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(a revision of ANSI S12.54-1999 / ISO
3744:1994)
Reaffirmed by ANSI June 19, 2020

AMERICAN NATIONAL STANDARD

**Acoustics – Determination of sound power levels
and sound energy levels of noise sources using
sound pressure – Engineering methods for an
essentially free field over a reflecting plane
(a nationally adopted international standard)**

Secretariat:

Acoustical Society of America

Approved on March 1, 2011

American National Standards Institute, Inc.

Abstract

This American National Standard specifies methods for determining the sound power level or sound energy level of a noise source from sound pressure levels measured on a surface enveloping the noise source (machinery or equipment) in an environment that approximates to an acoustic free field near one or more reflecting planes. The sound power level (or, in the case of noise bursts or transient noise emission, the sound energy level) produced by the noise source, in frequency bands or with A-weighting applied, is calculated using those measurements.

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Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering methods for an essentially free field over a reflecting plane

(a Nationally Adopted International Standard)

ANSI/ASA S12.54-2011 / ISO 3744:2010

Accredited Standards Committee S12, Noise

Standards Secretariat
Acoustical Society of America
35 Pinelawn Road, Suite 114 E
Melville, NY 11747-3177

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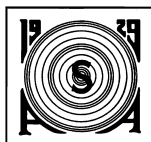
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Contents

1	Scope	1
1.1	General	1
1.2	Types of noise and noise sources	1
1.3	Test environment	1
1.4	Measurement uncertainty	2
2	Normative references	2
3	Terms and definitions	2
4	Test environment	9
4.1	General	9
4.2	Criteria for background noise	9
4.3	Criterion for acoustic adequacy of test environment	12
5	Instrumentation	13
5.1	General	13
5.2	Calibration	13
6	Definition, location, installation, and operation of noise source under test	13
6.1	General	13
6.2	Auxiliary equipment	13
6.3	Noise source location	14
6.4	Mounting of the noise source	14
6.5	Installation and mounting conditions for moving noise sources	15
6.6	Operation of source during test	15
7	Reference box and measurement surface	16
7.1	Reference box	16
7.2	Measurement surface	17
8	Determination of sound power levels and sound energy levels	20
8.1	Microphone positions on the measurement surface	20
8.2	Determination of sound power levels	23
8.3	Determination of sound energy levels	26
8.4	Calculation of apparent directivity indices	28
8.5	Calculation of apparent surface sound pressure level non-uniformity index	29
8.6	A-weighted sound power level and sound energy level	29
9	Measurement uncertainty	29
9.1	Methodology	29
9.2	Determination of σ_{omc}	30
9.3	Determination of σ_{R0}	30
9.4	Typical upper bound values of σ_{R0}	31
9.5	Total standard deviation σ_{tot} and expanded measurement uncertainty U	32
10	Information to be recorded	32
10.1	General	32
10.2	Noise source under test	32
10.3	Test environment	33

10.4	Instrumentation	33
10.5	Acoustical data	33
11	Test report	34
Annex A	(normative) Qualification procedures for the acoustic environment.....	35
A.1	General	35
A.2	Absolute comparison test	35
A.3	Determination of the environmental correction based on room absorption.....	36
Annex B	(normative) Microphone arrays on a hemispherical measurement surface	40
B.1	Microphone positions and additional microphone positions.....	40
B.2	Microphone positions for sources adjacent to two reflecting planes	41
B.3	Microphone positions for sources adjacent to three reflecting planes	41
B.4	Measurement paths	42
Annex C	(normative) Microphone arrays on a parallelepiped measurement surface.....	47
C.1	Microphone positions for sources mounted on one reflecting plane	47
C.2	Microphone positions for sources adjacent to two or three reflecting planes	48
Annex D	(informative) Microphone arrays on a cylindrical measurement surface.....	58
Annex E	(normative) Calculation of A-weighted sound power levels and A-weighted sound energy levels from frequency band levels	62
E.1	A-weighted sound power levels.....	62
E.2	A-weighted sound energy levels.....	62
E.3	Values of k and C_k for use in calculations	62
Annex F	(normative) Alternative microphone array on a hemispherical measurement surface for direct measurements of A-weighted sound pressure levels	65
F.1	General	65
F.2	Microphone positions on the measurement surface.....	65
Annex G	(normative) Sound power level and sound energy level under reference meteorological conditions	68
Annex H	(informative) Guidelines on the development of information on measurement uncertainty	70
H.1	General	70
H.2	Considerations on the total standard deviation σ_{tot}	70
H.3	Considerations on σ_{omc}	70
H.4	Considerations on σ_{R0}	72
H.5	Combined standard uncertainty.....	81
H.6	Measurement uncertainty based on reproducibility data.....	81
	Bibliography	82

