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AMERICAN NATIONAL STANDARD

Impulse Sound Propagation for Environmental Noise Assessment

Secretariat:

Acoustical Society of America

Approved on 8 August 1996:

American National Standards Institute, Inc.

Abstract

This Standard describes engineering methods to calculate the propagation of high-energy impulsive sounds through the atmosphere for purposes of assessment of environmental noise. The methods yield estimates for the mean C-weighted sound exposure level of impulsive sound at distances between the source and receiver ranging from 1 to 30 km. Equations to estimate the standard deviation about the mean C-weighted sound exposure levels are provided. The methods apply for explosive masses between 50 g and 1000 kg.

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AMERICAN NATIONAL STANDARD

IMPULSE SOUND PROPAGATION FOR ENVIRONMENTAL NOISE ASSESSMENT

ANSI S12.17-1996

Accredited Standards Committee S12, Noise

Standards Secretariat
Acoustical Society of America
120 Wall Street, 32nd Floor
New York, New York 10005-3993

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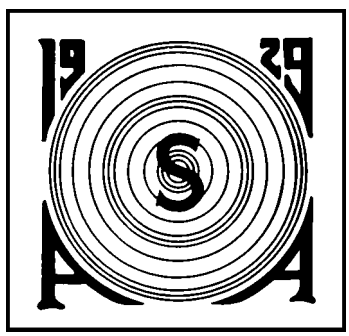

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ABSTRACT

This Standard describes engineering methods to calculate the propagation of high-energy impulsive sounds through the atmosphere for purposes of assessment of environmental noise. The methods yield estimates for the mean *C*-weighted sound exposure level of impulsive sound at distances between the source and receiver ranging from 1 to 30 km. Equations to estimate the standard deviation about the mean *C*-weighted sound exposure levels are provided. The methods apply for explosive masses between 50 g and 1000 kg.

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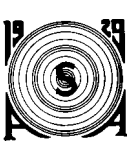

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Contents

Foreword

[This Foreword is not part of ANSI S12.17-1997 *American National Standard Impulse Sound Propagation for Environmental Noise Assessment*.]

This standard contains three informative annexes.

This standard was developed under the jurisdiction of Accredited Standards Committee S12, Noise, which has the following scope:

> *Standards, specifications, and terminology in the field of acoustic 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.*

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

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P. D. Schomer, *Vice Chair*
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U. S. Department of Transportation	A. G. Konheim

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

P. K. Baade	R. M. Guernsey	P. D. Schomer
R. G. Bartheld	R. K. Hillquist	W. R. Thornton
R. W. Benson	D. L. Johnson	D. J. Vendittis
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W. J. Galloway	L. H. Royster	

Working Group S12/WG22, Impulsive Sound Propagation for Environmental Noise Assessment, which assisted Accredited Standards Committee S12, Noise, in the development of this standard, had the following membership:

N. D. Lewis, *Chair*

G. R. Coonan	R. Raspet	J. W. Reed	M. J. White

Suggestions for improvement of this standard will be welcomed. Send suggestions for improvement to Accredited Standards Committee S12, Noise, in care of the ASA Standards Secretariat, 120 Wall Street, 32nd Floor, New York, NY 10005-3993, USA. Telephone: 1 (212) 248-0373; FAX: 1 (212) 248-0146.

American National Standard

Impulse Sound Propagation for Environmental Noise Assessment

1 Scope

This standard describes engineering methods that may be used to calculate the *C*-weighted sound exposure level of blast or high-energy impulsive sounds at distances ranging from 1 to 30 km from the source. Sources of high-energy impulsive sounds include blasting at mines or quarries, guns, military weapons, and other explosive devices that utilize non-nuclear explosives with a total explosive mass between 50 g and 1000 kg. The engineering methods described in this Standard may be used in environmental assessments to supplement the information determined by application of the procedures in Part 4 of ANSI S12.9-1997. For explosive masses greater than 1000 kg, the procedures in ANSI S2.20-1983 (R 1989) should be used to estimate the peak sound pressure level at a receiver location.

2 Normative references

The following Standards contain provisions which, through reference in this text, constitute provisions of this American National Standard. At the time of approval by the American National Standards Institute, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this American National Standard are encouraged to investigate the possibility of applying the most recent editions of the Standards listed below.

(1) **ANSI S1.1-1994**, *Acoustical Terminology.*

(2) **ANSI S2.20-1983 (R 1989),** *American National Standard Estimating Airblast Characteristics for Single Point Explosions in Air. With a Guide to Evaluation of Atmospheric Propagation and Effects.*

(3) **ANSI S12.9-1988 (R 1993): Part 1,** *American National Standard Quantities and Procedures for Description and Measurement of Environmental Sound—Part 1.*

(4) **ANSI S12.9-1997: Part 4,** *American National Standard Quantities and Procedures for Description and Measurement of Environmental Sound—Part 4: Assessments Methods.*

(5) I**SO 9613-2: 1995,** *Acoustics—Attenuation of Sound During Propagation Outdoors—Part 2: General Method of Calculation.*

3 Definitions

Definitions for quantities used in this Standard are given in ANSI S1.1-1994 or S12.9-1988. Additional quantities are defined below.

3.1 Scaled distance

Parameter used by the mining industry and equal to the source-to-receiver distance divided by the cube root of the mass of the explosive material, $S = d/m^{1/3}$, with distance d in kilometers and explosive mass m in kilograms. Unit, kilometers per cube root of kilograms, $m/(kg)^{1/3}$. Unit symbol, S.

3.2 TNT equivalent

Parameter to relate the sound exposure from different types of explosives to that of an explosive of TNT. The TNT equivalent of an explosive is equal to the explosive mass in kilograms times its efficiency. Explosive efficiencies are listed in ANSI S2.20-1983 (R 1989).

4 Engineering methods

4.1 General method for calculating mean values of *C*-weighted sound exposure levels of high-energy impulsive sounds

The mean *C*-weighted sound exposure level, in decibels, at a receiver location caused by an impulsive sound at a known source location and with known explosive mass shall be calculated from the following expression:

$$L_{CE} = 102.3 - 31.7 \lg(d/1) + C, \qquad (1)$$

where

L_{CE} = *C*-weighted sound exposure level in decibels relative to the reference sound exposure of $(20\ \mu Pa)^2 s$;