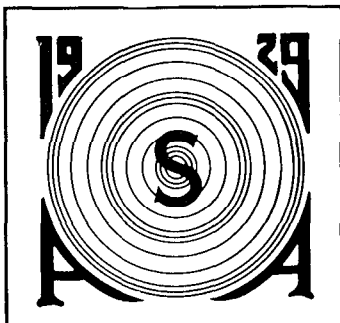


ANSI S12.9-1988
(ASA 76-1988)



MAR 02 1993

AMERICAN NATIONAL STANDARD
**QUANTITIES AND PROCEDURES
FOR DESCRIPTION AND MEASURE-
MENT OF ENVIRONMENTAL SOUND.
PART 1**



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

ACOUSTICAL SOCIETY OF AMERICA

Standards

ASA STANDARDS PUBLICATION PROGRAM

The Standards Program of the Acoustical Society of America is the responsibility of ASA's Committee on Standards (ASACOS) and is executed by the ASA's Standards Secretariat, headed by its Standards Manager. The ASA's Committee on Standards, in its responsibility for the overall Standards Publishing Program of the Acoustical Society, has appointed a Steering Committee in charge of Publishing and Planning. The Standards Manager, with the advice of the Standards Director and the Steering Committee of ASACOS, is charged with execution of the Standards Publishing Program. The ASACOS Steering Committee is constituted as follows:

A. Brenig, *Standards Manager* D. L. Johnson, *Chairman, S1* L. A. Wilber, *Chairman, S3*
K. M. Eldred, *Chairman, ASACOS* S. I. Hayek, *Chairman, S2* W. Melnick, *Chairman, S12*
H. E. von Gierke, *Vice Chairman, ASACOS*

MEMBERSHIP OF THE ASA COMMITTEE ON STANDARDS

Executive Committee

K. M. Eldred, *Chairman and Standards Director*
Ken Eldred Engineering
P. O. Box 1037
Concord, Massachusetts 01742

H. E. von Gierke, *Vice Chairman*
Director, Biodynamics &
Bioengineering Div
AAMRL/BB
Wright-Patterson AFB
Ohio 45433-6873

A. Brenig, *Standards Manager*
Acoustical Society of America
Standards Secretariat
335 E. 45th Street
New York, New York 10017-3483

Representation S1, Acoustics

D. L. Johnson, *Chairman, S1*
E. H. Toothman, *Vice Chairman, S1*
T. F. W. Embleton, *ASA Representative S1*

Representation S2, Mechanical Shock and Vibration

S. I. Hayek, *Chairman, S2*
R. M. Serbyn, *Vice Chairman, S2*

Representation S3, Bioacoustics

L. A. Wilber, *Chairman, S3*
J. L. Fletcher, *Vice Chairman, S3*
W. A. Yost, *ASA Alternate Representative, S3*

Representation S12, Noise

W. Melnick, *Chairman, S12*
R. K. Hillquist, *Vice Chairman, S12*

Technical Committee

Representation

L. W. Sepsmeier, *Architectural Acoustics*
J. Erdreich, *Bioresponse to Vibration*
G. S. K. Wong, *Engineering Acoustics*
J. B. Allen, *Musical Acoustics*
E. H. Berger, *Noise*
J. Reid, *Physical Acoustics*
C. Wier, *Physiological and Psychological Acoustics*
H. R. Silbiger, *Speech Communication*
H. Himelblau, *Structural Acoustics and Vibration*
S. Wolf, *Underwater Acoustics*

Ex Officio Members of ASACOS (nonvoting)

A. Brenig, *ASA representative to the Acoustical Standards Board (ASB) of the American National Standards Institute (ANSI)*
E. Ungar, *Chairman, ASA Technical Council*
W. Melnick, *Past Chairman ASACOS*
R. T. Beyer, *ASA Treasurer*

U. S. Technical Advisory Group (TAG) Chairs for International Technical Committees (nonvoting)

H. E. von Gierke, *Chairman, U. S. TAG, ISO/TC 43 Acoustics*
V. Nedzelnitsky, *Chairman, U. S. TAG, IEC/TC 29 Electroacoustics*
D. Muster, *Chairman, U. S. TAG, ISO/TC 108 Mechanical Shock and Vibration*
P. D. Edmonds, *Chairman, U. S. TAG, IEC/TC 87 Ultrasonics*

Editorial Staff at AIP

R. Nissim, *Managing Editor* C. Nedohon, *Chief Copy Editor* I. Gallina, *Chief Technical Keyboarder*

**ANSI S12.9-1988
(ASA 76-1988)**

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

**AMERICAN NATIONAL STANDARD
Quantities and Procedures for Description
and Measurement of Environmental Sound. Part 1**

ABSTRACT

This standard provides basic quantities for description of sound in community environments and general procedures for measurement of these quantities. Based on these quantities and procedures, compliance limits of sound may be specified by cognizant authorities and conformance with the limits controlled for purposes of environmental assessment, regulation, and land use planning.

