
AMERICAN NATIONAL STANDARD

Specification for Audiometers

ANSI/ASA S3.6-2018

Accredited Standards Committee S3, Bioacoustics

Standards Secretariat
Acoustical Society of America
1305 Walt Whitman Road, Suite 300
Melville, NY 11747

The American National Standards Institute, Inc. (ANSI) is the national coordinator of voluntary standards development and the clearinghouse in the U.S.A. for information on national and international standards.

The Acoustical Society of America (ASA) is an organization of scientists and engineers formed in 1929 to generate, disseminate, and promote the knowledge and practical applications of acoustics.



ANSI/ASA S3.6-2018
(Revision of ANSI/ASA S3.6-2010)

AMERICAN NATIONAL STANDARD

Specification for Audiometers

Secretariat:

Acoustical Society of America

Approved on September 20, 2018, by:

American National Standards Institute, Inc.

Abstract

The audiometers covered in this specification are devices designed for use in determining the hearing threshold level of an individual in comparison with a chosen standard reference threshold level. This standard provides specifications and tolerances for pure tone, speech, and masking signals and describes the minimum test capabilities of different types of audiometers.

AMERICAN NATIONAL STANDARDS ON BIOACOUSTICS

The Acoustical Society of America (ASA) provides the Secretariat for Accredited Standards Committees S1 on Acoustics, S2 on Mechanical Vibration and Shock, S3 on Bioacoustics, S3/SC 1 on Animal Bioacoustics, and S12 on Noise. These committees have wide representation from the technical community (manufacturers, consumers, trade associations, organizations with a general interest, and government representatives). The standards are published by the Acoustical Society of America as American National Standards after approval by their respective Standards Committees and the American National Standards Institute (ANSI).

These standards are developed and published as a public service to provide standards useful to the public, industry, and consumers, and to Federal, State, and local governments.

Each of the Accredited Standards Committees (operating in accordance with procedures approved by ANSI) is responsible for developing, voting upon, and maintaining or revising its own Standards. The ASA Standards Secretariat administers Committee organization and activity and provides liaison between the Accredited Standards Committees and ANSI. After the Standards have been produced and adopted by the Accredited Standards Committees, and approved as American National Standards by ANSI, the ASA Standards Secretariat arranges for their publication and distribution.

An American National Standard implies a consensus of those substantially concerned with its scope and provisions. Consensus is established when, in the judgment of the ANSI Board of Standards Review, substantial agreement has been reached by directly and materially affected interests. Substantial agreement means much more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered and that a concerted effort be made towards their resolution.

The use of an American National Standard is completely voluntary. Their existence does not in any respect preclude anyone, whether he or she has approved the Standards or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the Standards.

NOTICE: This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken periodically to reaffirm, revise, or withdraw this Standard.



Acoustical Society of America
ASA Secretariat
1305 Walt Whitman Road, Suite 300
Melville, New York 11747
Telephone: 1 (631) 390-0215
Fax: 1 631-923-2875
E-mail: asastds@acousticalsociety.org

© 2018 by Acoustical Society of America. This standard may not be reproduced in whole or in part in any form for sale, promotion, or any commercial purpose, or any purpose not falling within the provisions of the U.S. Copyright Act of 1976, without prior written permission of the publisher. For permission, address a request to the Standards Secretariat of the Acoustical Society of America.

Contents

1	Scope, purpose, and applications	1
1.1	Scope	1
1.2	Purpose	1
1.3	Applications	1
2	Normative references	1
3	Terms and definitions	3
4	Requirements for specific types of audiometers	8
4.1	Type and class designation	8
5	General requirements	9
5.1	Electrical safety requirements	9
5.2	Acoustic safety requirements	9
5.3	Power supply variation and environment conditions	9
5.4	Unwanted acoustic signals	11
5.5	Subject response system	13
5.6	Monitor earphone or loudspeaker	13
5.7	Operator and test subject speech communications	13
6	Signal sources	14
6.1	Pure-tone source	14
6.2	Speech source	17
6.3	Masking sounds	19
7	Signal level controls	21
7.1	Marking	21
7.2	Accuracy of sound pressure and vibratory force level for pure-tone and speech	21
7.3	Hearing level control	22
7.4	Masking sound level control	22
7.5	Tone switching	23
8	Reference signal facilities	25
8.1	Frequencies	25
8.2	Reference signal level control	25
9	Transducer calibration (specifications, RETSPLs, and RETFLs)	25
9.1	Air-conduction supra-aural earphones	26
9.2	Air conduction, circumaural earphones	27
9.3	Air conduction, insert earphones	28
9.4	Bone conduction	32
9.5	Sound field produced via loudspeakers	33
10	Device marking and instruction manual	36
10.1	Marking	36
10.2	Instruction manual	36
	Annex A (normative) Correction figures for free-field equivalent output for certain types of commonly used earphones	38
	Annex B (normative) Recordings of speech test material	40

Annex C (normative) Calibration of circumaural earphones for extended high-frequency testing.....	41
C.1 General.....	41
C.2 Calibration	41
C.3 Microphone.....	41
C.4 Adapters for making extended high-frequency measurements on an IEC 60318-1 ear simulator	41
C.5 Coupler configurations using a Type 1 adapter	41
C.6 Coupler configuration using a Type 2 adapter	44
C.7 Environmental conditions	44
C.8 References	44
Annex D (informative) Procedures for transfer of reference equivalent threshold values	45
D.1 General.....	45
D.2 Probe-tube method	45
D.3 Loudness-balance method.....	46
D.4 Threshold-determination method	46
D.5 Standard reference earphone with other-than-specified coupler.....	46
D.6 Standard earphones with other-than-specified cushions.....	47
D.7 Earphone and coupler both different from standard types.....	47
Annex E (informative) Audiogram format	48
E.1 General.....	48
E.2 Reference levels	48
E.3 Vertical scale	48
E.4 Horizontal scale.....	48
E.5 Scale proportions	48
Annex F (informative) Supra-aural cushions for earphones.....	49
Annex G (informative) Requirements for periodic calibration.....	51
G.1 Minimum periodic calibration requirements	51
G.2 Routine checking and subjective tests.....	51
G.3 Equipment needed to perform audiometer calibrations	55
G.4 Calibration of test equipment	55

