

Noise, or unwanted sound, is a pervasive occupational health problem. Exposure to high noise levels can cause temporary or permanent hearing loss depending on the intensity and duration of the noise exposure. A number of factors need to be considered when choosing hearing protection. The following information is based on reports from CSA (Canadian Standards Association) and OSHA (Occupational Safety and Health Administration).

**What factors should I consider when choosing hearing protection?**

Select hearing protection that is:

- Correct for the job. Contact the agency responsible for occupational health and safety legislation in your jurisdiction for more information.
- Provides adequate protection. Check the manufacturer’s literature.
- Comfortable enough to be accepted and worn by workers.

**How do I choose the correct hearing protection?**

A number of factors must be considered when choosing a hearing protection device (HPD):

- Daily noise exposure of worker (called “Lex”)
- Worker hearing ability
- Communication demands on the worker
- Use of other personal protective equipment
- Temperature and climate of work area
- Physical constraints of the worker or work activity

**What level of noise is acceptable for working in?**

85 dB is the current maximum sound level to which people should be exposed during a working day. Even a very short exposure to noise over this level is harmful when hearing protection is not worn, especially if the noise is high frequency dominated. Frequencies between 1.6 and 4 kHz are the most harmful to hearing, lower frequencies are less harmful. Hearing protection should be designed to have optimum performance in the high frequency area.

The red bar below shows how long it takes before a particular sound level becomes dangerous to the human ear.

85 dB	88dB	91 dB	94 dB	97 dB	100 dB	103 dB	106 dB	109 dB	112 dB
8 hours	4 hours	2 hours	1 hour	30 min	15 min	7.5 min	4 min	2 min	1 min

**How do I measure the noise level at my work place?**

If hearing protection is required in your work place, then a complete hearing conservation program should be implemented. A hearing conservation program includes noise assessment, hearing protector selection, employee training, audiometric testing, maintenance, inspection, record keeping, and program evaluation.

**What types of hearing protectors are available?**

<b>Ear plugs</b>	Use by inserting into the ear canal. They may be pre molded (preformed) or moldable (foam ear plugs). Ear plugs are sold as disposable products or reusable plugs. Custom molded ear plugs are also available.
<b>Semi-insert plugs</b>	Two ear plugs held over the ends of the ear canal by a rigid headband.
<b>Ear muffs</b>	Hard outer cups filled with sound-attenuating material and soft ear cushions that fit around the ear. They are secured by a head band.



**Ear plugs** can be bought in bulk or individually molded to fit the ear. They can be reusable or disposable. They are easy to use, inexpensive, and comfortable in hot or damp work areas, but they provide less protection than some muffs, and should not be used in areas having noise levels over 105 dB(A). They must be properly inserted to provide adequate protection. Ear plugs are not as visible as muffs so it can be hard for a supervisor to check if workers are wearing them.



**Ear muffs** vary depending on the depth of the dome, the force of the headband, and the type of noise dampening material used. The headband must fit tightly enough to secure a proper seal, but must also be comfortable. Ear muffs can usually provide greater protection than plugs, or sometimes both can be used to reach a higher attenuation. They are easier to fit, and more durable than plugs. Most ear muffs have replaceable parts.

**How can I be sure that my HPD is appropriate for my work area?**

A Noise Reduction Rating (NRR) system is used to determine the level of protection you are getting from your headset, ear muffs or ear plugs.

There are two ways to determine the correct NRR for your work area. If the industrial noise measurements are in dBC, subtract the NRR of the hearing protector from the dBC noise measure to determine the protected noise level for the worker.

EXAMPLE	<b>Ambient Noise</b>	<b>100 dBC</b>
	<b>Noise Reduction Rating</b>	<b>-24 NRR</b>
	<b>Protected Noise Level</b>	<b>76 dB</b>

If your industrial noise measurements are in dBA, subtract 7 from the NRR of the hearing protector as an error cushion for C-A differences, then subtract the resulting lower NRR from the dBA noise measure to determine the protected noise level for the worker.

EXAMPLE	<b>Ambient Noise</b>	<b>100 dBA</b>
	<b>Noise Reduction Rating</b>	<b>-24 NRR</b>
	<b>Error Cushion</b>	<b>-7 dB</b>
	<b>Protected Noise Level</b>	<b>83 dB</b>

**How is NRR determined?**

NRR is the most standardized method currently in use for describing a hearing protector's attenuation. A series of steps are used to calculate an NRR. Here is a breakdown of the steps:

<b>Laboratory Testing</b>	Test subjects undergo a series of testing across a range of frequencies with and without properly-fitted hearing protectors. The difference between the tests gives us the attenuation of the hearing protector. Each subject is tested three times, producing at least thirty attenuation tests at each frequency. The variability in these measurements, or the <b>standard deviation</b> , is calculated and the attenuation values are then averaged. The end result is the <b>mean attenuation</b> in dB at each frequency.
<b>Standard Deviation</b>	A correction factor of two standard deviations is subtracted from each attenuation value to account for possible differences in the way hearing protectors fit out in the real world. By subtracting two standard deviations, we can generalize the results from a small sample of ten subjects to a larger population.
<b>Hypothetical Noise</b>	The adjusted attenuation values are subtracted from standardized noise levels at each frequency band called <b>hypothetical noise levels</b> . This step is necessary to be able to apply the final NRR to a hearing protector user, and not a laboratory microphone which detects sound differently than the human ear.
<b>Logarithmic Addition</b>	In this step, we combine all the adjusted attenuated levels into a single number. Attenuation values are measured in decibels, which are logarithmic numbers. <b>Logarithms</b> cannot just be added mathematically (80 dB plus 80 dB does not equal 160 dB). They are added in a special way that accounts for the exponents.
<b>Correction Factor</b>	Finally, a 3 dB correction is built into the NRR calculation to account for the possible difference between the assumed noise spectrum used in the NRR calculation and the actual spectrum in the workplace.

For more information on Rescom<sup>®</sup> hearing protectors and hygiene kits, contact Rescom Sales Inc. at 1-800-665-2740 or visit our website [www.rescom.ca](http://www.rescom.ca). All Rescom<sup>®</sup> Hearing protection products are manufactured by Special Electronics & Designs Inc.

Sources

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