Ear plugs are inserted to block the ear canal. They may be premolded (preformed) or moldable (foam ear plugs). Ear plugs are sold as disposable products or reusable plugs. Custom molded ear plugs are also available.

Semi-insert ear plugs which consist of two ear plugs held over the ends of the ear canal by a rigid headband.

Ear muffs consist of sound-attenuating material and soft ear cushions that fit around the ear and hard outer cups. They are held together by a head band.

How do I pick my hearing protectors?

The choice of hearing protectors is a very personal one and depends on a number of

factors including level of noise, comfort, and the suitability of the hearing protector for both the worker and his environment. Most importantly, the hearing protector should provide the desired noise reduction. It is best, where protectors must be used, to provide a choice of a number of different types to choose from.

If the noise exposure is intermittent, ear muffs are more desirable, since it may be inconvenient to remove and reinsert earplugs.

How can I find out how much a hearing protector can reduce a worker's exposure to noise?

Manufacturers generally provide information about the noise reducing capability of a hearing protection as an NRR (noise reduction rating) number. The NRR ratings are based on the maximum noise reduction obtained in laboratory conditions. In order to allow for a safety margin, some organizations use one-half of the NRR as the actual noise reduction factor in the workplace conditions.

What is a Noise Reduction Rating (NRR)?

The noise reduction rating is a rating system developed to give guidelines about the potential hearing protection that hearing protectors can provide in a noisy environment. The amount of noise reduction is measured under controlled laboratory conditions and is given as an NRR number in dB's - the higher the number, the more hearing protection. The "real-life" protection provided by hearing protectors is less than the ideal or measured value.

NRR is used to estimate wearer's noise exposure by subtracting it from C-weighted sound level.

Estimated noise exposure = workplace noise level in dBC - NRR.

An additional safety factor of 7 dB is added when NRR is subtracted from A-weighted sound levels (dB(A)).

Estimated noise exposure = Workplace noise level in dB(A) - (NRR-7).

There are other single number ratings available. For details refer to the Canadian Standard CSA Z94.2 - 2002. Another single number rating is based on (Subject Fit) Real Ear Attenuation measurements, known as Single Number Rating (Subject Fit 84th percentile) and abbreviated as SNR (SF 84) (for details see ANSI Standard S12.6). "SF 84" indicates that 84% of the users in a well run hearing conservation program are expected to receive at least that much protection.

What is a Single Number Rating (SNR)?

An SNR is a single number rating system determined according to International Standard ISO 4869. The tests are carried out by commercial laboratories that are independent of the manufacturers. Like NRRs, SNRs are expressed in dB's and are used as a guide for comparing the potential noise reduction capability of different hearing protection devices. Since the procedures for measuring NRRs and SNRs are different, the values for an individual hearing protector are different. For further details please refer to the Canadian Standard CSA Z94.2-02 or American Standard ANSI S12.6.

How do I use NRR (Noise Reduction Rating) for selecting hearing protectors?

In order to determine effective exposure of a person wearing a hearing protector, the NRR must be subtracted from the measured C-weighted sound level [dB(C)] in the workplace. This method is sometimes referred to as NIOSH method #2.

$$\text{Effective exposure in dB(A)} = \text{sound level in dB(C)} - \text{NRR.}$$

The following method is used when only A-weighted sound level in dB(A) is measured.

$$\text{Effective exposure in dB(A)} = \text{Measured Sound Level in dB(A)} - (\text{NRR} - 7).$$

A more complicated method, NIOSH method #1, involves detailed calculations using octave-band analysis of the workplace noise and the noise attenuation provided by the hearing protector for noise in each octave band.

As mentioned earlier, the NRR ratings are based on the maximum noise reduction obtained in controlled, ideal laboratory conditions. To allow for a safety margin, some organizations use 50% of the NRR as the expected noise reduction factor under field conditions.

What are the advantages and limitations of ear plugs and ear muffs?

There are advantages and disadvantages associated with the use of either ear muffs and ear plugs.

Ear plugs can be mass-produced or individually molded to fit the ear, and they can be reusable or disposable. On the positive side, they are simple to use, less expensive than muffs, and more comfortable in hot or damp work areas. On the negative side, they provide less protection than some muffs, and should not be used in areas having noise levels over 105 dB(A) (A-weighted decibels). They are not as visible as muffs and a supervisor cannot readily check to see if workers are wearing them. They must be properly inserted to provide adequate protection.

