ANSI S12.5-1990
(ASA 87-1990)
[Revision of ANSI S12.5-1985]

AMERICAN NATIONAL STANDARD

REQUIREMENTS FOR THE PERFORMANCE AND CALIBRATION OF REFERENCE SOUND SOURCES

Accredited Standards Committee S12, Noise

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

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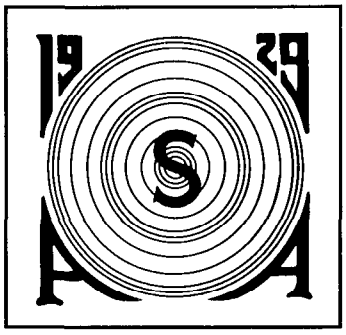

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AMERICAN NATIONAL STANDARD
Requirements for the Performance and Calibration of Reference Sound Sources

ACCREDITED STANDARDS COMMITTEE S12, NOISE

ABSTRACT

This standard contains performance requirements for reference sound sources that are to be used in conjunction with measurements of the noise emission of machinery or for certain other types of acoustical measurements The standard also contains information on procedures to be followed in calibrating a reference sound source to determine the sound power that it emits into a free field above a reflecting plane

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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

This standard was approved by the American National Standards Institute as ANSI S12.5-1990 on 2 August 1990.

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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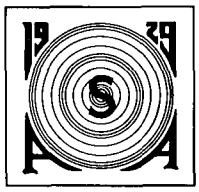

Published by the Acoustical Society of America through the American Institute of Physics

FOREWORD

[This Foreword is not a part of American National Standard Requirements for the Performance and Calibration of Reference Sound Sources, ANSI S12 5-1990 (ASA Catalog No 87-1990)]

This standard was developed under the jurisdiction of Accredited Standards Committee S12, Noise, using the American National Standards Institute (ANSI) Standards Committee Procedure. This standard was approved for publication by Accredited Standards Committee S12 and by the American National Standards Institute.

This standard has been editorially revised to include references to the series of sound power standards, which have been editorially revised and redesignated as S12 Standards (formerly designated as S1 standards)

Accredited Standards Committee S12, Noise, under whose jurisdiction this standard was developed, has the following scope.

> Standards, specifications, and terminology in the field of acoustical noise pertaining to methods of measurement, evaluation and control; including biological safety, tolerance, and comfort and physical acoustics as related to environmental and occupational noise

This standard is the counterpart of Draft International Standard ISO/DIS 6926; Acoustics—Determination of Sound Power Levels of Noise Sources—Characterization and Calibration of Reference Sound Sources, which was developed under the auspices of Technical Committee 43/Subcommittee 1 of the International Organization for Standardization (ISO/TC43/SC1).

This standard is complementary to a series of six standards specifying various methods for determining the sound power levels of machines and equipment. Taken together, the six standards specify the acoustical requirements for measurements appropriate for different test environments as shown in the table on p. iv.

At the time this standard was submitted to Accredited Standards Committee S12, Noise, for final approval, the membership was as follows:

W. Melnick, *Chairman*
R. K. Hillquist, *Vice-Chairman*
A Brenig, *Secretary*

Acoustical Society of America ● W Melnick, W Hillquist (*Alt*)
Acoustical Systems, Inc. ● R Goodwin, R Seitz (*Alt*)
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Audio Engineering Society ● M R Chial
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Compressed Air and Gas Institute ● J H Addington

American National Standards and International Standards specifying various methods for determining the sound power levels of machines and equipment.

American National Standard	International Standard	Classification of method	Test environment	Size of source	Character of noise	Sound power levels obtainable	Optional information obtainable
S12.31 (revision of S1.31-1980)	**ISO 3741**	Precision (Grade 1)	Reverberation room meeting specified requirements	Volume of source preferably less than 1% of test room volume	Steady, broad-band	In one-third octave or octave bands	A-weighted sound power level
S12.32 (revision of S1.32-1980)	**ISO 3742**				Steady, discrete-frequency or narrow-band		
S12.33 (revision of S1.33-1982)	**ISO 3743**	Engineering (Grade 2)	Special reverberant test room		Steady, broad-band narrow-band, discrete-frequency	A-weighted and in octave bands	Other weighted sound power levels
S12.34 (revision of S1.34-1980)	**ISO 3744**	Engineering (Grade 2)	Outdoors or in large room	Greatest linear dimension less than 15 m; otherwise limited only by available test environment	Any	A-weighted and in one-third octave or octave bands	Directivity information and sound pressure levels as a function of time; other weighted sound power levels
S12.35 (revision of S1.35-1979)	**ISO 3745**	Precision (Grade 1)	Anechoic or hemi-anechoic room	Volume of source preferably less than 0.5% of test room volume	Any		
S12.36 (revision of S1.36-1979)	**ISO 3746**	Survey (Grade 3)	No special test environment	No restrictions; limited only by available test environment	Steady, broad-band narrow-band, discrete-frequency	A-weighted	Sound pressure levels as a function of time; other weighted sound power levels
---	**ISO 3747**	Survey (Grade 3)	No special test environment	No restrictions	Steady, broad-band narrow-band, discrete-frequency	A-weighted	Sound power levels in octave bands

