INTERNATIONAL STANDARD

ISO 389-7

Third edition 2019-10

Acoustics — Reference zero for the calibration of audiometric equipment —

Part 7:

Reference threshold of hearing under free-field and diffuse-field listening

(standards.iteh.ai)

Acoustique — Zéro de référence pour l'étalonnage d'équipements audiométriques 0+9

https://standards.iteh.piartie 7: Niveda limihaire de référence dans des conditions d'écoute en champ libre et en champ diffus



iTeh STANDARD PREVIEW (standards.iteh.ai)

ISO 389-7:2019 https://standards.iteh.ai/catalog/standards/sist/cf60896f-a96d-45a7-922f-b0d773f02f2c/iso-389-7-2019



COPYRIGHT PROTECTED DOCUMENT

© ISO 2019

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office CP 401 • Ch. de Blandonnet 8 CH-1214 Vernier, Geneva Phone: +41 22 749 01 11 Fax: +41 22 749 09 47 Email: copyright@iso.org Website: www.iso.org

Published in Switzerland

Co	ntents	Page		
Fore	eword	iv		
Intr	oduction	v		
1	Scope	1		
2	Normative references	1		
3	Terms and definitions	1		
4	Specification	2		
Ann	ex A (informative) Notes on the derivation of the reference thresholds of hearing	5		
Bibl	Bibliography			

iTeh STANDARD PREVIEW (standards.iteh.ai)

ISO 389-7:2019 https://standards.iteh.ai/catalog/standards/sist/cf60896f-a96d-45a7-922f-b0d773f02f2c/iso-389-7-2019

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 of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html. (standards.iteh.ai)

This document was prepared by Technical Committee ISO/TC 43, *Acoustics*.

This third edition cancels and replaces the second edition (ISO 889-7:2005), which has been technically revised to incorporate the Amendment ISO 389-7:2005/Amd.1:2016. The main changes compared to the previous edition are as follows:

- the reference thresholds of hearing at 20 Hz under the conditions of free-field and diffuse-field listening and the reference threshold of hearing at 18 000 Hz under the condition of free-field listening were recalculated using additional experimental data;
- the Bibliography was updated.

A list of all parts in the ISO 389 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

In some audiological applications, the test signals are delivered by means of loudspeakers, either in a free sound field or in a diffuse sound field. This document specifies the reference zero for the calibration of audiometric equipment used for sound field audiometry. Corresponding audiometric test methods are specified in ISO 8253-1 and ISO 8253-2.

In common with other subjective phenomena, the threshold of hearing varies in detail from person to person but, for a group of otologically normal persons within a restricted age range, values for the central tendency can be determined to characterize the group. This document and other parts of ISO 389 specify threshold data applicable to otologically normal persons in the age range from 18 years to 25 years.

The data specified in this document relate to

- a) pure tones heard under conditions of binaural listening in free progressive plane waves with the subject directly facing the source of sound (frontal incidence), and with the sound pressure level measured in the free progressive wave at the centre position of the listener's head with the listener absent;
- b) one-third-octave bands of (white or pink) noise heard under conditions of binaural listening in a diffuse sound field with the sound pressure level measured in the sound field at the centre position of the listener's head with the listener absent.

For frequencies up to 8 kHz, each set of data may be equally applied to any other bands of (white or pink) noise for which the bandwidth is less than the critical bandwidth.

The data are based on an assessment of technical information provided by laboratories in different countries representing the most reliable data available at the time. For information, a note on the derivation of the reference values and the origin of the data is given in Annex A.

https://standards.iteh.ai/catalog/standards/sist/cf60896f-a96d-45a7-922f-b0d773f02f2c/iso-389-7-2019

iTeh STANDARD PREVIEW (standards.iteh.ai)

ISO 389-7:2019 https://standards.iteh.ai/catalog/standards/sist/cf60896f-a96d-45a7-922f-b0d773f02f2c/iso-389-7-2019

Acoustics — Reference zero for the calibration of audiometric equipment —

Part 7:

Reference threshold of hearing under free-field and diffuse-field listening conditions

1 Scope

This document specifies a reference threshold of hearing for the calibration of audiometric equipment used under the following conditions.

- a) The sound field in the absence of the listener consists of either a free progressive plane wave (free field) or a diffuse sound field, as specified in ISO 8253-2. In the case of a free field, the source of sound is directly in front of the listener (frontal incidence).
- b) The sound signals are pure (sinusoidal) tones in the case of free-field conditions and one-third-octave bands of (white or pink) noise in the case of diffuse-field conditions.
- c) The sound pressure level is measured in the absence of the listener at the position where the centre of the listener's head would be and ards iteh at
- d) Listening is binaural.

ISO 389-7:2019

NOTE 1 Correction values for the threshold of hearing under free-field-listening conditions and selected angles of sound incidence (45° and 90°) deviating from frontal incidence are given in ISO 8253-2 for information.

NOTE 2 Other conditions are given in Reference [1].