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 these committees, which have wide representation from the technical community (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 the Federal, State, and local governments.

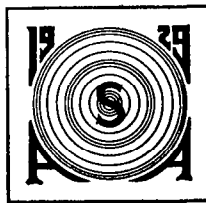
This standard was approved by the American National Standards Institute as ANSI S12.9-1988, Part 1, on 8 March 1988.

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.

Caution Notice: An American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken to reaffirm, revise, or withdraw this standard no later than five years from the date of publication.

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 U.S. for information on national and international standards.



Copyright © 1988 by the Acoustical Society of America. No portion of this publication may be quoted or reproduced in any form without permission of the Acoustical Society of America.

Any request to reproduce this standard in whole or in part should be addressed to the Standards Secretariat, Acoustical Society of America, 335 East 45th Street, New York, New York 10017-3483.

FOREWORD

[This Foreword is not a part of American National Standard Quantities and Procedures for Description and Measurement of Environmental Sound Part 1, ANSI S12.9-1988, Part 1 (ASA Catalog No. 76-1988)]

This standard is the American National version of a corresponding International Standard, ISO 1996 (1982) Part 1, with appropriate modifications to conform to American procedures and practice. This standard provides basic quantities and general procedures for the description and measurement of environmental sound in a community.

This standard was developed under the jurisdiction of Accredited Standards Committee S12, Noise, using the American National Standards Institute (ANSI) Accredited Standards Committee Procedures. The Acoustical Society of America holds the Secretariat for Accredited Standards Committee S12, Noise.

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

Standards, specifications, methods of measurement and test, and terminology in the fields of physical acoustics, including architectural acoustics, electroacoustics, sonics and ultrasonics, and underwater sound, but excluding those aspects which pertain to safety, tolerance, and comfort

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, R. K. Hillquist (*A/I*)
Air-Conditioning and Refrigeration Institute ● R. Harold, H. C. Skarbek (*A/I*)
Aluminum Association ● S. I. Roth
American Academy of Otolaryngology—Head & Neck Surgery, Inc. ● R. F. Naunton, L. A. Michael (*A/I*)
American Industrial Hygiene Association ● C. D. Bohl
American Occupational Medical Association ● T. R. Hatfield, J. Sataloff (*A/I*)
American Otological Society, Inc. ● J. Tonndorf
American Society of Heating, Refrigerating & Air-Conditioning Engineers (ASHRAE) ● H. S. Pei, G. F. Hohn (*A/I*)
American Speech-Language-Hearing Association ● S. J. Barry, V. W. Byers (*A/I*)
American Welding Society ● M. E. Kennebeck (*A/I*)
Audio Engineering Society, Inc. ● M. R. Chial
Bruel & Kjaer Instruments, Inc. ● G. C. Michel (*A/I*)
Compressed Air and Gas Institute (CAGI) ● J. H. Addington
Computer & Business Equipment Manufacturers Association ● L. F. Luttrell
Electric Light & Power Group ● C. E. Hickman, M. C. Mingoa (*A/I*)
Fastener Industry Noise Control Research Program ● E. H. Toothman, J. C. McMurray (*A/I*)
Federal Aviation Administration ● R. Tedrick
Larson-Davis Laboratories ● D. Johnson, L. Davis (*A/I*)
Motor Vehicle Manufacturers Association ● D. B. Smith, T. J. Slavin (*A/I*)
National Bureau of Standards ● S. L. Yaniv, D. R. Flynn (*A/I*)

FOREWORD

National Council of Acoustical Consultants ● J Erdreich, R L Richards (*Alt*)
National Electrical Manufacturers Association ● W L Billington
Naval Ship Research & Development Center ● (Vacant)
Power Tool Institute, Inc. ● J L Bennett
Scantek, Inc. ● R J Peppin
U.S. Army Aeromedical Research Laboratory ● B Mozo, J H Patterson (*Alt*)
U.S. Army Human Engineering Laboratory ● R Price, J Kalb (*Alt*)
U.S. Army Medical Corps ● R M Atack
U.S. Department of the Air Force ● H E von Gierke
U.S. Department of the Army, Environmental Office ● P D Schomer, R Raspet (*Alt*)
U.S. Department of the Navy, Naval Medical Command ● J Page

Individual experts of Accredited Standards Committee S12, Noise, were:

