

ANSI/ASA S12.9-2007 / Part 5

(Revision of ANSI S12.9-1998/Part 5)

Reaffirmed by ANSI
June 19, 2020

Reaffirmed by ANSI
September 29, 2017

Reaffirmed by ANSI
September 5, 2012

AMERICAN NATIONAL STANDARD

Quantities and Procedures for Description and Measurement of Environmental Sound – Part 5: Sound Level Descriptors for Determination of Compatible Land Use

ANSI/ASA S12.9-2007/Part 5

Accredited Standards Committee S12, Noise

Standards Secretariat
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**Quantities and Procedures for
Description and Measurement
of Environmental Sound —
Part 5: Sound Level Descriptors for
Determination of Compatible Land Use**

Secretariat:

Acoustical Society of America

Approved November 14, 2007:

American National Standards Institute, Inc.

Abstract

This Standard provides guidance on the compatibility of various human uses of land with the acoustical environment. This Standard uses the annual average of the total day-night adjusted sound exposure or the annual average of the adjusted day-night average sound level to characterize the acoustical environment. The annual average of the total day-night adjusted sound exposure and annual average of the adjusted day-night average sound level are explained in Part 4 of ANSI S12.9. An informative annex provides guidance for designation of land uses compatible with existing or predicted annual averages of the total day-night adjusted sound exposure or annual average of the adjusted day-night average sound level. Ranges of the annual average of the total day-night adjusted sound exposure or annual average of the adjusted day-night average sound level are outlined within which a specific region of compatibility may be drawn. These ranges take into consideration the transmission loss in sound level from outside to inside buildings as commonly constructed in that locality and living habits there.

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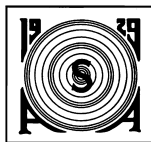
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Foreword

[This foreword is for information only and is not an integral part of ANSI/ASA S12.9-2007 / Part 5 American National Standard Quantities and Procedures for Description and Measurement of Environmental Sound — Part 5: Sound Level Descriptors for Determination of Compatible Land Use.]

This American National Standard supplements the other five Parts of this series of Standards. Part 1 presents definitions of quantities for description and measurement of outdoor environmental sounds. Part 2 describes methods to measure long-term environmental sounds over wide areas. Part 3 presents methods to measure short-term environmental sound when an observer is present to operate the instruments. Part 4 presents methods to assess noise and predict the long-term community response to noise. Part 6 presents methods to estimate awakenings associated with aircraft noise events heard in homes. This Part 5 of ANSI S12.9 supersedes and replaces ANSI S12.9-1998/Part 5, which in turn replaced ANSI S12.40-1990 and its predecessor, ANSI S3.23-1980.

The revisions contained in this 2007 edition of ANSI/ASA S12.9 / Part 5 are minor. The most major revision is that the outdoor noise environment recommended by ANSI/ASA S12.9-2007 / Part 5 for schools agrees with the recommendations in ANSI S12.60. Other changes to Figure A.1 are that the marginally compatible zone for single-family homes is reduced by 5 dB to be the same size range as other housing. Largely because of sleep disruption concerns, the un-soundproofed marginally compatible range for health care facilities is reduced to DNL 55 from 60 dB, and the un-soundproofed marginally compatible range for hotels is reduced to DNL 60 from 65 dB. The upper limit for health care facilities and hotels that include soundproofing remains unchanged at a DNL of 75 dB. There are numerous editorial changes including the change of the word “noise” to “sound” or “acoustical” and reference to ANSI S12.9 / Part 6.

This Standard contains one informative annex.

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 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.

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

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Suggestions for improvements of this standard will be welcomed. They should be sent to Accredited Standards Committee S12, Noise, 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

Introduction

0.1 The compatibility of various land uses with the outdoor noise environment at a receiver site depends on acoustical and non-acoustical factors.

- (i) *Acoustical factors*: the sound level at the receiver's outdoor location and its variation with time; the sound isolation provided by the buildings where people experience the effects of outdoor noise; and the noise environment generated indoors by indoor sources, including sounds produced by people themselves.
- (ii) *Non-acoustical factors*: the type of human activity associated with a specific land use; the differing responses of individuals to the same noise environment; attitudes toward the noise sources and the persons responsible for creating the noise; familiarity with an intruding noise through previous experiences; the disturbance of an activity or the annoyance caused by the noise; specific requirements of individual communities; the cost of achieving lower average sound levels; and the technical feasibility of reducing the sound levels.

