

AMERICAN NATIONAL STANDARD
**Instruments for the Measurement
of Sound Intensity**

Secretariat
Acoustical Society of America

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American National Standards Institute, Inc.

ABSTRACT

This standard specifies the requirements for instruments to measure sound intensity employing the two-microphone technique and methods for performance verification to meet the requirements. It conforms as closely as possible to the International Electrotechnical Commission (IEC) Standard on "Instruments for the Measurement of Sound Intensity," publication IEC 1043. The primary application of this standard is to instruments used for the determination of sound power of sources according to the requirements of ANSI S12.12-1992. The requirements and methods of performance verification are specified for the complete instrument system and separately for the probes and processors forming the complete system. The latter enables the user to assemble the instrument system from probes and processors procured from different manufacturers. Performance verifications are written in terms of type tests and periodic verifications.

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Foreword

[This Foreword is for information only, and is not a part of the American National Standard—Instruments for the Measurement of Sound Intensity, ANSI S1.9-1996 (ASA Catalog No. 117-1996).]

This primary purpose of this American National Standard is to specify minimum performance requirements of instruments to reduce to the lowest practical minimum any differences in corresponding measurements obtained with various makes and models of sound intensity measurement systems that meet the standard. The secondary purpose is to ensure the accuracy of measurements of sound intensity applied to the determination of sound power in accordance with ANSI S12.12-1992.

This standard is the American National Standard counterpart of International Electro-technical Commission Standard, IEC 1043 (1993), Instruments for the Measurement of Sound Intensity. The technical requirements in this American National Standard are similar to those in IEC 1043.

This standard contains one informative annex.

This Standard was developed under the jurisdiction of Accredited Standards Committee S1, Acoustics, which has the following scope:

Standards, specification, 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, human tolerance, and comfort.

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American National Standard

Instruments for the Measurement of Sound Intensity

0 Introduction

A sound-intensity measurement system satisfying the requirements of the standard will consist, in general, of a sound-intensity probe and a processor. Sound intensity is determined by a probe that senses sound pressures at two closely spaced points by two pressure-sensing microphones. The signal processor may be a dedicated analyzer or a computer system capable of sampling the sound-pressure signals from the probe and calculating the sound-pressure and sound-intensity levels in the required frequency bands.

Sound-intensity measurements are widely used to determine sound power of noise sources *in situ*. This method has the advantage of determining sound power by measurements carried out in the normal operating environment of sources, without the requirement of special facilities such as anechoic or reverberation rooms. Other applications of sound-intensity measurements include the determination of transmission loss of panels and investigation of the sound-radiation characteristics of complex sources.

The overall uncertainty in measured sound intensity depends on many factors. These include the instrument type, the frequency band, the angle of incidence of sound waves, the angle of the sound-intensity vector relative to the probe axis, the measurement environment, and the sound field. Because of its wide variations with these factors, a specific accuracy appropriate to all conditions cannot be given. Performance verification of the instruments is specified mostly under free-field conditions. As the geometrical configuration of the probe may be non-axisymmetrical, the directional characteristics on two perpendicular planes under free-field conditions are required.

Instruments, processors, and probes are classified according to the measurement accuracy achieved. There are two grades of accuracies, designated as

class 1 and class 2. The class 1 instrument, designated *precision*, is intended for accurate sound-intensity measurements in the field or laboratory. The class 2 instrument, designated *general purpose*, is intended for general field use. While the same requirements apply to both classes, the differences are in the tolerances allowed.

A scheme for periodic verification, serving as the basis of the periodic recalibrations required in many countries, is given in Appendix A.

Probes and processors are treated separately and together forming the instrument system.

1 Scope

This Standard applies to instruments that determine sound intensity by a two-microphone probe, consisting of a pair of spatially separated pressure-sensing microphones. Minimum requirements for two basic classes of instruments, class 1, precision, and class 2, general purpose, are specified, with tolerances increasing with class number. The instruments are required to analyze sound intensity in one-third octave or octave bands and optionally to provide A-weighted band levels. They are also required to measure sound-pressure levels in addition to sound-intensity levels to facilitate the use of field indicators in ANSI S12.12-1992. The performance requirements of the probe and processor, comprising the instrument system, are specified together and separately.

2 Purpose

The primary purpose of this American National Standard is to specify minimum performance requirements of the instruments to reduce to the lowest practical minimum any differences in corresponding measurements obtained with various makes and models of sound-intensity measurement systems that meet the standard. The secondary purpose is to ensure the accuracy of measurements of sound intensity applied to the determination of sound power in accordance with ANSI S12.12-1992.

3 Applications

The main application of this standard is to determine sound power of noise sources, especially *in situ*, according to ANSI S12.12-1992. The other ap-