Tables

Table 1 — Minimum required facilities for specific type and class of audiometers.....	8
Table 2a — Required frequencies and hearing levels for various audiometers	15
Table 2b — Required frequencies and hearing levels for EHF audiometers.....	15
Table 3 — Maximum permissible harmonic distortion, expressed in percent.....	16
Table 4 — Narrowband masking noise: upper and lower cut-off frequencies and correction factors for determining RETSPLs.....	20
Table 5 — Reference equivalent threshold sound pressure levels (RETSPLs) (dB re 20 μ Pa) for supra-aural earphones in common use	27

Table 6 — Reference equivalent threshold sound pressure levels (RETSPLs) (dB re 20μPa) for circumaural earphones.....	28
Table 7a — Reference equivalent threshold sound pressure levels (RETSPLs) (dB re 20μPa) for ER-3A, ER-3C, RadioEar IP30 and EARTone 3A insert earphones	30
Table 7b — Reference equivalent threshold sound pressure levels (RETSPLs) (dB re 20μPa) for ER-2 insert earphones for use at Extended High Frequency	31
Table 8 — Reference equivalent threshold force levels (RETFLs) for bone vibrators.....	33
Table 9a — Reference equivalent threshold sound pressure levels (RETSPLs) (dB re 20 μPa) for binaural listening in a sound field and the ear closest to the loudspeaker	35
Table 9b — Reference equivalent threshold sound pressure levels (RETSPLs) (dB re 20 μPa) for speech signals for binaural listening in a sound field and the ear closest to the loudspeaker (all values were rounded to the nearest 0.5 dB).....	36
Table A.1 — Difference between the free-field equivalent sensitivity level G_F and the coupler or acoustic coupler or ear simulator level G_C for two types of earphones.....	39

Figures

Figure 1 — Rise/fall envelope of test tones.....	24
Figure 2 — Coupling of the insert earphone to the calibration coupler. Figure 2(a) shows an occluded ear simulator (as described in ANSI/ASA S3.25 and IEC 60318-4 (formerly IEC 60711)), see subclause 9.3.1; Figure 2(b) an HA-2 acoustic coupler with rigid tube attachment (as described in ANSI/ASA S3.55/Part 5/IEC 60318-5 MOD), see subclause 9.3.2; and Figure 2(c) an HA-1 acoustic coupler (as described in ANSI/ASA S3.55/Part 5/IEC 60318-5 MOD), see subclause 9.3.3	29
Figure 3 — Loudspeaker angle of incidence for use in a sound field	34
Figure C.1 — Type 1 adapter for use with IEC 60318-1 ear simulator	42
Figure C.2 — Position of Type 1 adapter on the IEC 60318-1 ear simulator.....	42
Figure C.3 — Type 2 adapter for use with IEC 60318-1 ear simulator	43
Figure C.4 — Position of Type 2 adapter on the IEC 60318-1 ear simulator.....	43
Figure F.1 — Earphone supra-aural cushion MX41/AR.....	49
Figure F.2 — Earphone supra-aural cushion Type 51	50

Foreword

[This Foreword is for information only and is not a part of ANSI/ASA S3.6-2018 American National Standard Specification for Audiometers. As such, this Foreword may contain material that has not been subjected to public review or a consensus process. In addition, it does not contain requirements necessary for conformance to the standard.]

This standard comprises a part of a group of definitions, standards, and specifications for use in bioacoustics. It was developed and approved by Accredited Standards Committee S3 Bioacoustics, under its approved operating procedures. Those procedures have been accredited by the American National Standards Institute (ANSI). The Scope of Accredited Standards Committee S3 is as follows:

Standards, specifications, methods of measurement and test, and terminology in the fields of psychological and physiological acoustics, including aspects of general acoustics which pertain to biological safety, tolerance, and comfort.

This standard is a revision of ANSI/ASA S3.6-2010 and replaces all prior revisions of this standard. This 2018 revision has been technically revised to incorporate changes to keep this standard compatible with other equivalent international (IEC and ISO) standards. This standard contains comparable information to current ISO Standards for pure-tone thresholds, bone conduction and sound field.

At the time this Standard was submitted to Accredited Standards Committee S3, Bioacoustics, for approval, the membership was as follows:

W.J. Murphy, *Chair*
VACANT, *Vice-Chair*

Acoustical Society of America	C.J. Struck
.....	P.B. Nelson (Alt.)
American Academy of Audiology	C. Schweitzer
.....	T. Ricketts (Alt.)
American Industrial Hygiene Association	T.K. Madison
.....	D. Driscoll (Alt.)
American Speech-Language-Hearing Association (ASHA)	L.A. Wilber
.....	N. DiSarno (Alt.)
Beltone/GN Resound	S. Petrovic
.....	D.M. Warren (Alt.)
Council for Accreditation in Occupational Hearing Conservation (CAOHC)	B. Charlton
.....	b. Kirchner (Alt.)
Department of Defense – Hearing Center of Excellence	D. Brungart
.....	R. Williams (Alt.)
Diagnostic Group	T. McColley
.....	P. Dobrowski (Alt.)