The data are given in numerical form for the preferred frequencies in the one-third-octave series from 20 Hz to 16 000 Hz inclusive in accordance with ISO 266 and, in addition, for some intermediate audiometric frequencies up to 18 000 Hz.

The threshold data differ from the audiometric zero specified in ISO 389-1, ISO 389-2, ISO 389-5 and ISO 389-8, since the latter refer to monaural listening through earphones with sound pressure levels referred to specified couplers and ear simulators. Direct comparison between the data in the parts of ISO 389 mentioned above and in this document is therefore not appropriate.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at https://www.iso.org/obp
- IEC Electropedia: available at http://www.electropedia.org/

threshold of hearing

level of a sound at which, under specified conditions, a person gives 50 % of correct detection responses on repeated trials

Note 1 to entry: The results of threshold determination depend to a certain degree on the test procedure used. The data presented in the ISO 389 series are all based on the use of the threshold test procedures defined in ISO 8253-1. When a test procedure with other characteristics is used, differences of up to several decibels on average may be expected.

otologically normal person

person in a normal state of health who is free from all signs or symptoms of ear disease and from obstructing wax in the ear canals, and who has no history of undue exposure to noise, exposure to potentially ototoxic substances, or familial hearing loss

3.3

reference threshold of hearing

at a specified frequency, sound pressure level of a pure tone or a one-third-octave band of noise corresponding to the median value of the binaural thresholds of hearing of otologically normal persons (3.2) within the age limits from 18 years to 25 years inclusive

3.4

free sound field

sound field where the boundaries of the room exert a negligible effect on the sound waves

3.5 diffuse sound field

diffuse sound field sound waves arriving at a given location more or less simultaneously from all directions with equal probability and level

ISO 389-7:2019

iTeh STANDARD PREVIEW

https://standards.iteh.ai/catalog/standards/sist/cf60896f-a96d-45a7-922fb0d773f02f2c/iso-389-7-2019

Specification 4

The reference thresholds of hearing for the listening conditions specified in Clause 1 are given in Table 1. This table also gives the differences between sound pressure levels of one-third-octave bands of noise in a diffuse sound field and the sound pressure levels of pure tones in a frontally incident free progressive wave for equal thresholds of hearing. A graphical illustration of the reference thresholds of hearing is given in Figure 1.

Table 1 — Reference thresholds of hearing for the listening conditions specified in Clause 1 and differences between sound pressure levels in the two types of sound field

Frequency	Reference threshold of he	Difference				
f	free-field listening (frontal incidence)	diffuse-field listening				
	T_f (ref. 20 μ Pa)	T_f' (ref. 20 μ Pa)	$\Delta L = T_f - T_f'$			
Hz	dB	dB	dB			
20	78,1	78,1	0			
25	68,7	68,7	0			
31,5	59,5	59,5	0			
40	51,1	51,1	0			
50	44,0	44,0	0			
63	37,5	37,5	0			
80	31,5	31,5	0			
100	26,5	26,5	0			
a At 16 000 Hz, experimental data for ΔL was reported from one laboratory only.						

 Table 1 (continued)

Frequency	Reference threshold of hearing under the condition of		Difference			
f	free-field listening (frontal incidence)	diffuse-field listening				
	T_f (ref. 20 μ Pa)	T'_f (ref. 20 μ Pa)	$\Delta L = T_f - T_f'$			
Hz	dB	dB	dB			
125	22,1	22,1	0			
160	17,9	17,9	0			
200	14,4	14,4	0			
250	11,4	11,4	0			
315	8,6	8,4	0,2			
400	6,2	5,8	0,4			
500	4,4	3,8	0,6			
630	3,0	2,1	0,9			
750	2,4	1,2	1,2			
800	2,2	1,0	1,2			
1 000	2,4	0,8	1,6			
1 250	3,5	1,9	1,6			
1 500	2,4	1,0	1,4			
1 600 i	12th STANDARI	D,PREVIEW	1,2			
2 000	-1,3	-1,5	0,2			
2 500	-4,2 (Standards.)	<u>13,11.a1)</u>	-1,1			
3 000	-5,8 ISO 380 720	-4,0	-1,8			
3 150 https://	standards.iteh.ai/catalog/standards/s	ist/200896f-a96d-45a7-922f-	-2,0			
4 000	-5,4 b0d773f02f2c/iso-38	9 -3,8 019	-1,6			
5 000	-1,5	-1,8	0,3			
6 000	4,3	1,4	2,9			
6 300	6,0	2,5	3,5			
8 000	12,6	6,8	5,8			
9 000	13,9	8,4	5,5			
10 000	13,9	9,8	4,1			
11 200	13,0	11,5	1,5			
12 500	12,3	14,4	-2,1			
14 000	18,4	23,2	-4,8			
16 000	40,2	43,7	−3,5 ^a			
18 000	70,4	_	_			
At 16 000 Hz, experimental data for ΔL was reported from one laboratory only.						