Figures

Figure 1	— Reference box and origin of co-ordinates for one, two and three reflecting planes	17
Figure B.1	— Preferred microphone positions on the hemispherical measurement surface for all noise sources (The co-ordinates of the positions are given in Table B.1)	42

Figure B.2 — Microphone positions on the hemispherical measurement surface for a broadband noise source (The co-ordinates of the positions are given in Table B.2)	43
Figure B.3 — Microphone positions on a half-hemispherical measurement surface adjacent to two reflecting planes (The co-ordinates of the positions are given in Table B.2).....	44
Figure B.4 — Microphone positions on a quarter-hemispherical measurement surface adjacent to three reflecting planes (The co-ordinates of the positions are given in Table B.3)	45
Figure B.5 — Coaxial circular paths for a moving microphone.....	46
Figure C.1 — Key microphone positions on a parallelepiped measurement surface consisting of rectangular partial areas	48
Figure C.2 —Additional microphone positions over the whole parallelepiped measurement surface consisting of rectangular partial areas	48
Figure C.3 —Example for additional localized microphone positions on a rectangular partial area	49
Figure C.4 —Key microphone positions on a parallelepiped measurement surface consisting of triangular partial areas	49
Figure C.5 —Additional microphone positions over the whole parallelepiped measurement surface consisting of triangular partial areas	50
Figure C.6 — Example for additional localized microphone positions on a pair of triangular partial areas	50
Figure C.7 — Example of a measurement surface with microphone positions and paths for a small machine (with dimensions $l_1 \leq d, l_2 \leq d, l_3 \leq 2d$).....	51
Figure C.8 — Example of a measurement surface with microphone positions and paths for a tall machine with a small base area (with dimensions $l_1 \leq d, l_2 \leq d, 2d < l_3 \leq 5d$)	52
Figure C.9 — Example of a measurement surface with microphone positions and paths for a long machine (with dimensions $4d < l_1 \leq 7d, l_2 \leq d, l_3 \leq 2d$).....	53
Figure C.10 — Example of a measurement surface with microphone positions and paths for a medium-sized machine (with dimensions $d < l_1 \leq 4d, d < l_2 \leq 4d, 2d < l_3 \leq 5d$).....	54
Figure C.11 — Example of a measurement surface with microphone positions and paths for a large machine (with dimensions $4d < l_1 \leq 7d, d < l_2 \leq 4d, 2d < l_3 \leq 5d$)	55
Figure C.12 — Parallelepiped measurement surface with six microphone positions for floor-standing noise sources adjacent to two reflecting planes	56
Figure C.13 — Parallelepiped measurement surface with four microphone positions for floor-standing noise sources adjacent to three reflecting planes	57
Figure D.1 — Example of cylindrical measurement surface and microphone array, with six side microphone paths and three top microphone paths	59

Figure D.2 — Example of a microphone array with five side microphone paths and four top microphone paths	60
Figure D.3 — Example of a microphone array on a half-cylindrical measurement surface adjacent to two reflecting planes	61
Figure D.4 — Example of a microphone array on a quarter-cylindrical measurement surface adjacent to three reflecting planes.....	61
Figure F.1 — Alternative microphone array on a hemispherical measurement surface for direct measurements of A-weighted sound pressure levels.....	67

Tables

Table 1 — Maximum background noise levels in test room for absolute criteria	11
Table 2 — Typical upper bound values of the standard deviation of reproducibility of the method, σ_{R0} , for sound power levels and sound energy levels determined in accordance with this American National Standard	32
Table A.1 — Approximate values of the mean sound absorption coefficient, α	39
Table B.1 — Preferred microphone positions for all noise sources.....	40
Table B.2 — Microphone positions for a broadband noise source.....	41
Table B.3 — Microphone positions for a source adjacent to three reflecting planes.....	41
Table E.1 — Values of k and C_k for mid-band frequencies of one-third octave bands.....	63
Table E.2 — Values of k and C_k for mid-band frequencies of octave bands.....	64
Table F.1 — Co-ordinates of alternative microphone positions.....	66
Table F.2 — Values of the constant, a	66
Table H.1 — Examples of calculated total standard deviations σ_{tot} for three different cases.....	72
Table H.2 — Uncertainty budget for determinations of σ_{R0} for sound power level and sound energy level, valid for frequencies from 500 Hz to 4 kHz, or for A-weighted measurements of a source with a relatively flat frequency spectrum.....	75

Foreword

[This Foreword is for information only, and is not a part of the American National Standard ANSI/ASA S12.54-2011 / ISO 3744:2010 American National Standard Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Engineering methods for an essentially free field over a reflecting plane.]

This standard comprises a part of a group of definitions, standards, and specifications for use in noise. It was developed and approved by Accredited Standards Committee S12, Noise, under its approved operating procedures. Those procedures have been accredited by the American National Standards Institute (ANSI). The Scope of Accredited Standards Committee S12 is as follows:

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 a revision of ANSI S12.54-1999 / ISO 3744:1994, which has been technically revised.

