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ANSI/AMCA Standard 300-08

Reverberant Room Method for Sound Testing of Fans

An American National Standard
Approved by ANSI on April 18, 2008

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC.

The International Authority on Air System Components

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ANSI/AMCA STANDARD 300-08

Reverberant Room Method for Sound Testing of Fans

Air Movement and Control Association International, Inc.
30 West University Drive
Arlington Heights, IL 60004-1893

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Authority

AMCA Standard 300-05 was adopted by the membership of the Air Movement and Control Association International, Inc. on 30 July 2005. It was approved as an American National Standard and became effective on 18 April, 2008.

Foreward

This standard was originally developed in response to the need for a reliable and accurate method of determining the sound power levels of fan equipment. The original document was written by the AMCA P158NB Sound Test Code Committee. Where possible, it was based on ASHRAE Standard 36-62, and combined state-of-the-art with practical considerations. It was first published as a Recommended Practice in February 1962, and adopted as a Standard Test Code in October 1963. The sound power reference level now used in this standard was changed in January 1965, from 10^{-13} watts to 10^{-12} watts. The third edition (January 1967) AMCA 300-67 Test Code for Sound Rating included minor revisions. In 1974, minor editorial changes were made, and size-speed conversions were transferred to AMCA 301 Methods for Calculating Fan Sound Ratings From Laboratory Test Data. The 1985 edition continued the original philosophy of combining the theoretical and the practical. The 1996 edition was improved by increasing the accuracy of Reference Sound Source values through improvements in calibration requirements and procedure, and where appropriate, calling for units of measure in SI (I-P) sequence. Where there have been successful improvements in state-of-the-art, full advantage has been taken. This latest edition refines the duct end correction factors to values whose source can be traced to its origin.

Introduction

This standard establishes a method of determining the sound power levels of a fan. The method is reproducible in all laboratories that are qualified to the requirements of this standard. The method employs standard sound measurement instrumentation, applied to rooms that are restricted to certain acoustic properties. The test setups are designed generally to represent the physical orientation of a fan as installed, following ANSI/AMCA 210 Laboratory Methods of Testing Fans for Aerodynamic Performance Rating. Sound is defined as radiant mechanical energy that is transmitted by pressure waves in air; it is the objective cause of hearing. Sound pressure level is described mathematically as a logarithmic quantity derived from sound pressure. The unit of sound pressure level is the decibel, referenced to a base of 20 μPascal, or 0.0002 μbar. The sound pressure level at any given point in space depends on the distance between the source and the receiver, reflection if in an enclosed room, proximity of the source to other sound sources, etc. Sound in a room is the result of one or more active sound power sources within that room. Sound power is the total sound energy radiated per unit time. Sound power level is described mathematically as a logarithmic quantity derived from the sound power. The unit of sound power level is the decibel referenced to 1 picowatt (1.0×10^{-12} watt). Sound power levels determined through use of this standard are useful for comparison between fans and in acoustical design. Since sound power is independent of acoustic environment, two or more fans proposed for a specific aerodynamic performance condition may be evaluated by comparison to determine whether one is more suitable for an application than another. Moreover, fan sound power levels establish an accurate base for estimating the acoustical outcome of the fan installation in terms of sound pressure levels. A successful estimate of sound pressure levels requires extensive information on the fan and the environment in which it is to be located. It is often advantageous for the fan equipment user to employ acoustical consultation to ensure that all factors that affect the final sound pressure levels are considered. Additional information on the complexity of this situation may be found in other documents available elsewhere.

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Reverberant Room Method for Sound Testing of Fans

1. Scope

This standard applies to fans of all types and sizes. This standard is limited to the determination of airborne sound emission for the specified setups. Vibration is not measured, nor is the sensitivity of airborne sound emission to vibration effects determined.

The size of a fan that can be tested in accordance with this standard is limited only by the practical aspects of the test setups. Dimensional limitations, test subject dimensions, and air performance will control the test room size and power and mounting requirements for the test subject.

The test setup requirements in this standard establish the laboratory conditions necessary for a successful test. Rarely will it be possible to meet these requirements in a field situation. This standard is not intended for field measurements.

2. Normative References

The following standards contain provisions that, through specific reference in this text, constitute provisions of this American National Standard. At the time of publication 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.

ANSI/AMCA 210-99 / ANSI/ASHRAE 51-1999 *Laboratory Methods of Testing Fans for Aerodynamic Performance Rating*, Air Movement and Control Association International, Inc., 30 W. University Drive, Arlington Heights, IL 60004-1893 U.S.A, 1999

ANSI S1.4-1983; S1.4A-1985 *Specification for Sound Level Meters*, Acoustical Society of America, 120 Wall St., 32nd Floor, New York, NY 10005-3993 U.S.A., 1985 (AMCA #2315-83-AO)

ANSI S1.11-2004 *Specification for Octave Band and Fractional Octave Band Analog and Digital Filters*, Acoustical Society of America, 120 Wall St., 32nd Floor, New York, NY 10005-3993 U.S.A., 1986 (AMCA #1727-86-AO)

ANSI S1.40-1984 *Standard Specification for Acoustical Calibrators*, Acoustical Society of America, 120 Wall St., 32nd Floor, New York, NY 10005-3993 U.S.A., 1984 (AMCA #1895-84-AO)

ANSI S12.5-1990 *Requirements for the Performance and Calibration of Reference Sound Sources*, Acoustical Society of America, 120 Wall St., 32nd Floor, New York, NY 10005-3993 U.S.A., 1990 (AMCA #1863-90-AO)

ANSI S12.12-1992 *Engineering Method for the Determination of Sound Power Levels of Noise Sources Using Sound Intensity*, Acoustical Society of America, 120 Wall St., 32nd Floor, New York, NY 10005-3993 U.S.A., 1992 (AMCA #1850-92-AO)

ANSI/IEEE/ASTM SI 10-1997 *Standard for Use of the International System of Units (SI): The Modern Metric System*, Institute of Electrical and Electronic Engineers, 345 east 47th Street, New York, NY 10017 U.S.A., 1997 (AMCA #2924-97-AO)

3. Definitions / Units of Measure / Symbols

3.1 Definitions

3.1.1 Blade passage frequency (*BPF*). The frequency of fan impeller blades passing a single fixed object, per the following formula:

BPF = (number of blades)(fan rotational speed, rev/min) / 60, in Hz.

3.1.2 Chamber. An enclosure used to regulate airflow and absorb sound; it may also conform to air test chamber conditions given in ANSI/AMCA 210.

3.1.3 Decibel (dB). A dimensionless unit of level in logarithmic terms for expressing the ratio of a power, or power-like, quantity to a similar reference quantity (see Sections 3.1.13 and 3.1.14).

3.1.4 Ducted fan. A fan having a duct connected to either its inlet, its outlet, or to both.

3.1.5 End reflection. A phenomenon that occurs whenever sound is transmitted across an abrupt change in area, such as at the end of a duct in a room. When end reflection occurs some of the sound entering the room is reflected back into the duct and does not escape into the room.