BS EN ISO 389-3:2016

BSI Standards Publication

Acoustics — Reference zero for the calibration of audiometric equipment

Part 3: Reference equivalent threshold vibratory force levels for pure tones and bone vibrators

bsi.

...making excellence a habit.™

Document Sharing Hub

Full document details: BS EN ISO 389-3:2016

National foreword

This British Standard is the UK implementation of EN ISO 389-3:2016. It supersedes BS EN ISO 389-3:1999 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EH/1/1, Hearing.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2016.
Published by BSI Standards Limited 2016

ISBN 978 0 580 82086 1

ICS 11.040.01; 13.140

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 29 February 2016.

Amendments/corrigenda issued since publication

Date	Text affected

Documents
Document Sharing Hub

Full document details: BS EN ISO 389-3:2016

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 389-3

February 2016

ICS 13.140

Supersedes EN ISO 389-3:1998

English Version

Acoustics - Reference zero for the calibration of audiometric equipment - Part 3: Reference equivalent threshold vibratory force levels for pure tones and bone vibrators (ISO 389-3:2016)

Acoustique - Zéro de référence pour l'étalonnage d'équipements audiométriques - Partie 3: Niveaux de référence équivalents de force vibratoire liminaire pour les vibrateurs à sons purs et les ossivibrateurs (ISO 389-3:2016)

Akustik - Standard-Bezugspegel für die Kalibrierung audiometrischer Geräte - Teil 3: Äquivalente Bezugs-Schwellenkraftpegel für reine Töne und Knochenleitungshörer (ISO 389-3:2016)

This European Standard was approved by CEN on 2 January 2016.

CEN 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 CEN 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 CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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

© 2016 CEN All rights of exploitation in any form and by any means reserved worldwide for CEN national Members.

Ref. No. EN ISO 389-3:2016 E

Documents
Document Sharing Hub

Full document details: BS EN ISO 389-3:2016

European foreword

This document (EN ISO 389-3:2016) has been prepared by Technical Committee ISO/TC 43 "Acoustics" in collaboration with Technical Committee CEN/TC 211 “Acoustics” the secretariat of which is held by DIN.

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 August 2016, and conflicting national standards shall be withdrawn at the latest by August 2016.

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

This document supersedes EN ISO 389-3:1998.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Endorsement notice

The text of ISO 389-3:2016 has been approved by CEN as EN ISO 389-3:2016 without any modification.

Documents
Document Sharing Hub

Full document details: BS EN ISO 389-3:2016

Contents

Page

Foreword ... **iv**
Introduction ... **v**
1 Scope ... **1**
2 Normative references ... **1**
3 Terms and definitions ... **2**
4 Reference equivalent threshold vibratory force levels (RETVFL) ... **3**
5 Test conditions and requirements ... **4**
5.1 General ... 4
5.2 Bone vibrator ... 4
5.3 Fitting of the bone vibrator ... 4
5.4 Mechanical coupler ... 5
5.5 Test signal ... 5
5.6 Masking noise ... 5
5.7 Masking transducer ... 5
5.8 Fitting of masking transducer ... 5
5.9 Baseline masking level ... 6
Annex A (informative) **Note on the derivation of RETVFL values** ... **7**
Annex B (informative) **Guidance on the application of the reference zero to the calibration of bone-conduction audiometers** ... **8**
Annex C (informative) **Differences in reference equivalent threshold vibratory force levels between forehead and mastoid location of vibrator** ... **10**
Annex D (informative) **Bone-conduction threshold of hearing for frequencies below 250 Hz** ... **12**
Bibliography ... **13**

© ISO 2016 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS EN ISO 389-3:2016

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 43, *Acoustics*.

This second edition cancels and replaces the first edition (ISO 389-3:1994), which has been technically revised. It also incorporates the Technical Corrigendum ISO 389-3:1994/Cor 1:1995.

