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Hearing protectors - Recommendations for selection, use, care and maintenance - Guidance document

Gehörschützer - Empfehlungen für Auswahl, Einsatz, Pflege und Instandhaltung - Leitfaden Dokument

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Protecteurs contre le bruit - Recommandations relatives a la sélection, a l'utilisation, aux précautions d'emploi et a l'entretien - Document guide

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FOREWORD

These guidelines have been prepared by Technical Committee CEN/TC 159 "Hearing Protectors", of which the secretariat is held by SIS, based upon material made available by ISO/TC 94/SC 12 "Hearing Protectors".

This European Standard has been prepared under a mandate given to CEN by the Commission of the European Communities and the European Free Trade Association, and support essential requirements of EC Directive(s).

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 1994, and conflicting national standards shall be withdrawn at the latest by June 1994.

In accordance with the CEN/CENELEC Internal Regulations, following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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WARNING

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This document was published as a European Standard to provide a harmonised base for national standards.

It is a guidance document which means that it cannot be used for type-approval purposes.

The guidance contained in this standard is not intended to be exhaustive, but to highlight important aspects to which attention should be given.

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0 INTRODUCTION

Hearing protection devices are items of personal protection equipment which as a result of their attenuation properties, reduce the effects of noise on hearing, in order to avoid hearing damage.

This document has been prepared to give guidance to all persons who have to supply, purchase or wear hearing protectors, and to encourage the use of effective criteria in their selection, use, care and maintenance.

In order that the protection offered by hearing protectors be effectively realised, hearing protectors should be used all the time that the user is in a potentially hazardous noise environment. In the selection of hearing protectors, attention is therefore drawn to the importance of considering factors which may influence comfort and acceptance.

In hearing conservation programmes, measures other than personal hearing protection, such as the identification of noise areas, assessment of personal noise exposure, and noise abatement, require attention as a priority, as shown in figure 1.

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1 SCOPE

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This European Standard gives recommendations for the selection, use, care and maintenance of hearing protectors.

Special types of hearing protectors are outside the scope of this Standard, although they are classified in 4.4, and some of the guidance will be relevant to them.

2 NORMATIVE REFERENCES

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 24869-1:1992	Acoustics - Hearing protectors, Part 1: Subjective method for the measurement of sound attenuation (ISO 4869-1:1990)
ISO/DIS 4869-2:1992	Acoustics - Hearing protectors - Part 2: Estimation of effective A-weighted sound pressure levels when hearing protectors are worn

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EN 352-1:1993	Hearing protectors - Safety requirements and testing - Part 1: Ear-muffs
EN 352-2:1993	Hearing protectors - Safety requirements and testing - Part 2: Ear-plugs
EN 457:1992	Danger signals for workplaces - Auditory danger signals

3 DEFINITIONS

For the purpose of this Standard, the following definitions apply:

3.1 **action level L_{act}**: Maximum daily personal noise exposure level ($L_{AEq\ 8h}$) and/or peak level L_{peak} above which level hearing protectors must be made available and/or must be worn as stipulated by national laws or regulations, or custom and practice.

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3.2 **care**: The day-to-day attention given to the protector by the wearer.

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3.3 **effective protection**: The reduction in $L_{AEq\ 8h}$ achieved by wearing the hearing protector, taking into account the time for which it is worn during exposure to the noise.

3.4 **maintenance**: The regular inspection and repair of the protector, for example the replacement of defective ear-muff cushions.

3.5 **over-protection**: The selection and wearing of a hearing protector with too high an attenuation.

NOTE: This may lead to a sense of isolation and difficulties with perception of sounds.

3.6 **selection**: The process of choosing the most suitable protector.

3.7 **use**: The day-to-day wearing of a hearing protector by the person to be protected.

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4 CLASSIFICATION

4.1 Ear-muffs

Ear-muffs consist of cups which fit over the ears and are sealed to the head with soft cushions usually filled with plastic foam or liquid. The cups are usually lined with sound absorptive material. They are connected by a tensioning band (headband), usually made of metal or plastics. A flexible headstrap is sometimes fitted to each cup or to the headband close to the cups. This strap is used to support the cups when the headband is worn behind the head or under the chin. Some ear-muffs have one cup intended only for the left ear and another only for the right ear. Ear-muffs may be available in "normal" and "restricted size range" types.

"Normal" size ear-muffs are intended to fit the majority of head sizes to be found in the working population in Europe. "Restricted size range" ear-muffs are designed to fit particular head sizes, "Small size range" and "Large size range" ear-muffs may be available.

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4.1.1 Types of bands connecting the cups

Ear-muffs are available with headbands, neckbands, chinbands, nosebands and universal bands. Ear-muffs with neckbands and chinbands permit the simultaneous wearing of a safety helmet. Universal bands can be worn over the head, behind the head, or under the chin. Universal bands, neckbands and chinbands may be complemented by headstraps to ensure a reliable fit of the muff.

4.1.2 Helmet mounted ear-muffs

These consist of individual cups attached to arms fixed to an industrial safety helmet and are adjustable so that they can be positioned over the ears when required.

4.2 Ear-plugs

These are hearing protectors which are inserted and worn in the ear canal, or in the ear cavity, intended to seal its entrance. They are sometimes provided with an interconnecting cord or headband.

Ear-plugs fall into two categories:

disposable: intended for one fitting only

reusable: intended for more than one fitting

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4.2.1 **Premoulded ear-plugs**

Premoulded ear-plugs can readily be inserted into the ear canal without prior shaping. Premoulded ear-plugs are usually made of soft forms of glass down, silicone, rubber or plastics. They can be available in a range of sizes.

