

STN	Elektroakustika Audiometrické zariadenia Časť 1: Zariadenia pre audiometriu čistého tónu a reči	STN EN 60645-1 36 4805
------------	--	--

Electroacoustics - Audiometric equipment - Part 1: Equipment for pure-tone and speech audiometry

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 02/18

Obsahuje: EN 60645-1:2017, IEC 60645-1:2017

Oznámením tejto normy sa od 06.10.2020 ruší
STN EN 60645-1 (36 4805) z augusta 2015

126192

Úrad pre normalizáciu, metrológiu a skúšobníctvo Slovenskej republiky, 2018
Podľa zákona č. 264/1999 Z. z. o technických požiadavkách na výrobky a o posudzovaní zhody a o zmene a doplnení niektorých zákonov v znení neskorších predpisov sa slovenská technická norma a časti slovenskej technickej normy môžu rozmnožovať alebo rozširovať len so súhlasom slovenského národného normalizačného orgánu.

English Version

**Electroacoustics - Audiometric equipment - Part 1: Equipment for
pure-tone and speech audiometry
(IEC 60645-1:2017)**

Electroacoustique - Appareils audiométriques -
Partie 1: Appareils pour l'audiométrie tonale et vocale
(IEC 60645-1:2017)

Akustik - Audiometer - Teil 1: Reinton-Audiometer
(IEC 60645-1:2017)

This European Standard was approved by CENELEC on 2017-04-18. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

European foreword

The text of document 29/927/FDIS, future edition 4 of IEC 60645-1, prepared by IEC/TC 29 "Electroacoustics" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60645-1:2017.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2018-04-06
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2020-10-06

This document supersedes EN 60645-1:2015.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 60645-1:2017 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

ISO 389-9 NOTE Harmonized as EN ISO 389-9.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60268-3	-	Sound system equipment - Part 3: Amplifiers	EN 60268-3	-
IEC 60268-7	-	Sound system equipment - Part 7: Headphones and earphones	EN 60268-7	-
IEC 60268-17	-	Sound system equipment - Part 17: Standard volume indicators	HD 483.17 S1	-
IEC 60318-1	-	Electroacoustics - Simulators of human head and ear - Part 1: Ear simulator for the measurement of supra-aural and circumaural earphones	EN 60318-1	-
IEC 60318-3	-	Electroacoustics - Simulators of human head and ear - Part 3: Acoustic coupler for the calibration of supra-aural earphones used in audiometry	EN 60318-3	-
IEC 60318-4	-	Electroacoustics - Simulators of human head and ear - Part 4: Occluded-ear simulator for the measurement of earphones coupled to the ear by means of ear inserts	EN 60318-4	-
IEC 60318-5	-	Electroacoustics - Simulators of human head and ear - Part 5: 2 cm ³ coupler for the measurement of hearing aids and earphones coupled to the ear by means of ear inserts	EN 60318-5	-
IEC 60318-6	-	Electroacoustics - Simulators of human head and ear - Part 6: Mechanical coupler for the measurements on bone vibrators	EN 60318-6	-
IEC 60601-1	-	Medical electrical equipment - Part 1: General requirements for basic safety and essential performance	EN 60601-1	-
IEC 60601-1-2	-	Medical electrical equipment - Part 1-2: General requirements for basic safety and essential performance - Collateral standard: Electromagnetic disturbances - Requirements and tests	EN 60601-1-2	-