ISO 389 consists of the following parts, under the general title *Acoustics — Reference zero for the calibration of audiometric equipment*:

— *Part 1: Reference equivalent threshold sound pressure levels for pure tones and supra-aural earphones*

— *Part 2: Reference equivalent threshold sound pressure levels for pure tones and insert earphones*

— *Part 3: Reference equivalent threshold vibratory force levels for pure tones and bone vibrators*

— *Part 4: Reference levels for narrow-band masking noise*

— *Part 5: Reference equivalent threshold sound pressure levels for pure tones in the frequency range 8 kHz to 16 kHz*

— *Part 6: Reference threshold of hearing for test signals of short duration*

— *Part 7: Reference threshold of hearing under free-field and diffuse-field listening conditions*

— *Part 8: Reference equivalent threshold sound pressure levels for pure tones and circumaural earphones*

— *Part 9: Preferred test conditions for the determination of reference hearing threshold levels*

© ISO 2016 – All rights reserved
Documents
Document Sharing Hub
Full document details: BS EN ISO 389-3:2016

Introduction

Each part of ISO 389 specifies a specific reference zero for the calibration of audiometric equipment. ISO 389-1, ISO 389-2 and ISO 389-8 are applicable to audiometric equipment for the transmission of pure tones by air conduction.

For clinical diagnostic and other audiometric purposes, it is often necessary to compare the measured hearing threshold levels of a person for sound transmitted to the inner ear by the air-conduction and bone-conduction pathways, respectively. Bone-conducted sound is provided for this purpose by an electromechanical vibrator applied to the mastoid prominence or to the forehead of the person under test.

The reference zero for the calibration of audiometric equipment for air conduction is defined in ISO 389-1, ISO 389-2 and ISO 389-8 in terms of reference equivalent threshold sound pressure levels (RETSPL), i.e. threshold sound pressure levels produced in an ear simulator or acoustic coupler of specified characteristics by supra-aural, circumaural or insert earphones of various patterns, when excited electrically at a level corresponding to the threshold of hearing of young otologically normal persons. Similarly, this part of ISO 389 provides a reference zero for bone-conduction audiometry in terms of reference equivalent threshold vibratory force levels (RETVFL), i.e. the vibratory force levels produced by a bone vibrator on a specified mechanical coupler when the vibrator is excited electrically at a level corresponding to the threshold of hearing of young otologically normal persons. In some countries, the preferred location is the mastoid prominence; in other countries, the forehead location is used in addition to the mastoid prominence. Different RETVFL values are valid for each of the two positions (see Annex C).

For bone-conduction measurements, it is necessary to specify the static force of application of the vibrator to the test subject and to the mechanical coupler, as well as certain geometrical features of the vibrator tip. In addition, it is usually necessary to apply masking noise to the ear not under test, since excitation of the cranial bones by the vibrator may be heard by that ear instead of (or in addition to) the ear intended for the test. An appropriate specification of the masking noise is, therefore, required as an adjunct to the reference equivalent threshold vibratory force levels, and such a specification is given in this part of ISO 389. Due to the so-called “occlusion effect” whereby the wearing of the transducer needed to provide the (air-conducted) masking noise causes a lowering of the bone-conduction threshold of hearing of the ear receiving the masking signal, it is necessary for the level of masking noise to be raised to cancel out the occlusion effect and provide adequate masking of the ear not under test. The specification of masking noise given in this part of ISO 389 is based on the procedures used in the experimental investigations from which the reference zero of this part of ISO 389 is derived.

Use of this reference zero to calibrate audiometers will ensure that measured bone-conduction hearing threshold levels of persons with unimpaired hearing or with hearing losses of purely sensorineural type (i.e. having unimpaired outer and middle ear function) will be compatible with the air-conduction hearing threshold levels of the same persons when using the reference zero of ISO 389-1, ISO 389-2 or ISO 389-8, respectively. Although exact equivalence of air-conduction and bone-conduction thresholds for any individual in these classes cannot be expected, due to biological variability of sound transmission through the external and middle ear and through the cranial bones, this part of ISO 389 will ensure that systematic deviations averaged over groups of such persons are reduced to a practical minimum.

This part of ISO 389 is based on an assessment of technical data provided by laboratories in three countries using methods of threshold testing which, in the respects described, were essentially uniform. Examination of the data showed that the experimental results were consistent. It has, therefore, been possible to standardize a reference zero by means of RETVFL values which are to be used for all bone vibrators used in audiometry having similar characteristics to those used by the laboratories. The systematic uncertainties introduced by this deliberate simplification will be small in comparison to the usual step size of hearing level controls in clinical audiometers (5 dB).

© ISO 2016 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS EN ISO 389-3:2016

Documents
Document Sharing Hub