P K Baade	R S Gales	G C Maling, Jr
R G Bartheld	W J Galloway	A H Marsh
L Batchelder	E E Gross, Jr	W Melnick
R W Benson	R Guernsey	J Wesler
R D Bruce	R K Hillquist	G Winzer
K M Eldred	W W Lang	R W Young
S Feldman		

Working Group S12-15, Measurement and Evaluation of Outdoor Community Noise, which assisted Accredited Standards Committee S12, Noise, in the development of this standard, had the following membership:

P D Schomer, *Chairman*

C D Bohl	W J Galloway	S J Newman
W Bowlby	F M Kessler	R J Peppin
A J Campanella	N D Lewis	L C Sutherland
J J Earshen	A H Marsh	J E Wesler

Suggestion 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.

CONTENTS

0 INTRODUCTION	1
1 PURPOSE	1
2 SCOPE	1
3 APPLICATIONS	1
4 REFERENCES	1
4.1 American National Standards	1
4.2 International Standards	1
4.3 American Society for Testing and Materials	2
5 DEFINITIONS, NOMENCLATURE, AND MATHEMATICAL DESCRIPTIONS	2
5.0 Preface	2
5.1 Definitions	2
5.2 Nomenclature	4
5.3 Mathematical Descriptions	5
6 INSTRUMENTS AND CALIBRATION	6
6.1 General	6
6.2 Calibration	7
7 MEASUREMENTS	7
7.1 General	7
7.2 Measurement Positions	7
7.3 Meteorological Conditions	8
7.4 Measurement of Time-average Sound Level or Sound Exposure	8
7.5 Adjustment	8
8 INFORMATION TO BE RECORDED	8
8.1 General Information	8
8.2 Specific Temporal, Terrain, and Atmospheric Conditions Prevailing during the Measurements	8
APPENDIX: SOME QUANTITIES USED FOR VARIOUS NOISE ASSESSMENT PURPOSES	9
TABLES	
TABLE 1 Quantity symbols and unity symbols	5

American National Standard

Quantities and Procedures for Description and Measurement of Environmental Sound. Part 1

0 INTRODUCTION

This standard describes basic quantities and general procedures for assessment of sound with respect to community response. Research on the ways in which people and communities are affected by common everyday noises in the environment has led to a variety of measures for assessment of different types of noise. The variety of measures has introduced some confusion about the relationship among the measures and their applicability for specific purposes. This standard defines consistent measures for physical quantities that may be used to measure and assess environmental sound.

Time-average A-weighted sound level is adopted in this standard as a basic quantity for all community sound except high-energy impulsive sound: See ANSI S3.23-1980. A C-weighted sound exposure level is used to describe high-energy impulsive sounds such as blasts or sonic booms. The Appendix provides information concerning some of the basic quantities that have been used to describe certain environmental sounds.

1 PURPOSE

The purpose of this standard is to provide basic quantities and procedures for the description and measurement of sound in community environments. The information in this document supplements the basic information contained in the American National Standards listed as references.

2 SCOPE

This standard defines the basic quantities that can be used separately or in combination for the description of community sound and describes basic procedures for measurement of the quantities. The scope of this standard encompasses all types of environmental sounds, separately or in combination, that contribute to the total sound at a site.

This standard does not specify limits for environmental sounds or recommend measurement locations or durations.

3 APPLICATIONS

This standard is applicable to the description and measurement of community sound for purposes of land use planning, environmental assessment, and noise control. Based on the principles described in this standard, compliance limits of sound may be specified by cognizant authorities and conformance with these limits controlled for purposes of environmental assessment and regulation and land use planning.

4 REFERENCES

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.

American National Standard Sound Level Descriptors for Determination of Compatible Land Use, ANSI S3.23-1980 (R 1986).

American National Standard Methods for the Measurement of Sound Pressure Levels, ANSI S1.13-1971 (R1976).

American National Standard Specification for Sound Level Meters, ANSI S1.4A-1985.

American National Standard Methods for the Measurement of Impulse Noise, ANSI S12.7-1986.

American National Standard Method for Assessment of High-Energy Impulsive Sound with Respect to Residential Communities, ANSI S12.4-1986.

American National Standard Specification for Acoustical Calibrators, ANSI S1.40-1984.

American National Standard Guidelines for the Preparation of Standard Procedures to Determine the Noise Emission from Sources, ANSI S12.1-1983.

4.2 International Standards

When the following International Standards are superseded by an approved revision, the revision shall apply.

Acoustics—Description and Measurement of Environmental Noise—Part 1: Basic Quantities and Procedures, ISO 1996(1982).