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61260-1	-	Electroacoustics - Octave-band and fractional-octave-band filters - Part 1: Specifications	EN 61260-1	-
IEC 61672-1	-	Electroacoustics - Sound level meters - Part 1: Specifications	EN 61672-1	-
ISO 266	-	Acoustics - Preferred frequencies	EN ISO 266	-
ISO 389-1	-	Acoustics - Reference zero for the calibration of audiometric equipment - Part 1: Reference equivalent threshold sound pressure levels for pure tones and supra-aural earphones	EN ISO 389-1	-
ISO 389-2	-	Acoustics - Reference zero for the calibration of audiometric equipment - Part 2: Reference equivalent threshold sound pressure levels for pure tones and insert earphones	EN ISO 389-2	-
ISO 389-3	-	Acoustics - Reference zero for the calibration of audiometric equipment - Part 3: Reference equivalent threshold vibratory force levels for pure tones and bone vibrators	EN ISO 389-3	-
ISO 389-4	1994	Acoustics - Reference zero for the calibration of audiometric equipment - Part 4: Reference levels for narrow-band masking noise	EN ISO 389-4	1998
ISO 389-5	-	Acoustics - Reference zero for the calibration of audiometric equipment - Part 5: Reference equivalent threshold sound pressure levels for pure tones in the frequency range 8 kHz to 16 kHz	EN ISO 389-5	-
ISO 389-7	-	Acoustics - Reference zero for the calibration of audiometric equipment - Part 7: Reference threshold of hearing under free-field and diffuse-field listening conditions	EN ISO 389-7	-
ISO 389-8	-	Acoustics - Reference zero for the calibration of audiometric equipment - Part 8: Reference equivalent threshold sound pressure levels for pure tones and circumaural earphones	EN ISO 389-8	-
ISO 4869-1	-	Acoustics - Hearing protectors - Part 1: Subjective method for the measurement of sound attenuation	EN 24869-1	-
ISO 8253-1	2010	Acoustics - Audiometric test methods - Part 1: Pure-tone air and bone conduction audiometry	EN ISO 8253-1	2010
ISO 8253-2	-	Acoustics - Audiometric test methods - Part 2: Sound field audiometry with pure-tone and narrow-band test signals	EN ISO 8253-2	-
ISO 8253-3	-	Acoustics - Audiometric test methods - Part 3: Speech audiometry	EN ISO 8253-3	-



INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Electroacoustics – Audiometric equipment –
Part 1: Equipment for pure-tone and speech audiometry**

**Électroacoustique – Appareils audiométriques –
Partie 1: Appareils pour l’audiométrie tonale et vocale**





THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2017 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
 3, rue de Varembe
 CH-1211 Geneva 20
 Switzerland

Tel.: +41 22 919 02 11
 Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Catalogue IEC - webstore.iec.ch/catalogue

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - www.iec.ch/searchpub

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

65 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.



INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Electroacoustics – Audiometric equipment –
Part 1: Equipment for pure-tone and speech audiometry**

**Électroacoustique – Appareils audiométriques –
Partie 1: Appareils pour l’audiométrie tonale et vocale**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 17.140.50

ISBN 978-2-8322-4079-3

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	5
INTRODUCTION.....	7
1 Scope.....	8
2 Normative references	8
3 Terms and definitions	9
4 Requirements by type and class of audiometer.....	13
5 General requirements	15
5.1 General safety requirements	15
5.2 Acoustic safety requirements	15
5.3 Environmental conditions	15
5.4 Warm-up time	15
5.5 Power supply variation.....	15
5.5.1 Interruption of power supply	15
5.5.2 Mains operation.....	15
5.5.3 Battery operation	15
5.5.4 Other power supplies.....	16
5.6 Electromagnetic compatibility.....	16
5.7 Unwanted sound	16
5.7.1 General	16
5.7.2 Unwanted sound from and between any combination of transducers.....	16
5.7.3 Unwanted sound from an earphone	16
5.7.4 Unwanted sound from a bone vibrator.....	16
5.7.5 Unwanted sound radiated by an audiometer	17
5.8 Testing of automatic-recording audiometers.....	17
5.9 Interface connections.....	17
6 Test signals.....	17
6.1 Speech signals	17
6.1.1 Speech signal general requirements	17
6.1.2 Free-field equivalent earphone output level	17
6.1.3 Uncorrected earphone output level	18
6.1.4 Loudspeaker output level.....	18
6.1.5 Bone vibrator output level.....	18
6.1.6 Speech signal frequency response	18
6.1.7 Calibration signal.....	18
6.1.8 Live voice microphone frequency response.....	18
6.1.9 Scale reference and output level.....	19
6.1.10 Distortion requirements for speech signals	19
6.2 Pure tones	20
6.2.1 Frequency range and hearing level range	20
6.2.2 Frequency acceptance limits.....	21
6.2.3 Total harmonic distortion	21
6.2.4 Rate of frequency change.....	21
6.2.5 Frequency modulation	21
6.3 External signal sources	22
6.3.1 Signals	22
6.3.2 Frequency response	22

