

# Commercial, Educational and Industrial Acoustical Standards

A guide to the varied and complex world of acoustical standards, guidelines, and codes..

**S**tandards are developed in an attempt to standardize procedures for testing and rating products. They also standardize methods in which measurements are made so that results can be compared and suitability criteria can be developed. The intent of product standards is to equalize the playing field between products and manufacturers so that products and data can be objectively compared. Acoustical standards have been developed by a wide variety of trade organizations, engineering societies and quasi-governmental organizations.

In the United States, the American National Standards Institute (ANSI) serves as the unifying body to develop and collect standards. ANSI also ensures that these standards are not biased toward any particular industry group or organization.

Recent efforts have been made to bring every standard around the world under one unifying umbrella of international standards called the International Standards Organization (ISO). ISO's role in this process is to ensure the standards are consensus standards representing a diversity of views of both industry groups and engineering organizations.

## CODES, STANDARDS, GUIDELINES, AND CERTIFIED RATINGS

Standards and guidelines published by industry organizations are, in general, voluntary processes to allow others to compare product performances and to layout procedures for making measurements. In-

dustry groups have also developed certification programs based around some of these standards.

Certification programs are usually based around testing to a set of standards in an independent laboratory. Most Certification programs involve periodic check tests to maintain certification. Depending on the program these check tests are either unannounced "open market" tests or planned and scheduled tests.

Some standards are also incorporated into local or national building codes. Only when incorporated into codes do these standards have the force of law behind them.

## APPLICABILITY OF STANDARDS AND CERTIFIED RATINGS

The large table beginning on the next page includes all the relevant acoustical standards and guidelines for HVAC applications and equipment from the Air Movement and Control Association International (AMCA), the Air-conditioning Refrigeration Institute (ARI), the National Institute of Standards and Technology (NIST), American Society for Testing and Materials (ASTM), ISO, and the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).

AMCA provides standards and certified rating programs for fans, dampers, louvers and acoustical duct silencers. It also has application manuals for specifiers, engineers and others with an interest in air systems to use in the selection, evaluation and trouble shooting of air system components. All are

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Device	Type	Organization	Standard	Title
Laboratories & test facilities	Lab accreditation	AMCA	111-1999	Laboratory accreditation program
Notes: This standard sets the laboratory qualifications for testing to all AMCA reverberation room methods. It also sets the laboratory requirements for the sound certification programs. Laboratories are calibrated to the AMCA lab in Chicago.				
	Lab accreditation	NIST	Handbook 150 2001 Edition	National voluntary laboratory accreditation program
Notes: NVLAP will accredit labs to most any standard. This accreditation does not include check test against a standard lab but only reviews the quality of the personnel, facilities and procedures. Most often used for testing of material properties such as transmission loss or absorption.				
	Test method	ANSI	S12.51-2002	Determination of sound power levels of noise sources using sound pressure - Precision methods for reverberation rooms
Notes: Replaced ANSI S12.31 and S12.32. This is the basis of most reverberant room test standards.				
	Test method	ANSI	S12.12-1992 (R2002)	Engineering method for the determination of sound power levels of noise sources using sound intensity
Notes: Intensity is an alternate method of determining a device's sound power. It has yet to achieve wide spread acceptance in the HVAC community.				
	Test method	ARI	250-2001	Performance and calibration of reference sound sources
	Lab quality	ARI	280-1995	Requirements for the qualification of reverberant rooms in the 63 Hz octave band
Notes: ARI 350 and 280 are referenced in ARI 260				
	Test method	ASTM	E90-2002	Standard test method for laboratory measurement of airborne sound transmission loss of building partitions and elements
	Test method	ISO	9614-2002	Determination of sound power levels of noise sources using sound intensity
	Test method	ISO	3741-1999	Determination of sound power levels of noise sources using sound pressure -- Precision methods for reverberation rooms
Notes: ISO 9614 and 3741 are the ISO equivalents of ANSI S12.51 and S12.12				
Grills registers & diffusers (GRD)	Ratings	ASHRAE	70-1991	Method of testing for rating the performance of air outlets and inlets
Notes: Air outlets and inlets are tested for acoustical performance in reverb rooms meeting the requirements of ANSI S12.51 and ISO 3741. This standard requires that an air distribution device be installed with several diameters of straight duct to avoid the introduction of duct-generated noise. Typically, the sound power is then reduced by 10 dB in every octave band for room effect, and plotted on an NC chart. Data is typically presented as NC values over a range of inlet velocities. Application guidance: In practice, of course, there is seldom this ideal configuration, and rooms are not likely to absorb 10 dB in every octave band. It is recommended by several manufacturers that 5 NC be added to the catalog data to account for inlet effects and real room absorption.				
	Ratings	ARI	890-2001	Air diffusers and air diffuser assemblies
Notes: ARI has a GRD standard, but has not implemented a certification program. The Air Diffusion Council had a certification program for GRDs, ADC 1062. Last updated in 1984, the ADC 1062 standard and certification program are no longer active, and there are presently no ADC certified products or laboratories.				
Variable air volume terminals	Ratings	ASHRAE	130-1996	Method of testing for rating the performance of air outlets and inlets
Notes: This method uses the reverb room as described above for GRDs, and has two installations: discharge sound with the unit located outside the reverb room, and radiated sound, with the unit installed inside the room. Data is typically presented in the second through seventh octave bands at several airflows and inlet duct pressures, along with an equivalent NC value.				
	Certification program	ARI	880-1998	Industry standard for air terminals
Notes: This standard references ASHRAE 130 as the method of test. VAV Terminal Certification Program: ARI has a certification program for air terminals. Units are rated at "Standard Rating Conditions," and at least two different units from each manufacturer are check tested at an independent laboratory annually. This is the only HVAC product currently ARI Certified by octave band. Application Guidance: ARI has produced an application standard (described earlier) for use in estimating room sound levels in space. It includes an appendix (Appendix E) of recommended deducts for typical installations. These assumptions include several feet of lined duct downstream of the unit. If no lining is included on a project, the Appendix E values will be optimistic.				