Computer and Business Equipment Manufacturers Association ● L F Luttrell
Edison Electronic Institute ● (Vacant), M C Mingoia (*Alt*)
Fastener Industry Noise Control Research Program ● E H Toothman, J C McMurray (*Alt*)
Federal Aviation Administration ● R N Tedrick
Larson-Davis Laboratories ● D Johnson, L Davis (*Alt*)
National Council of Acoustical Consultants ● J Erdreich, R L Richards (*Alt*)
National Institute of Standards and Technology ● D R Flynn, D J Evans (*Alt*)
National Electrical Manufacturers Association ● D Rawlings
David Taylor Research Center ● D Vendittis
Power Tool Institute ● R Callahan
Scantek, Inc. ● R J Peppin
U.S. Army Aeromedical Research Lab. ● R Mozo, J H Patterson (*Alt*)
U.S. Army Human Engineering Laboratory ● G R Price, J Kalb (*Alt*)
U.S. Department of the Army, Walter Reed Medical Center ● R M Atack
U.S. Air Force ● R McKinley
U.S. Army Construction Engineering Research Laboratory ● P D Schomer, M White (*Alt*)
U.S. Department of the Navy, Naval Medical Command ● J Page, L Marshall (*Alt*)

Individual Experts of the Accredited Standards Committee S12, Noise were:

P K Baade	K M Eldred	G C Maling
R G Bartheld	R S Gales	A H Marsh
L Batchelder	W J Galloway	L Wilber
R W Benson	R Guernsey	G Winzer
L Beranek	W W Lang	R W Young

Working group S12/WG 23 on Determination of Sound Power, which has cognizance of the subject matter in this standard, had the following membership.

P K Baade, *Chair*

R G Bartheld	G C Maling, Jr
G Diehl	J Malosh
D R Flynn	A H Marsh
R K Hillquist	R J Peppin

Suggestions for improvements in this standard will be welcomed They should be sent to Accredited Standards Committee S12 at the Standards Secretariat, in care of the **Acoustical Society of America, 335 East 45th Street, New York, New York 10017-3483. Telephone (212) 661-9404.**

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TABLE

American National Standard Requirements for the Performance and Calibration of Reference Sound Sources

0 INTRODUCTION

Reference sound sources are used extensively in "comparison methods" for determination of the noise emission from stationary sound sources. A reference sound source, of known sound power output, is used to establish the numerical relationship between the sound power level of a source, in a given location in a given acoustical environment, and the space- and time-average sound pressure level at a set of microphone positions. Once that relationship is established, it is straightforward to measure the average sound pressure level produced by an "unknown source" and to compute the sound power level produced by that source.

This standard defines key performance characteristics of reference sound source and specifies procedures for their calibration.

This standard supplements a series of six American National Standards that specify various methods for determining the sound power levels of machines and equipment, ANSI S12.31-1990–S12.36-1990. Those standards specify only the acoustical requirements for measurements appropriate for different test environments. Five of these six American National Standards, S12.31-1990, S12.32-1990, S12.33-1990, S12.34-1988, and S12.36-1990 include procedures in which a reference sound source is utilized. An additional standard S12.30-1990, contains guidelines for the use of this series.

NOTE: In addition to being useful for determining sound power levels, reference sound sources may be used to characterize an acoustical environment (for example, as to absorption characteristics) and to estimate the influence of an acoustical environment on the sound pressure levels produced by one or more noise sources located in that environment.

1 SCOPE AND PURPOSE

1.1 This standard specifies the essential acoustical performance requirements of reference sound sources.

1.2 This standard specifies procedures for calibrating any sound source intended for use as a reference sound source for determination of one-third octave-band, octave-band, and A-weighted sound power levels.

1.3 In order to achieve uniform and accurate results, this standard requires that calibration be performed in an acoustical environment providing an acoustic free field over a reflecting plane; i.e., in a hemi-anechoic environment.

1.4 This standard specifies the significant details of the procedures necessary to achieve the estimated calibration uncertainty given in Table I.

2 MEASUREMENT UNCERTAINTY

Calibration of a reference sound source, when carried out in conformity with the requirements of this standard, is expressed in terms of the sound power levels produced by the source while it is radiating into an acoustic free field above a reflecting plane. Determinations of the sound power levels of a reference sound source will result, with very few exceptions, in standard deviations which are equal to or less than those given in Table I. The standard deviations of Table I take into account the cumulative effects of all causes of measurement uncertainty. The A-weighted sound power level is determined with an estimated standard deviation of 1 dB.

TABLE I. Estimated standard deviation of sound power level calibrations of reference sound sources in hemi-anechoic rooms.

Octave band center frequency, hertz	One-third octave-band center frequency, hertz	Standard deviation of mean values, decibel
125	100 to 160	1 0
250 to 4000	200 to 4000	0 5
8000	5000 to 10 000	1 0

NOTES:

(1) The standard deviations listed in Table I are measures of the uncertainties associated with the test methods defined in this standard If a reference sound source were transported to each of a large number of laboratories and, if, at each laboratory, the sound power level of that source were measured in accordance with the provisions of this standard, the standard deviation, as a function of frequency, of the many sound power level determinations could be calculated. It is these standard deviations which have been estimated and listed in Table I.

(2) The above uncertainties apply only to the particular sound source that is calibrated Calibration of one reference sound source shall not be assumed to apply to another reference sound source of the same design unless statistical data are available to specify the additional uncertainty introduced by product variability