

TECHNICAL REPORT

ISO
TR 4869-3

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Acoustics — Hearing protectors —

Part 3:

Simplified method for the measurement of insertion loss of ear-muff type protectors for quality inspection purposes

Acoustique — Protecteurs individuels contre le bruit —

Partie 3: Méthode simplifiée de mesurage de l'affaiblissement acoustique des protecteurs du type serre-tête, destinée aux contrôles de qualité



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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- type 1, when the necessary support within the technical committee cannot be obtained for the publication of an International Standard, despite repeated efforts;
- type 2, when the subject is still under technical development requiring wider exposure;
- type 3, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example).

Technical reports are accepted for publication directly by ISO Council. Technical reports types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical reports type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

ISO/TR 4869-3, which is a technical report of type 2, was prepared by Technical Committee ISO/TC 43, *Acoustics*.

ISO 4869 will consist of the following parts, under the general title *Acoustics — Hearing protectors*:

- *Part 1: Subjective method for the measurement of sound attenuation*
- *Part 2: Estimated noise reduction*
- *Part 3: Simplified method for the measurement of insertion loss of ear-muff type protectors for quality inspection purposes* [Technical Report]

Annex A of this Technical Report is for information only.

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Introduction

During the preparation of ISO 4869 : 1981, *Acoustics — Measurement of sound attenuation of hearing protectors — Subjective method*, the document contained at a certain time both a subjective and a purely physical measurement method. Based on member body comments it was decided to split up the two methods in separate documents, giving priority to the subjective method which was issued in 1981 as ISO 4869. A first draft proposal for the physical method, document 43/1 N 367, was circulated to ISO/TC 43/SC 1 member bodies for comments in the period 1978-12-15 to 1979-03-15 for presentation at the SC 1 meeting in May 1979 in Stockholm, Sweden, where a second draft proposal, document 43/1 N 390, was approved for DIS-circulation subject to amendments in response to comments made at the meeting. ISO/DIS 6290 was circulated for voting amongst all ISO member bodies in the period 1983-01-06 to 1983-07-06. Upon recommendation from Working Group 17, the plenary SC 1 meeting in April 1985 in Budapest, Hungary, approved that an amended text be submitted to ISO/TC 43 member bodies for adoption as a technical report. Such a proposal for a technical report was circulated for voting amongst ISO/TC 43 member bodies as document 43 N 749 in the period 1986-12-15 to 1987-01-20 with the following result: 12 approvals, 1 disapproval and 1 abstention.

A subjective method for the measurement of the sound attenuation of hearing protectors is given in ISO 4869-1. In order to describe a simplified method for the measurement of the insertion loss using an objective method for production control and certification applications, an acoustic test fixture as specified in this Technical Report has been developed with the aim of achieving a simple but reproducible method of measurement.

The acoustic test fixture was tested in a round robin test including hearing protectors of the ear-muff type tested at some laboratories (Germany, F.R., Sweden, UK). The results were encouraging.

The new testing method has been used in two independent international round robin tests within the EEC and in the Nordic countries.

The reproducibility of the results from these tests is, however, not satisfactory. The major reasons for the deviations observed cannot be fully explained at present. There is a need for further experiments with the acoustic test fixture in order to clarify the reasons for the deviations in the results.

In order to allow gathering of data and experience with this device to provide a background for resolving the present problems and for issuing an International Standard within a few years, it has been decided to publish a description of the test fixture and of the measurement procedure presented in ISO/DIS 6290 — revised in response to comments submitted during the DIS-voting — in the form of a technical report, under number ISO/TR 4869-3.

The method specified in this Technical Report does not provide results which are the same as those obtained by the subjective method because of the requirements for simplicity and reproducibility of test results and other more basic considerations.

The test fixture specified in this Technical Report is not intended to supplant those dummy heads which include simulation of various anatomical features and which are used, for example, for development testing purposes.

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Acoustics — Hearing protectors —

Part 3:

Simplified method for the measurement of insertion loss of ear-muff type protectors for quality inspection purposes

1 Scope

This Technical Report specifies a method for measuring the insertion loss of ear-muff type hearing protectors for quality inspection purposes. The method may also be used to investigate production spreads of performance as part of type approval or certification procedures and to investigate the change of performance with age.

A measurement of application force is specified because the force affects acoustic performance.

The method specified in this Technical Report is not intended to be used as the basic test for type approval purposes. Performance data obtained by this method are not to be quoted as representing the real-ear sound attenuation of an ear-muff, nor the protection provided by the ear-muff.

NOTES

1 A further application of the method is its use to ensure that ear-muff hearing protector samples submitted for subjective testing of attenuation according to ISO 4869-1 have performance typical of the type.

2 For the testing of certain ear-muffs such as those attached to safety helmets, or those with contoured ear-cups or ear-cushions, the procedure described in this Technical Report may have to be slightly modified.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Technical Report. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Technical Report are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 48 : 1979, *Vulcanized rubbers — Determination of hardness (Hardness between 30 and 85 IRHD)*.

ISO 4869-1 : — ¹⁾, *Acoustics — Hearing protectors — Part 1: Subjective method for the measurement of sound attenuation*.

IEC 225 : 1966, *Octave, half-octave and third-octave band filters intended for the analysis of sound and vibrations*.

IEC 263 : 1982, *Scales and sizes for plotting frequency characteristics*.

IEC 50(801) : 1984, *International Electrotechnical Vocabulary. Chapter 801: Acoustics and electro-acoustics. Section 1: General terms*.

3 Definitions

For the purposes of this Technical Report, the following definitions apply.

3.1 hearing protector: A device worn by a person to prevent unwanted auditory effects from acoustic stimuli.

3.2 ear-muff: A hearing protector consisting of an ear-cup to be pressed against each pinna or of a circumaural ear-cup to be pressed against the head around the pinna. The ear-cups can be pressed against the head with a special headband or neck-band or by means of a device attached to a safety helmet or other equipment.

3.3 headstrap: A flexible strap fitted to each cup, or to the headband close to the cup. It may be adjusted to support the ear-muffs, usually behind-the-head types, by resting on the top of the head.

3.4 acoustic test fixture: A device that approximates certain dimensions of an average adult human head and is used, for the purposes of this Technical Report, for measuring the insertion loss of hearing protectors of ear-muff type. For this purpose, it includes a microphone arrangement for measuring sound pressure levels.

3.5 insertion loss: The algebraic difference, in decibels, between the one-third octave band pressure level measured by

1) To be published. (Revision of ISO 4869 : 1981.)