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**Acoustics — Hearing protectors —
Part 2: Estimation of effective A-weighted
sound pressure levels when hearing
protectors are worn**

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Contents

	Page
Introduction	1
1 Scope	2
2 Normative references	3
3 Terms and definitions	3
4 Measurement of the sound attenuation of hearing protectors	4
5 Calculation of the assumed protection value, APV_{fx} , of a hearing protector for a selected protection performance	4
6 Octave-band method	5
7 <i>HML</i> method	6
7.1 General	6
7.2 Calculation of <i>H</i> , <i>M</i> and <i>L</i> values	6
7.3 Application of <i>HML</i> method for estimation of the effective A-weighted sound pressure level	8
8 <i>SNR</i> method	9
8.1 General	9
8.2 Calculation of <i>SNR</i> values	9
8.3 Application of <i>SNR</i> method for estimation of the effective A-weighted sound pressure level	9
Annex A (informative) Example of the calculation of the assumed protection values, APV_{fx}	11
Annex B (informative) Example of the calculation of $L'_{p, Ax}$ according to the octave-band method	12
Annex C (informative) Calculation of <i>H</i> , <i>M</i> and <i>L</i> values for a particular hearing protector	13
Annex D (informative) Example of the calculation and use of <i>SNR</i> values	16
Annex E (informative) Uncertainty of attenuation values and ratings	18
Bibliography	19
Annex JA (informative) Comparison table between JIS and corresponding International Standard	20

Foreword

This Japanese Industrial Standard has been established by the Minister of Health, Labour and Welfare and the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee according to the proposal for establishment of Japanese Industrial Standard submitted by Japan Safety Appliance Association (JSAA)/Japanese Standards Association (JSA) with a draft being attached, based on the provision of Article 12, paragraph (1) of the Industrial Standardization Act. This Standard partially replaces **JIS T 8161:1983**, which has been withdrawn.

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JIS T 8161 series consists of the following 2 parts under the general title *Acoustics — Hearing protectors —*:

Part 1: Subjective method for the measurement of sound attenuation

Part 2: Estimation of effective A-weighted sound pressure levels when hearing protectors are worn

Acoustics — Hearing protectors — Part 2 : Estimation of effective A-weighted sound pressure levels when hearing protectors are worn

Introduction

This Japanese Industrial Standard has been prepared based on **ISO 4869-2** : 2018, Edition 2, with some changes in the technical contents to increase convenience of use.

The vertical lines on both sides and dotted underlines indicate changes from the corresponding International Standard. A list of modifications with the explanations is given in Annex JA. Uncertainty of attenuation values and ratings is given in Annex E.

This Standard estimates an “effective” level, i.e. the A-weighted sound pressure level at the head centre with the listener absent, minus the attenuation of the hearing protection devices. Effective values are estimated since those are required to assess noise hazard with respect to permissible noise exposure limits. An effective level differs from that in the ear canal since it has been converted to a sound-field value via the transfer function of the open ear. Effective levels are typically 5 dB to 10 dB less than ear canal levels depending on the spectrum of the incident noise.

Ideally, the A-weighted sound pressure level effective when a hearing protector is worn should be estimated on the basis of both the octave-band sound attenuation data of the hearing protector (measured in accordance with **JIS T 8161-1**) and the octave-band sound pressure levels of the noise. It is recognized, however, that in many situations information on the octave-band sound pressure levels of the noise might not be available. Therefore, for many practical purposes, there is a need for simpler methods to determine the effective A-weighted sound pressure levels which are only based on the A- and C-weighted sound pressure levels of the noise. This Standard addresses both of these situations by specifying an octave-band calculation method as well as two alternative simplified procedures, the *HML* method and the *SNR* method.

The octave-band method is a calculation method involving the workplace octave-band sound pressure levels and the octave-band sound attenuation data for the hearing protector that is being assessed. Although it can be thought of as an “exact” reference method, it has its own inherent inaccuracies, since it is based upon mean sound attenuation values and standard deviations for a group of test subjects, and not the specific sound attenuation values for the individual person in question.

The *HML* method specifies three attenuation values, *H*, *M* and *L*, determined from the octave-band sound attenuation data of a hearing protector. These values, when combined with the C- and A-weighted sound pressure levels of the noise, are used to calculate the effective A-weighted sound pressure level when the hearing protector is worn.

The *SNR* method specifies a single attenuation value, the single number rating, de-

terminated from the octave-band sound attenuation data of a hearing protector. This value is subtracted from the C-weighted sound pressure level of the noise to calculate the effective A-weighted sound pressure level when the hearing protector is worn.

Due to the large spread of the sound attenuation provided by hearing protectors when worn by individual persons, all three methods are nearly equivalent in their accuracy in the majority of noise situations. Even the simplest method, the *SNR* method, will provide a reasonably accurate estimate of the effective A-weighted sound pressure level to aid in the selection and specification of hearing protectors. In special situations, for example especially high- or low-frequency noises, it is necessary to use either the *HML* or the octave-band method.

Depending on the choice of a certain parameter in the calculation process, various protection performances can be obtained. It should be noted that the protection performance values for all three methods are only valid when :

- the hearing protectors are worn correctly and in the same manner as they were worn by subjects when carrying out the **JIS T 8161-1** test;
- the hearing protectors are properly maintained;
- the anatomical characteristics (shape of external ear canal or pinna) of the subjects involved in the **JIS T 8161-1** test are a reasonable match for the population of actual wearers.

Thus, the principal source of potential inaccuracy in use of the three methods described in this Standard is the basic **JIS T 8161-1** input data. If the input data do not accurately describe the degree of protection achieved by the target population, then no calculation method will provide sufficient accuracy.

NOTE Differences of 3 dB or less in the determination of the effective sound pressure level for comparable hearing protectors are generally insignificant.

1 Scope

This Standard specifies three methods (the octave-band, *HML* and *SNR* methods) of estimating the A-weighted sound pressure levels effective when hearing protectors are worn. The methods are applicable to either the sound pressure level or the equivalent continuous sound pressure level of the noise. Although primarily intended for steady noise exposures, the methods are also applicable to noises containing impulsive components. It is possible that these methods could not be suitable for use with peak sound pressure level measurements.

The octave-band, *H*, *M*, *L* or *SNR* values are suitable for establishing sound attenuation criteria for selecting or comparing hearing protectors, and/or setting minimum acceptable sound attenuation requirements.

NOTE The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows.

ISO 4869-2 : 2018 *Acoustics — Hearing protectors — Part 2 : Estima-*