ASA/ANSI S3.39-1987
(ASA 71-1987)

Reaffirmed by ANSI June 5, 2020

AMERICAN NATIONAL STANDARD

Specifications for Instruments to Measure Aural Acoustic Impedance and Admittance (Aural Acoustic Immittance)

Secretariat:

Acoustical Society of America

Approved on 5 October 1987:

American National Standards Institute, Inc.

Abstract

This standard provides specifications for instruments designed to measure acoustic impedance, acoustic admittance, or both quantities, within the human external ear canal. Terms that apply to these instruments and to related measurements are defined. Four types of instruments are classified. Characteristics, specifications, and recommended calibration procedures then are provided. Material within this standard is intended both for users and for manufacturers of instruments that measure aural acoustic impedance and admittance.

ANSI S3.39-1987
(ASA 71-1987)

Reaffirmed by ANSI
April 22, 2002

Reaffirmed by ANSI
May 18, 2007

Reaffirmed by ANSI
June 15, 2012

Reaffirmed by ANSI June 5, 2020

Standards Secretariat
Acoustical Society of America
335 East 45th Street
New York, New York 10017-3483

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Published for the Acoustical Society of America by the American Institute of Physics

AMERICAN NATIONAL STANDARDS ON ACOUSTICS

The Acoustical Society of America holds the Secretariat for Accredited Standards Committees S1 on Acoustics, S2 on Mechanical Shock and Vibration, S3 on Bioacoustics, and S12 on Noise. Standards developed by those committees, which have wide representation from the technical community (including manufacturers, consumers, and general-interest representatives), are published for the Acoustical Society of America by the American Institute of Physics as American National Standards after approval by their respective standards committees and the American National Standards Institute.

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

This standard was approved by the American National Standards Institute as ANSI S3.39-1987 on 5 October 1987.

An American National Standard implies a consensus of those substantially concerned with its scope and provisions. An American National Standard is intended as a guide to aid the manufacturer, the consumer, and the general public. The existence of an American National Standard does not in any respect preclude anyone, whether he has approved the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard. American National Standards are subject to periodic review and users are cautioned to obtain the latest editions.

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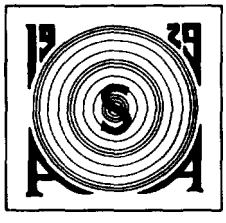
The Acoustical Society of America (ASA) is an organization of scientists and engineers formed in 1929 to increase and diffuse the knowledge of acoustics and to promote its practical applications.

The American National Standards Institute, Inc. (ANSI) is the national coordinator of voluntary standards development and the clearing house in the United States for information on national and international standards.



FOREWORD

[This Foreword is not a part of American National Standard Specifications for Instruments to Measure Aural Acoustic Impedance and Admittance (Aural Acoustic Immittance), S3.39-1987 (ASA Catalog No. 71-1987).]

This standard provides specifications for instruments designed to measure acoustic impedance, acoustic admittance, or both quantities, within the human external ear canal. Terms that apply to these instruments and to related measurements are defined. Four types of instruments are classified. Characteristics, specifications, and recommended calibration procedures then are provided. Material within this standard is intended both for users and for manufacturers of instruments that measure aural acoustic impedance and admittance.

This standard is similar in most respects to an IEC draft document, Aural Impedance/Admittance Instruments, developed by Working Group 14 of IEC Technical Committee No. 29 Electroacoustics, of the International Electrotechnical Commission (IEC/TC 29/WG14).

This standard was developed under the jurisdiction of Accredited Standards Committee S3, Bioacoustics, using the American National Standards Institute (ANSI) Accredited Standards Committee Procedure. The Acoustical Society of America holds the Secretariat for Accredited Standards Committee S3, Bioacoustics.

Accredited Standards Committee S3, Bioacoustics, under whose jurisdiction this standard was developed, has the following scope:

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

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

L. A. Wilber, *Chairman*
H. Silbiger, *Vice-Chairman*
A. Brenig, *Secretary*

Acoustical Society of America ● L. A. Wilber, W. A. Yost (*Alt*)
American Academy of Otolaryngology—Head and Neck Surgery, Inc. ● R. F. Naunton, L. A. Michael (*Alt*)
American Industrial Hygiene Association ● C. D. Bohl, T. D. Bonney (*Alt*)
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American Otological Society, Inc. ● J. Tonndorf
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Compressed Air and Gas Institute ● J. L. Bennett
Exchange Carriers Standards Association ● P. R. Gwodz
Hearing Industries Association ● C. Rogan