Ear muffs can vary with respect to the material and depth of the dome, and the force of the headband. The deeper and heavier the dome, the greater the low-frequency attenuation provided by the protector. The headband must fit tightly enough to maintain a proper seal, yet not be too tight for comfort. On the positive side, ear muffs can usually provide greater protection than plugs, although this is not always true. They are easier to fit, generally more durable than plugs, and they have replaceable parts. On the negative side, they are more expensive, and often less comfortable than plugs, especially in hot work areas. In areas where noise levels are very high, muffs and plugs can be worn together to give better protection.

The following table summarizes the differences between ear plugs and ear muffs.

Comparison of Hearing Protection	
Ear Plugs	Ear Muffs
Advantages: <ul style="list-style-type: none"> ● small and easily carried 	Advantages: <ul style="list-style-type: none"> ● less attenuation variability among users

<ul style="list-style-type: none"> ● convenient to use with other personal protection equipment (can be worn with ear muffs) ● more comfortable for long-term wear in hot, humid work areas ● convenient for use in confined work areas 	<ul style="list-style-type: none"> ● designed so that one size fits most head sizes ● easily seen at a distance to assist in the monitoring of their use ● not easily misplaced or lost ● may be worn with minor ear infections
<p>Disadvantages:</p> <ul style="list-style-type: none"> ● requires more time to fit ● more difficult to insert and remove ● require good hygiene practices ● may irritate the ear canal ● easily misplaced ● more difficult to see and monitor usage 	<p>Disadvantages:</p> <ul style="list-style-type: none"> ● less portable and heavier ● more inconvenient for use with other personal protective equipment. ● more uncomfortable in hot, humid work area ● more inconvenient for use in confined work areas ● may interfere with the wearing of safety or prescription glasses: wearing glasses results in breaking the seal between the ear muff and the skin and results in decreased hearing protection.

Why is user preference so important?

The human aspects of hearing protection are particularly important since the only useful kind of protection is the protection that is actually worn. Some people do not accept particular kinds of protectors; every human being is different, and the anatomy of the ear and ear canal can vary significantly from person to person.

It is a good idea for the employer to provide a number of different types of hearing protection from which workers can choose, keeping in mind any safety or hygienic reasons for not providing a particular kind of protector. That is, a particular type of protector should not be used if noise levels are too high or if it proves to be inadequate from a hygienic point of view. For example, ear plugs which are used in a plant setting where people reuse them throughout the day, often reinserting them with dirty fingers, can introduce dirt and bacteria into the ears, causing ear infections.

The bottom line on hearing protection is worker preference. If the workers do not like the type of protection (for example, if it is uncomfortable, does not fit well, or is impractical), they will not wear it.

What should I know about the fit of my hearing protectors?

Follow manufacturers' instructions. With ear plugs, for example, the ear should be pulled outward and upward with the opposite hand to enlarge and straighten the ear canal, and insert the plug with clean hands.

- Ensure the hearing protector tightly seals within the ear canal or against the side of the head. Hair and clothing should not be in the way.

What happens to the protection level when hearing protectors are removed for short periods of time?

In order to get full benefit, hearing protectors must be worn all the time during noisy work. If hearing protectors are removed only for a short duration, the protection is substantially reduced. The following table gives a maximum protection provided for non-continuous use of an ideally fitted "100%" efficient hearing protector. For example if one takes off his/her hearing protector for 5 min in a 8-hour shift, the maximum

protection will be 20 dB. The following tables gives other examples.

Maximum protection provided by non-continuous use of Hearing Protection	
Percent time used	Maximum Protection
50%	3 dB
60%	4 dB
70%	5 dB
80%	7 dB
90%	10 dB
95%	13 dB
99%	20 dB
99.9%	30 dB

Ear protectors must be used **ALL THE TIME** to get full benefit.

How should I care for my hearing protection device?

- Follow the manufacturer's instructions.
- Check hearing protection regularly for wear and tear.
- Replace ear cushions or plugs that are no longer pliable.
- Replace a unit when head bands are so stretched that they do not keep ear cushions snugly against the head.
- Disassemble ear muffs to clean.
- Wash ear muffs with a mild liquid detergent in warm water, and then rinse in clear warm water. Ensure that sound-attenuating material inside the ear cushions does not get wet.
- Use a soft brush to remove skin oil and dirt that can harden ear cushions.
- Squeeze excess moisture from the plugs or cushions and then place them on a clean surface to air dry. (Check the manufacturer's recommendations first to find out if the ear plugs are washable.)

Credit: Canadian Center for Occupational Health and Safety