ASA/ANSI S1.20-2012

(Revision of ANSI S1.20-1988 (R2003)
Reaffirmed by ANSI May 28, 2020

AMERICAN NATIONAL STANDARD

Procedures for Calibration of Underwater Electroacoustic Transducers

Secretariat:

Acoustical Society of America

Approved on February 17, 2012:

American National Standards Institute, Inc.

Abstract

This standard establishes measurement procedures for calibrating underwater electroacoustic transducers. It is a revision of American National Standard S1.20-1988 (R2003). Both primary and secondary calibration procedures are specified for frequencies from a few hertz to a few megahertz. Procedures are specified for determining the measurable characteristics of free-field receive voltage sensitivity, transmitting response, directional response, voltage coupling loss, impedance, and equivalent noise pressure. Measurement uncertainty analysis is introduced for these measurement types, with identification of common error sources. Equations are given for the following derived characteristics: beam pattern, directivity factor and index, equivalent two-way beam width, acoustic power output and level, electrical power input, transmitting efficiency, open-circuit effective bandwidth, and quality factor. Annexes have been included to address: A) free-field calibration in a laboratory tank, B) medium correction factors, C) measurement of sensitivity and response—infrasonic and low audio-frequency range, D) phase of free-field voltage sensitivity via reciprocity method, E) nonlinear effects including cavitation, and F) standard-target method for calibrating active sonars.

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Procedures for Calibration of Underwater Electroacoustic Transducers

ANSI/ASA S1.20-2012

Accredited Standards Committee S1, Acoustics

Standards Secretariat
Acoustical Society of America
35 Pinelawn Road, Suite 114 E
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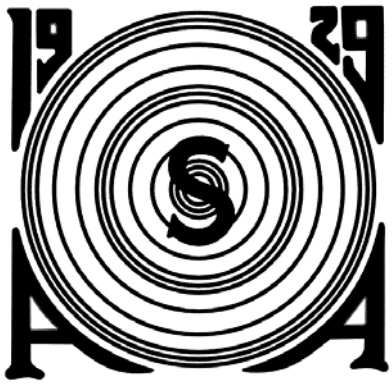

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Foreword

[*This Foreword is for information only and is not a part of ANSI/ASA S1.20-2012 American National Standard Procedures for Calibration of Underwater Electroacoustic Transducers*.]

This standard comprises a part of a group of definitions, standards, and specifications for use in acoustics. It was developed and approved by Accredited Standards Committee S1 Acoustics, under its approved operating procedures. Those procedures have been accredited by the American National Standards Institute (ANSI). The Scope of Accredited Standards Committee S1 is as follows:

> *Standards, specifications, methods of measurement and test, and terminology in the field of physical acoustics, including architectural acoustics, electroacoustics, sonics and ultrasonics, and underwater sound, but excluding those aspects which pertain to biological safety, tolerances, and comfort.*

This standard establishes measurement procedures for calibrating underwater electroacoustic transducers and describes forms for presenting and assessing the resultant data. Both primary and secondary calibration procedures are specified for the frequency range from a few hertz to a few megahertz.

This standard is not comparable to any existing ISO Standard.

This standard includes six Informative Annexes.

At the time this Standard was submitted to Accredited Standards Committee S1, Acoustics, for approval, the membership was as follows:

P. Battenberg, *Chair*
R.J. Peppin, *Vice-Chair*

S.B. Blaeser, *Secretary*

Acoustical Society of America ..... A.H. Marsh
..... P.D. Schomer (Alt.)

Air-Conditioning, Heating and Refrigeration Institute ..... S.J. Lind
..... D. Abbate (Alt.)

American Industrial Hygiene Association ..... D. Driscoll
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Individual Experts of Accredited Standards Committee S1, Acoustics

S.L. Ehrlich
K.M. Eldred
W.W. Lang
A.H. Marsh
P.D. Schomer
J.P. Seiler
L. Wu

Working Group S1/WG 9, Calibration of Underwater Electroacoustic Transducers, which assisted Accredited Standards Committee S1, Acoustics, in the development of this standard, had the following membership.

R.M. Drake, Chair

K.G. Foote
S.E. Forsythe
R.M. Logan
J.A. Meyers
S.P. Robinson
P.D. Theobald

Suggestions for improvements of this standard will be welcomed. They should be sent to Accredited Standards Committee S1, Acoustics, in care of the Standards Secretariat of the Acoustical Society of America, 35 Pinelawn Road, Suite 114E, Melville, New York 11747-3177. Telephone: 631-390-0215; FAX: 631-390-0217; E-mail: asastds@aip.org.

American National Standard

Procedures for Calibration of Underwater Electroacoustic Transducers

1 Scope

This standard establishes measurement procedures for calibrating underwater electroacoustic transducers and describes forms for presenting and assessing the resultant data. It is a revision of American National Standard S1.20-1988 (R 2003).

2 Normative references

ANSI S1.1-1994 (R 2004) *American National Standard Acoustical Terminology*

ANSI/ASA S1.8-1989 (R 2011) *American National Standard Reference Quantities for Acoustical Levels*

3 Terminology

For the purposes of this standard, the terms and definitions given in ANSI S1.1-1994 (R 2004) apply, except where otherwise specifically re-defined herein.

4 Letter symbols

Letter symbols used in this standard comply with those given in ANSI/IEEE Std 260.4-1996 A*merican National Standard Letter Symbols and Abbreviations for Quantities Used in Acoustics* (revision and redesignation of ANSI Y10.11-1984), ISO 80000 *Quantities and Units*, ANSI S1.1-1994 (R 2004) A*merican National Standard Acoustical Terminology*, and ANSI/ASA S1.8-1989 (R 2011) A*merican National Standard Reference Quantities for Acoustical Levels*. Additional letter symbols, when utilized, are defined within this standard.

5 Applications

5.1 Application statement

Primary and secondary calibration procedures are specified for the frequencies from a few hertz to a few megahertz.

5.2 Measurement types

Procedures are specified for determining the measurable characteristics of free-field sensitivity (more specifically identified as “free-field voltage sensitivity,” a receive voltage measurement), transmitting current response, transmitting voltage response, directional response, voltage coupling loss, impedance, and equivalent noise pressure.

5.3 Transmit and acoustic boundary considerations

Transmit drive conditions and acoustic boundaries can significantly affect the quality of acoustic transmit signal measurements and therefore the quality of the computed measurement parameters. Care should always be taken to work within device-specific operating ranges and under known acoustic conditions.