Industrial Safety Equipment Association, Inc. • F. Lotito, R. Campbell (*1st Alt*), F. E. Wilcher, Jr. (*2nd Alt*)
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National Electrical Manufacturers Association • E. N. Cellentani
National Hearing Aid Society • W. F. S. Hopmeier
Power Tool Institute, Inc. • J. L. Bennett
U.S. Army Aeromedical Research Laboratory • J. H. Patterson, B. Mozo (*Alt*)
U.S. Army Human Engineering Laboratory • G. Garinther, G. R. Price (*Alt*)
U.S. Army Medical Corps. • R. M. Atack
U.S. Department of the Air Force • H. E. von Gierke, C. Nixon (*Alt*)
U.S. Department of the Navy—Naval Medical Command • (vacant)

Individual experts of the Accredited Standards Committee S3 were:

L. Batchelder	W. J. Galloway	D. Johnson	H. E. von Gierke
R. W. Benson	R. Guernsey	H. Levitt	L. Wilber
K. M. Eldred	J. C. Guignard	S. F. Lybarger	W. Yost
R. S. Gales	K. D. Kryter	W. Melnick	R. W. Young

Working Group S3-60, Measurement of Acoustic Impedance and Admittance of the Ear, which assisted Accredited Standards Committee S3, Bioacoustics, in the development of this standard, has the following membership:

D. J. Lilly, *Chairman*

M. Burkhard	R. F. Sullivan
R. L. Grason	L. A. Wilber
P. B. Madsen	

Suggestions for improvements in this standard will be welcomed. They should be sent to the Standards Manager, Standards Secretariat, Acoustical Society of America, 335 East 45th Street, New York, NY 10017-3483.

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American National Standard Specifications for Instruments to Measure Aural Acoustic Impedance and Admittance (Aural Acoustic Immittance)

1 SCOPE

The instruments covered by this standard are designed primarily for the measurement of acoustic impedance, acoustic admittance, or both quantities, within the human external auditory meatus. The standard is concerned with the parameters and tolerances of instruments used for measurement of aural acoustic impedance and aural acoustic admittance when the probe-tone frequency is 226 Hz. It is not within the scope of this standard to establish normative values for human ears.

Within this standard four types of instruments are classified according to the types of measurements that they can perform and according to their features, tolerances, and ranges.

2 PURPOSE

The purpose of this standard is to ensure that acoustic-impedance or acoustic-admittance measurements will be substantially the same for a given ear when these measurements are obtained with any instruments that meet the specifications and tolerances outlined in this standard, and when comparable test conditions prevail. This standard is not intended to inhibit development, to restrict incorporation of new features (such as probe frequencies other than 226 Hz), or to discourage other improvements that may become useful in the measurement of aural acoustic impedance or acoustic admittance.

3 APPLICATIONS

This standard applies to instruments that are used primarily to measure or to monitor aural acoustic impedance or acoustic admittance within the external auditory meatus.

4 REFERENCES TO OTHER STANDARDS

4.1 American National Standards

When the following American National Standards are superseded by a revision approved by the American National Standards Institute, Inc., the revision shall apply.

(1) American National Standard Acoustical Terminology (Including Mechanical Shock and Vibration), ANSI S1.1-1960 (R 1976).

(2) American National Standard Specification for Audiometers, ANSI S3.6-1969 (R 1986).

(3) American National Standard for Coupler Calibration of Earphones, ANSI S3.7-1979.

(4) American National Standard Letter Symbols and Abbreviations for Quantities Used in Acoustics, ANSI Y10.11-1984.

4.2 Other National Standards

(1) IEEE Standard Pulse Terms and Definitions, ANSI/IEEE Std. 181-1977.

(2) Safe Current Limits for Electromedical Apparatus, ANSI/AAMI SCL 12/78.

5 DEFINITIONS

Traditionally, acoustic-impedance data have been reported with units (cgs) acoustic ohms. The units in this standard, however, conform to the International System of Units (SI). Table 1 provides an outline of some quantities used in this standard, standard symbols, names that traditionally have been used for the units, cgs units, and SI units. For analysis purposes, the impedance-type analogy is used throughout this standard.

5.1 acoustic immittance: refers collectively to acoustic impedance, to acoustic admittance, or to both quantities.

5.2 acoustic impedance: at a given surface, the complex ratio of effective sound pressure averaged over the surface to effective volume velocity through it. The symbol is Z_a and the unit is pascal second per meter to the third power ($Pa \cdot s/m^3$).

5.3 acoustic resistance: the real component of complex acoustic impedance. The symbol is R_a and the unit is pascal second per meter to the third power ($Pa \cdot s/m^3$).