6.3.3	Playback device input	22
6.3.4	Signal-to-noise ratio for playback device input	22
6.3.5	Electrical sensitivity	22
6.3.6	Reference level for external signal source	23
6.4	Operator and test subject speech communication	23
6.4.1	General	23
6.4.2	Operator to test subject speech communication (talk-forward)	23
6.4.3	Test subject to operator speech communication (talk-back)	23
6.4.4	Operator to test subject speech communication for live voice speech audiometry	23
6.4.5	Test subject to operator speech communication for vocal response speech audiometry	24
6.5	Masking sound	24
6.5.1	General	24
6.5.2	Narrow-band noise	24
6.5.3	Speech weighted noise	26
6.5.4	Other masking sound	26
7	Transducers	26
7.1	Types of transducers	26
7.2	Headband	26
7.3	Loudspeaker	26
8	Signal level control	26
8.1	Marking of pure-tone and speech signal level controls	26
8.2	Signal indicator	27
8.3	Sound pressure level and vibratory force level acceptance limits	27
8.4	Signal level control	28
8.4.1	Manual audiometers	28
8.4.2	Automatic-recording audiometers	28
8.4.3	Signal level control acceptance limits	28
8.5	Masking sound level control	28
8.5.1	General	28
8.5.2	Masking sound level	28
8.5.3	Masking sound level acceptance limits	29
8.5.4	Masking sound level range	29
8.6	Signal switching	29
8.6.1	Signal switch for manual audiometers	29
8.6.2	On/off ratio for manual audiometers	29
8.6.3	Rise/fall times for manual audiometers	29
8.6.4	Automatic pulsed presentation	30
8.6.5	Subject's response system	30
8.6.6	Subject's response time for automated test procedures	30
9	Reference tone	31
9.1	General	31
9.2	Frequencies	31
9.3	Reference tone level control	31
9.3.1	Range	31
9.3.2	Intervals	31
9.3.3	Marking	31
9.3.4	Acceptance limits	31

9.3.5	Operation	31
10	Calibration	31
11	Electrical output of test signals	32
12	Audiogram format	33
13	Test requirements to demonstrate conformity	33
13.1	General.....	33
13.2	Environmental conditions and power supply variation.....	33
13.3	Electromagnetic compatibility.....	34
13.4	Unwanted sound	34
13.4.1	Unwanted sound from an earphone	34
13.4.2	Unwanted sound from a bone vibrator.....	35
13.4.3	Unwanted sound radiated by an audiometer	35
13.5	Total harmonic distortion of test signals	35
13.6	Microphone for live voice speech testing.....	36
13.7	Signal accuracy	36
13.7.1	Accuracy of sound pressure level and vibratory force level	36
13.7.2	Accuracy of hearing level control	36
13.8	Masking sound.....	36
13.8.1	Narrow-band noise	36
13.8.2	Masking sound level	36
13.9	Headbands	37
13.9.1	General	37
13.9.2	Supra-aural and circumaural earphone headband.....	37
13.9.3	Bone vibrator headband.....	37
14	Maximum permitted expanded uncertainty of measurements U_{\max}	37
15	Marking and instruction manual	38
15.1	Marking.....	38
15.2	Instruction manual	38
Annex A (informative) Relationship between tolerance interval, corresponding acceptance interval and the maximum permitted uncertainty of measurement.....		40
Bibliography.....		41
Figure 1 – Rise/fall envelope of test tones		30
Figure A.1 – Relationship between tolerance interval, corresponding acceptance interval and the maximum permitted uncertainty of measurement		40
Table 1 – Minimum facilities for audiometers		14
Table 2 – Minimum number of frequencies to be provided and the minimum range of values of hearing level for type and class of audiometer		20
Table 3 – Maximum permissible acoustic total harmonic distortion, for supra-aural, circumaural, insert earphones and bone vibrators		21
Table 4 – Narrow-band masking noise: upper and lower cut-off frequencies for a sound pressure spectrum density level of –3 dB referenced to the level at the centre frequency of the band		25
Table 5 – Standards specifying reference equivalent threshold levels		32
Table 6 – Symbols for the graphical presentation of hearing threshold levels.....		33
Table 7 – Values of U_{\max} for basic measurements.....		38

