Hearing Protectors Testing And Labeling – What's New?

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INTRODUCTION

Two issues are associated when dealing with hearing protectors: how to measure their attenuation and what to do with the result of the measurement. Procedures for how to perform both operations have been in place for many years, normalized by national and international standards. In this paper we will review some of the existing standards and the new tendencies that are now under development.

Normalization Documents

International Organization for Standardization (ISO)

All ISO standards that deal with attenuation of hearing protectors are under the number ISO 4869. Right now, the following standards have been published:

ISO 4869 – 1: Acoustics – Hearing Protectors – Part 1: Subjective method for the measurement of sound attenuation. It deals with testing the attenuation on human subjects, measuring the threshold of hearing with and without protectors.

ISO 4869 – 2: Acoustics – Hearing Protectors – Part 2: Estimation of the effective A-weighted sound pressure levels when hearing protectors are worn. It describes three different procedures for the estimation of the sound level resulting from the use of the protector, using three different methods.

ISO/WD 4869 – 3.2 (Working Draft): Acoustics – Hearing Protectors – Part 3: Simplified method for the measurement of insertion loss of ear-muff type protectors for quality inspection purposes. This is the working draft for testing of insertion loss using an Acoustic Test Fixture.

ISO/TR 4869 – 4 (Technical Report): Acoustics – Hearing Protectors – Part 4: Method for the measurement of effective sound pressure levels for level dependent sound restoration ear-muffs. Sound restoration ear-muffs amplify the external noise when bellow a certain level, so the person can hear as if he didn't wear the protector. As the sound level increases, the amplification provided by the muff decreases and the system switches off when the level reaches the preset limit. This Technical Report describes the measurement procedure and the instrumentation to be used.

ISO/WD 4869 – 7.4 (Working Draft): Acoustics – Hearing Protectors – Part 7: Subjective method for measurement of sound attenuation – Subject-fit method.

Similar to ISO 4869 – 1, this test is performed using subjects. However, subjects are naive (not familiar with the use of protectors). Fitting of the protectors during the test is done by the subjects, without external help. This is a procedure similar to the Method B in the ANSI S12.6-1997 Standard.

2.2 American National Standard Institution (ANSI)

There are two measurement procedures in the ANSI S12.6-1997 Methods for Measuring the Real-Ear Attenuation of Hearing Protectors. Method A is similar to the experimenter-supervised fit from the previous version of the Standard (ANSI 12.6-1984). It yields results that are the upper limits of performance that can be obtained using highly experienced subjects under the direct supervision of the experimenter. Method B, on the contrary, relays on subjects that are naive in the use of hearing protectors. Their only information regarding the fitting of the protectors is that on the manufacturers' package. It approximates the attenuation that has could be obtained in the real-life by users involved in hearing protection programs. The ANSI Standard applies to only passive hearing protectors.

2.3 The Environmental Protection Agency (EPA)

The EPA produced in 1979 the document EPA (1979) Noise Labeling Requirements for Hearing Protectors. Federal Register, Vol. 42, No 190, 40 CFR Part 211, 56139-56147. by which every protector sold in the USA should be labeled using the Noise Reduction Rating (NRR). The NRR is a single number rating, calculated from the measured attenuation values. When subtracted from the measured ambient noise in dBC, it results in the noise level in dBA of the protected ear. The NRR is probably the most known characteristic of a protector. However, it is also well known fact that its value is overly optimistic. Up to the point that OSHA had recommended that the NRR be derated from 25% up to 70% for certain types of protectors.

On March 2003, EPA hold a two-days public meeting to collect information regarding revising the Federal Regulation 40 CFR Part 211 regarding the effective rating and labeling of protectors. Participants included manufactur-

ers, researchers and government. All protectors were considered including the active and passive non-linear devices, passive, active noise reduction, sound restoration systems, and communication systems/radios. It is expected that EPA will take into account
the material that was presented during the sessions and will come with a new and improved method for rating and labeling the protectors.

2.4 Canadian Standard Institution (CSA)

The CSA Standard CSA Z94.2-02 "Hearing Protection Devices – Performance, Selection, Care and Use" was issued in January 2002. Contrary to the ANSI and the ISO standards, it does not contains provisions regarding testing of the protectors. As the title indicates, it is mostly a document for the users, rather than for the measuring laboratories.
As per the attenuation testing, the standard specifies that tests should be performed as per ANSI Standard S12.6, Method B, that is a Real-ear attenuation at threshold (REAT) procedure, where protectors are fit by the subjects that are persons not familiar with the use of protectors (naïve subjects). Results from the test are used to compute the Single Number Rating (Subject Fit 84^{th} Percentile), abbreviated SNR(SF_{84}) that provides a nominal 84% protection confidence interval (i.e., 84% of the users in a well-run hearing conservation program are expected to receive at least that much protection).

Provisions for writing Hearing Protection Program are also provided, as are details of the different types of hearing protectors and their advantages and applications. It touches subjects such as sound attenuation, attenuation at frequency extremes, double protection, overprotection, etc.

For the selection of the protectors, the concept of the Grade, calculated from the SNR(SF_{84}) is included.