This Standard is identical to International Standard ISO 3744, Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Engineering methods for an essentially free field over a reflecting plane, which was prepared by Technical Committee ISO/TC 43 Subcommittee SC 1, Noise. However, in conformance with ANSI and ISO rules, the words "American National Standard" replace the words "International Standard" where they appear in the ISO document, decimal points were substituted in place of the decimal commas used in ISO documents, and American English spelling is used in place of British English spelling.

The ANSI or ANSI/ASA equivalents for the ISO standards in the ISO 3740 series and other referenced nationally adopted standards are given below:

- ANSI S12.5 / ISO 6926 is an identical national adoption of ISO 6926;
- ANSI/ASA S12.50/ISO 3740 is an identical national adoption of ISO 3740;
- ANSI/ASA S12.51/ISO 3741 is an identical national adoption of ISO 3741;
- ANSI/ASA S12.53/Part 1/ISO 3743-1 is an identical national adoption of ISO 3743-1;
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- ANSI/ASA S12.54/ISO 3744 is an identical national adoption of ISO 3744;
- ANSI S12.55/ISO 3745 is an identical national adoption of ISO 3745;
- ANSI S12.56/ISO 3746 is an identical national adoption of ISO 3746; and
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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

This American National Standard is a national adoption of one of the series ISO 3741^[2] to ISO 3747^[6], which specify various methods for determining the sound power levels and sound energy levels of noise sources including machinery, equipment and their sub-assemblies. General guidelines to assist in the selection are provided in ISO 3740^[1]. The selection depends on the environment of the available test facility and on the precision of the sound power level or sound energy level values required. It may be necessary to establish a noise test code (see ISO 12001) for the individual noise source in order to select the appropriate sound measurement surface and microphone array from among those allowed in each member of the ISO 3741^[2] to ISO 3747^[6] series, and to give requirements on test unit mounting, loading and operating conditions under which the sound power levels or sound energy levels are to be obtained. The sound power emitted by a given source into the test environment is calculated from the mean square sound pressure that is measured over a hypothetical measurement surface enclosing the source, and the area of that surface. The sound energy for a single sound event is calculated from this sound power and the time over which it existed.

The methods specified in this American National Standard permit the determination of the sound power level and the sound energy level in frequency bands optionally with frequency A-weighting applied.

For applications where greater accuracy is required, reference can be made to ISO 3745, ISO 3741^[2] or ISO 9614^{[13]-[15]}. If the relevant criteria for the measurement environment specified in this American National Standard are not met, it might be possible to refer to another standard from this series, or to ISO 9614^{[13]-[15]}.

This American National Standard describes methods of accuracy grade 2 (engineering grade) as defined in ISO 12001, when the measurements are performed in a space that approximates an acoustically free field over a reflecting plane. Such an environment can be found in a specially designed room, or within industrial buildings or outdoors. Ideally, the test source should be mounted on a sound-reflecting plane located in a large open space. For sources normally installed on the floor of machine rooms, corrections are defined to account for undesired reflections from nearby objects, walls and the ceiling, and for the residual background noises that occur there.

American National Standard

Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Engineering methods for an essentially free field over a reflecting plane

1 Scope

1.1 General

This American National Standard specifies methods for determining the sound power level or sound energy level of a noise source from sound pressure levels measured on a surface enveloping the noise source (machinery or equipment) in an environment that approximates to an acoustic free field near one or more reflecting planes. The sound power level (or, in the case of noise bursts or transient noise emission, the sound energy level) produced by the noise source, in frequency bands or with A-weighting applied, is calculated using those measurements.

NOTE Differently shaped measurement surfaces can yield differing estimates of the sound power level of a given noise source and an appropriately drafted noise test code (see ISO 12001) gives detailed information on the selection of the surface.

1.2 Types of noise and noise sources

The methods specified in this American National Standard are suitable for all types of noise (steady, non-steady, fluctuating, isolated bursts of sound energy, etc.) defined in ISO 12001.

This American National Standard is applicable to all types and sizes of noise source (e.g. stationary or slowly moving plant, installation, machine, component or sub-assembly), provided the conditions for the measurements can be met.

NOTE It is possible that the conditions for measurements given in this American National Standard are impracticable for very tall or very long sources such as chimneys, ducts, conveyors and multi-source industrial plants. A noise test code for the determination of noise emission of specific sources can provide alternative methods in such cases.

1.3 Test environment

The test environments that are applicable for measurements made in accordance with this American National Standard can be located indoors or outdoors, with one or more sound-reflecting planes present on or near which the noise source under test is mounted. The ideal environment is a completely open space with no bounding or reflecting surfaces other than the reflecting plane(s) (such as that provided by a qualified hemi-anechoic chamber), but procedures are given for applying corrections (within limits that are specified) in the case of environments that are less than ideal.