4.2.2 **User formable ear-plugs**

User formable ear-plugs are made from compressible materials that the wearer shapes before inserting them into the ear canals. After insertion these ear-plugs often expand and form a seal within the ear canals.

4.2.3 **Custom moulded ear-plugs**

These ear-plugs are normally made of plastic materials which is moulded to fit the shape of the wearer's ear canals.

4.3 Banded ear-plugs

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Banded ear-plugs are ear-plugs usually of soft silicone, rubber or plastics and suspended on a headband. They are inserted into or placed on the entrance of the ear canal so as to effect a seal.

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4.4 Special types

4.4.1 **Level-dependent protectors**

Level-dependent protectors are designed to provide increased protection as the sound level increases.

4.4.2 **Active noise reduction (ANR) protectors**

These are hearing protectors which incorporate electroacoustic devices designed to partially cancel incoming sound in order to improve further the protection of the wearer.

4.4.3 **Communication ear-muffs**

Ear-muffs with communication facilities are available using a wired or aerial system through which working signals, alarms, messages or entertainment programmes may be relayed.

4.4.4 **Acoustic helmets**

Acoustic helmets cover a large part of the head as well as the outer ear. This can additionally reduce the transmission of air-borne sound to the skull and

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therefore reduce bone conduction of the sound to the inner ear.

5 SELECTION

5.1 General

Since there are many different types of protectors capable of dealing with a wide range of work situations, it is desirable to choose the most suitable protectors for the job.

This selection should take account (see following paragraphs) of factors such as:

Certification mark

Sound attenuation requirement

Wearer's comfort

Working environment and activity

Medical disorders

Compatibility with other headgear such as helmets, spectacles, etc.

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5.2 Certification mark

Only hearing protectors marked with an appropriate certification mark of conformity should be selected (for an example see figure 2).

5.3 Sound attenuation requirement

5.3.1 General

It is desirable for a protector to reduce the noise level at the wearer's ears below the action level. However, consideration also needs to be given to avoid isolation to the wearer thereby adding to their difficulty in perceiving sounds (see figure 3 and 5.3.4).

5.3.2 Selection of hearing protectors according to their sound attenuation

The procedures recommended for estimating the effective A-weighted noise level at the ear when hearing protectors are worn are given in annexes A and B. Preference should be given to the procedures as given in A.2, then A.3, A.4, A.5 in that order.

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5.3.3 "Real-world" attenuation

The attenuation data used to estimate the noise level at the ear when hearing protectors are worn is that derived from the subjective threshold test of EN 24869-1. Although this method uses a number of human subjects who fit the protector themselves for the test, the performance achieved in the "real-world" may be lower than that obtained in the laboratory test because of poor fitting, long hair, or the wearing of spectacles or other protective clothing.

This reduction in attenuation in the "real-world" will itself vary from product to product. It can be minimised by correct fitting (see 6.6).

5.3.4 Effect of over-protection

Caution should be exercised against selecting hearing protectors which provide unnecessarily high attenuation. Such devices might cause communication difficulties or be less comfortable than devices with lower attenuation, and therefore they would be worn for less of the time (see figure 3).

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5.3.5 Combination of ear-muffs and ear-plugs

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Working in extreme noise conditions may require more protection than provided by an ear-muff or ear-plug worn alone. The attenuation of a combination is not the sum of that of the individual protectors. Some combinations can even reduce the protection. Competent advice should be sought regarding the ability of a combination of protectors to provide more attenuation. If attenuation data for combinations are available, those products should be preferred.

5.3.6 Inadequate attenuation

For those noise environments for which it is not possible to select a hearing protector giving adequate attenuation (see A.1), other means of reducing exposure must be found e.g. by reducing noise emission or shortening the exposure duration.

5.4 <u>The wearer's comfort</u>

The comfort of hearing protectors cannot be given an absolute quantitative characteristic (comfort index) at present. Parameters such as mass, materials and construction, cushion pressure, headband force and adjustability for ear-muffs, and ease of fitting and removal for ear-plugs may be relevant. Requirements for such parameters are defined in EN 352-1 and EN 352-2.

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Wherever possible the user should be allowed to make a personal choice of hearing protectors. Purchasers, employers, supervisors or other parties as appropriate, should ensure that the choice is made from among suitable types.

5.5 Working environment and activity

5.5.1 High temperature and humidity

Physical work, especially at high ambient temperatures and/or humidity, could cause severe, unpleasant sweating under ear-muffs. In such cases ear-plugs are preferred. If ear-muffs are worn, thin absorbent cushion covers may be used.

It is not possible to judge subjectively the loss of attenuation that can be caused by using covers. Products with attenuation data for the combination of muff and cover should be preferred.

5.5.2 Dust

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Work in dusty environments can produce a layer of dirt between ear-muff cushions and the skin which could result in skin irritation. In such cases disposable ear-plugs or ear-muffs with cushion covers may be preferred.

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5.5.3 Repeated short term noise exposure

Ear-muffs and "banded ear-plugs" are preferred in repeated short term noise exposure because they are quick and easy to fit and remove.

5.5.4 Informative sounds of the working process

Where high frequency informative sounds in the working noise have to be heard, hearing protectors having a uniform sound attenuation characteristic over the frequency range are preferred.

5.5.5 Warning signals and speech communication

Where recognition of sounds such as speech and warning signals may be impaired by low frequency ambient noises, hearing protectors having a uniform sound attenuation characteristic over the frequency range are preferred. See also EN 457.

If among the wearers there are persons with an existing hearing loss they should be included in the group of subjects when performing a listening check in accordance with EN 457.