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and testing –
Part 7: Level-dependent ear-plugs

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Protecteurs individuels contre le bruit - Exigences de
sécurité et essais - Partie 7: Bouchons d'oreilles à
atténuation dépendante du niveau

Gehörschützer - Sicherheitstechnische Anforderungen und
Prüfungen - Teil 7: Pegelabhängig dämmende
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Foreword

This document (EN 352-7:2002) has been prepared by Technical Committee CEN/TC 159, "Hearing protectors", the secretariat of which is held by SIS.

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of an identical text or by endorsement, at the latest by June 2003, and conflicting national standards shall be withdrawn at the latest by June 2003.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directives, see informative Annex ZA, which is an integral part of this standard.

In this standard the annexes A and B are informative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

EN 352-7:2002 (E)

Introduction

This standard for "Hearing Protectors – Safety requirements and testing – Part 7: Level-dependent ear-plugs", specifies procedures for the testing of personal hearing protection devices in relation to Directive 89/686/EEC - Personal Protective Equipment.

EN 352-1 deals with requirements for ear-muffs, EN 352-2 with ear-plugs, EN 352-3 with ear-muffs attached to industrial safety helmets. EN 13819-1 and EN 13819-2 deal with testing plans common to all types of hearing protectors covered by this series of ENs.

Additional safety requirements and the associated test procedures for level-dependent ear-muffs are contained in EN 352-4, for ear-muffs with active noise reduction in EN 352-5 and for ear-muffs with electrical audio input facility in EN 352-6. An associated standard EN 458, covers selection, use, care and maintenance of hearing protection.

The particular requirement for hearing protectors in relation to their ability to reduce noise to below daily limit levels set by Directive 86/188/EEC - "on the protection of workers from the risks related to exposure to noise at work" is addressed in the standard by means of a requirement to report in which noise environments the hearing protector may be used without exceeding the relevant action level set by that Directive.

The test method for hearing protector attenuation described in EN 24869-1 and applied in Parts 1, 2 and 3 is not sufficient for level-dependent ear-plugs. Additional methods of measurement, for the purposes of determining the sound delivered to the wearer's ear from the sound restoration circuit, are under consideration. Until such time as this work is completed, the test method described in Annex B of this standard is recommended for level-dependent ear-plugs, in addition to the EN 24869-1 test.

Level-dependent ear-plugs are designed to provide restoration of external sounds, while providing attenuation of sounds at high levels. They may be selected for use in intermittent or impulsive noise environments and where external warning sounds are required to be heard. This standard is concerned with those ear-plugs having an electronic sound restoration circuit.

This part of the standard is a specification intended for type approval purposes, for which 4 sets of specimen ear-plugs are tested, (further samples may be required for testing under EN 352-2).

The requirements and tests of the standard are concerned primarily with the level-dependent performance of the ear-plugs.

1 Scope

This European Standard is concerned with ear-plugs fitted with an electronic level-dependent sound restoration function. It specifies additional constructional, design and performance requirements, methods of test, marking requirements and user information relating to the incorporation of the level-dependency facility. The performance of the ear-plug in impulsive noise is not addressed.

The requirements of this standard are intended to take account of the ergonomic interaction between the wearer, the device and, where possible, the working environment in which the device is likely to be used (see Annex ZA of this standard and EN 458)

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 (including amendments).

EN 352-2:2002, *Hearing protectors - General requirements - Part 2: Ear-plugs*

EN 13819-1, *Hearing protectors - Testing - Part 1: Physical test methods*

3 Terms and definitions

For the purposes of this European Standard the terms and definitions given in EN 352-2:2002 and the following terms and definitions apply:

3.1

criterion level (H)

A-weighted sound pressure level of the H noise for which the A-weighted diffuse-field related sound pressure level when a level-dependent ear-plug is worn first exceeds 85 dB(A), calculated as the mean plus one standard deviation performance for the samples tested

3.2

criterion level (M)

A-weighted sound pressure level of the M noise for which the A-weighted diffuse-field related sound pressure level when a level-dependent ear-plug is worn first exceeds 85 dB(A), calculated as the mean plus one standard deviation performance for the samples tested

3.3

criterion level (L)

A-weighted sound pressure level of the L noise for which the A-weighted diffuse-field related sound pressure level when a level-dependent ear-plug is worn first exceeds 85 dB(A), calculated as the mean plus one standard deviation performance for the samples tested

3.4

level-dependent ear-plug

ear-plug fitted with an electronic level-dependent sound restoration circuit

3.5

sound restoration circuit

electroacoustic device intended to reproduce lower level external sounds in the ear canal, while usually providing attenuation of higher level sounds by means of a level-dependent gain function

4 Requirements

4.1 General

Level-dependent ear-plugs shall meet the requirements of EN 352-2. Additional requirements are listed below.

4.2 Materials and construction

The electronic circuit of the level-dependent ear-plug shall meet the electrical safety and EMC requirements appropriate to this class of equipment.

4.3 Performance

4.3.1 General

Level-dependent ear-plugs shall meet all the performance requirements of EN 352-2, including the minimum attenuation requirement in their passive mode. Additionally, the requirements specified below in 4.3.2 shall be satisfied.

Specimens of ear-plugs shall be conditioned and tested as specified in 5.1.1 and 5.1.2. The scheme of testing shall be as specified in 5.1.3.

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4.3.2 Criterion levels

The criterion levels for the three noises H, M and L determined in accordance with 5.2 shall be reported in wearer information (6.1).

5 Testing

5.1 Specimens, conditioning and scheme of testing

This scheme of testing is additional to that described in EN 13819-1. It shall be carried out on additional samples.

5.1.1 Specimens

Four sets of ear-plugs shall be submitted for testing. The individual ear-plugs shall be numbered 1 to 8. Fresh batteries shall be fitted for the test.

5.1.2 Conditioning and testing atmosphere

All specimens shall be conditioned and tested in an atmosphere having a temperature of $22\text{ °C} \pm 5\text{ °C}$ and a relative humidity of not more than 85 %, as required in EN 13819-1.

5.1.3 Scheme of testing

The eight ear-plug specimens shall be tested for criterion levels as described in 5.2. The volume control of each ear-plug, if fitted, shall be set to maximum.

5.2 Criterion levels

The acoustic measurement procedures for level dependent ear-plugs are under consideration. For the time being and because of the urgent need, such measurements may be carried out in accordance with test procedures described in Annex B.

6 Information supplied by the manufacturer

6.1 Wearer information

The following information for the wearer (in addition to that required by EN 352-2) shall be supplied with the ear-muffs:

- a) the number of this standard, EN 352-7;
- b) an indication as to whether the hearing protector provides a level-dependent facility;
- c) the values of the criterion levels as determined by the procedures described in the Annex B;
- d) recommended storage conditions before and after use;
- e) method of checking, charging and changing batteries;
- f) for ear-plugs with level-dependency, the statements:

1) "This ear-plug is provided with level-dependent attenuation. The wearer should check correct operation before use. If distortion or failure is detected, the wearer should refer to the manufacturers advice for maintenance and replacement of the battery."