0.2 Many rating methods and measurement procedures have been proposed for assessing the compatibility between the noise environment and human activity. To assess the environmental acceptability of a site for various land uses it is desirable, when possible, to use a single measure that applies to sounds from all sources, individually and in combination, contributing to the overall sound at a site.

0.3 This Standard specifies the annual average of the total day-night adjusted sound exposure and corresponding annual average of the adjusted day-night average sound level as the acoustical measures to be used in assessing compatibility between various land uses and an outdoor noise environment. Total day-night adjusted sound exposure and adjusted day-night average sound level are similar to non-adjusted total day-night sound exposure and day-night average sound level. The difference is that the sound exposures for sounds with special characteristics such as impulsiveness, dominant pure tones, rapid onset, and sounds with strong low-frequency content are adjusted by a factor before they are added into the total.

NOTE 1 The annual average of the total day-night adjusted sound exposure is the average of the daily total day-night sound exposure over the number of days specifically included in the computation. As such, it can be thought of as *the total (day-night) sound (exposure) on the average day*.

NOTE 2 For some noise environments, the total day-night sound exposure or the day-night average sound level without some of the adjustments may be more appropriate for assessments of compatible land use. Annex A designates land uses such as sports arenas where the total day-night sound exposure or the day-night average sound level without the adjustments may be more appropriate for assessments of compatible land use.

0.4 Part 4 of ANSI S12.9 describes the calculation of total day-night adjusted sound exposure and adjusted day-night average sound level. Part 1 of ANSI S12.9 defines day-night average sound level and other descriptors of community noise. Part 2 of ANSI S12.9 describes long-term measurement procedures. Part 3 of ANSI S12.9 describes short-term measurement procedures with an observer present. Part 6 of ANSI S12.9 provides methods for the estimation of awakenings associated with aircraft noise events heard in homes.

0.5 Definitions of the descriptors of sound are exact and are specified with the same precision as any physically measurable acoustical quantity. In contrast to the physical measurement of the sound, the assessment of the relation of land use to prevailing noise is significantly less precise, in view of the non-acoustical factors described in 0.1 and because average noise levels may not adequately characterize the

noise environment for some types of noise (e.g., an environment characterized by a series of loud, infrequent noise events).

0.6 The ranges to the annual average of the total day-night adjusted and non-adjusted sound exposure or annual average of the adjusted and non-adjusted day-night average sound level noted in the annex for various land uses reflect the statistical variability of the responses of large groups of people to noise. Any particular value of adjusted day-night average sound level may not, therefore, accurately assess an individual's response to an actual acoustical environment.

0.7 Guidelines given in the annex for the annual average of the total day-night adjusted sound exposure and annual average of the adjusted day-night average sound level were based on studies of noise-induced annoyance and other forms of noise-induced activity interference. A listing of the data on these relationships is given in the bibliography to Part 4 of ANSI S12.9.

American National Standard

Quantities and Procedures for Description and Measurement of Environmental Sound — Part 5: Sound Level Descriptors for Determination of Compatible Land Use

1 Scope

1.1 This Standard provides guidelines for assessing the compatibility of various human uses of land with the actual or projected outdoor acoustical environment at a site. The total acoustical environment is characterized by the annual average of the total day-night adjusted sound exposure or the annual average of the adjusted day-night average sound level. This Standard is based on the long-term annoyance response of average communities as measured by the percent of a community that is highly annoyed.

NOTE Annex A contains designated land uses such as sports arenas where the total day-night sound exposure or the day-night average sound level without the adjustments may be more appropriate for assessments of compatible land use.

1.2 This Standard does not address the effects of short-term exposure of people to intrusive sounds in locations such as parks and wilderness areas. The Standard does not address other effects of noise such as sleep disturbance or health effects. The effects of aircraft noise on sleep can be found in ANSI S12.9-2000 / Part 6. This Standard does not provide a method to predict the response of a community to short-term, infrequent, or non-repetitive sources of sound.

2 Normative references

The following referenced documents are indispensable for the application of this standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

ANSI S12.9-1988 / Part 1 (R 2003) *American National Standard Quantities and Procedures for Description and Measurement of Environmental Sound — Part 1*.

ANSI S12.9-2005 / Part 4 *American National Standard Quantities and Procedures for Description and Measurement of Environmental Sound — Part 4: Noise Assessment and Prediction of Long-Term Community Response*.

3 Definitions

For the purposes of this Part 5, the following definitions and quantities given in ANSI S1.1, ANSI S12.9/Part 1 and ANSI S12.9/Part 4 apply.