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTROACOUSTICS – AUDIOMETRIC EQUIPMENT –

Part 1: Equipment for pure-tone and speech audiometry

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60645-1 has been prepared by IEC technical committee 29: Electroacoustics.

This fourth edition cancels and replaces the third edition, published in 2012, and the first edition IEC 60645-2, published in 1993. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

This edition now includes the requirements for both pure-tone (prior edition of IEC 60645-1) and speech audiometers (prior edition of IEC 60645-2) into a single document. The technical requirements in this edition remain similar to the intent of the prior two documents, but now eliminate technical and editorial contradictions caused by two separate standards with different review cycles applying to an audiometer.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
29/927/FDIS	29/941/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 60645 series, published under the general title *Electroacoustics – Audiometric equipment*, can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

Developments in the field of hearing measurements for diagnostic, hearing conservation and rehabilitation purposes have resulted in the availability of a wide range of audiometers. In addition it is possible to consider the audiometer in terms of a set of functional units which can be specified independently. By specifying these functional units it is then possible to specify the performance of other audiometric equipment which use these units. The IEC 60645 series consists of a number of parts. IEC 60645-1 is the first in the series and covers the requirements for both pure-tone and speech audiometers.

This standard describes the performance requirements for pure-tone audiometers, which are designed for the measurement of hearing in the frequency range from 125 Hz to 16 kHz, and speech audiometers, which are designed for performing live or recorded speech audiometry.

When speech signal facilities are provided by an audiometer, performance requirements are given for both live voice and recorded speech material. Although live voice speech audiometry may not be capable of meeting the requirements of this standard, it is widely practiced, particularly with children, and therefore a specification is included in order to ensure as high a degree of reliability as possible. This standard does not specify the speech material that is used for test purposes or the required acoustic properties of the test room.¹

Speech audiometers use earphones or loudspeakers to present signals to the test subject. In this standard, specifications of the performance characteristics of speech audiometers and relevant calibration and test methods are given with respect to both a free-field equivalent output level method and an uncorrected ear simulator or acoustic coupler output level method.

In order to relate earphone listening to sound field listening, the concept of a free-field equivalent output level of an earphone, as described in IEC 60268-7, is used for specification and measurement purposes.

Although it is recognised that bone vibrators are used for speech audiometry purposes, their performance can be extremely variable when using speech signals. Therefore only known “good practice” specifications for bone conduction using speech signals are provided to promote consistency when this capability is provided.

The test requirements to demonstrate audiometer conformity are now specified separately. Conformance to the performance specification in this standard is demonstrated when a measured deviation from a design goal equals or does not exceed the corresponding acceptance limit(s), and the laboratory has demonstrated that the associated uncertainty of measurement equals or does not exceed the maximum permitted uncertainty specified in this standard. The requirements for an audiometer are essentially the same as in the previous editions of IEC 60645-1 and IEC 60645-2.

¹ These requirements are specified in ISO 8253-1.

ELECTROACOUSTICS – AUDIOMETRIC EQUIPMENT –

Part 1: Equipment for pure-tone and speech audiometry

1 Scope

This part of IEC 60645 specifies general requirements for audiometers designed for use in determining hearing threshold levels, relative to standard reference threshold levels established by means of psychoacoustic test methods, and those designed to perform psychoacoustic tests using speech material.

The object of this standard is to ensure:

- a) that tests of hearing in the frequency range 125 Hz to 16 kHz on a given human ear, performed with different pure-tone audiometers which comply with this standard, give substantially the same results;
- b) that the results obtained represent a valid comparison between the hearing of the ear tested and the reference threshold of hearing;
- c) that a means of presenting speech material to a subject in a standardized manner is provided. This will ensure that tests of hearing using a specific speech signal and a specific manner of signal presentation, when performed with different audiometers which comply with this standard, give substantially the same results;
- d) that audiometers are classified according to the range of test signals they present, according to the mode of operation or according to their presumed primary application.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60268-3, *Sound system equipment – Part 3: Amplifiers*

IEC 60268-7, *Sound system equipment – Part 7: Headphones and earphones*

IEC 60268-17, *Sound system equipment – Part 17: Standard volume indicators*

IEC 60318-1, *Electroacoustics – Simulators of human head and ear – Part 1: Ear simulator for the measurement of supra-aural and circumaural earphones*

IEC 60318-3, *Electroacoustics – Simulators of human head and ear – Part 3: Acoustic coupler for the calibration of supra-aural earphones used in audiometry*

IEC 60318-4, *Electroacoustics – Simulators of human head and ear – Part 4: Occluded-ear simulator for the measurement of earphones coupled to the ear by means of ear inserts*

IEC 60318-5, *Electroacoustics – Simulators of human head and ear – Part 5: 2 cm³ coupler for the measurement of hearing aids and earphones coupled to the ear by means of ear inserts*

IEC 60318-6, *Electroacoustics – Simulators of human head and ear – Part 6: Mechanical coupler for the measurement of bone vibrators*

IEC 60601-1, *Medical electrical equipment – Part 1: General requirements for basic safety and essential performance*

IEC 60601-1-2, *Medical electrical equipment – Part 1-2: General requirements for basic safety and essential performance – Collateral standard: Electromagnetic disturbances – Requirements and tests*

IEC 61260-1, *Electroacoustics – Octave-band and fractional-octave-band filters – Part 1: Specifications*

IEC 61672-1, *Electroacoustics – Sound level meters – Part 1: Specifications*

ISO 266, *Acoustics – Preferred frequencies*

ISO 389-1, *Acoustics – Reference zero for the calibration of audiometric equipment – Part 1: Reference equivalent threshold sound pressure levels for pure tones and supra-aural earphones*

ISO 389-2, *Acoustics – Reference zero for the calibration of audiometric equipment – Part 2: Reference equivalent threshold sound pressure levels for pure tones and insert earphones*

ISO 389-3, *Acoustics – Reference zero for the calibration of audiometric equipment – Part 3: Reference equivalent threshold force levels for pure tones and bone vibrators*

ISO 389-4:1994, *Acoustics – Reference zero for the calibration of audiometric equipment – Part 4: Reference levels for narrow-band masking noise*

ISO 389-5, *Acoustics – Reference zero for the calibration of audiometric equipment – Part 5: Reference equivalent threshold sound pressure levels for pure tones in the frequency range 8 kHz to 16 kHz*

ISO 389-7, *Acoustics – Reference zero for the calibration of audiometric equipment – Part 7: Reference threshold of hearing under free-field and diffuse-field listening conditions*

ISO 389-8, *Acoustics – Reference zero for the calibration of audiometric equipment – Part 8: Reference equivalent threshold sound pressure levels for pure tones and circumaural earphones*

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

ISO 8253-1:2010, *Acoustics – Audiometric test methods – Part 1: Pure-tone air and bone conduction audiometry*

ISO 8253-2, *Acoustics – Audiometric test methods – Part 2: Sound field audiometry with pure-tone and narrow-band test signals*

ISO 8253-3, *Acoustics – Audiometric test methods – Part 3: Speech audiometry*

koniec náhľadu – text ďalej pokračuje v platenej verzii STN