Device	Type	Organization	Standard	Title
<b>Grills registers &amp; diffusers (GRD) (continued)</b>	Applications	ARI	885-1998	<i>Procedure for estimating occupied space sound levels in the application of air terminals and air outlets (with addendum)</i>
<b>Silencers &amp; attenuators</b>	Certification program	AMCA	1011-1999	<i>Certified ratings program - acoustical duct silencers</i>
Notes: Under the AMCA certification program, planned check tests are conducted every three years on each line of duct silencers.				
	Ratings	ANSI	E477-1999	<i>Standard test method for measuring acoustical and airflow performance of duct liner materials and prefabricated silencers</i>
	Ratings	ASTM	E90.2	<i>Standard test method for laboratory measurement of airborne sound transmission loss</i>
Notes: The test standard is used to evaluate acoustical louvers as required in AMCA 500L.				
<b>Fans</b>	Application	ANSI/AMCA	204-1996	<i>Balance quality and vibration levels for fans</i>
Notes: Vibration standards for both factory and field fan balance.				
	Ratings	AMCA	300-1996	<i>Reverberant room method for sound testing of fans</i>
Notes: The primary fan sound ratings test used in the US. This standard addresses fans in different arrangements (ducted and non-ducted) and addresses inlet-,outlet-,and cabinet-radiated noise. It also forms the basis for ARI 260 sound testing.				
	Application	AMCA	301-1990	<i>Methods for calculating fan sound ratings from laboratory test data</i>
Notes: Describes how to interpolate points between test data developed in Standard 300 for different fan sizes and operating points.				
	Application	AMCA	302-1973	<i>Application of sound ratings for non-ducted air moving devices</i>
Notes: A little used standard for non-ducted fans that rates fans in terms of loudness instead of the more common sound power ratings.				
	Application	AMCA	303-1979	<i>Application of sound power level ratings for fans</i>
Notes: An applications standard that discusses how AMCA 300 sound power rating should be applied.				
	Certification Program	AMCA	311-1990	<i>Certified sound ratings program for air moving devices</i>
Notes: The AMCA Certification program. Planned check tests are conducted every three years on each fan line certified.				
	Ratings	AMCA	320-Proposed	<i>Laboratory method for sound testing of fans using intensity</i>
Notes: A proposed method for rating fans using intensity. Currently undergoing ASNI and ISO review.				
	Ratings	ANSI/AMCA ASHRAE	330-1997 68-1997	<i>Laboratory method of testing to determine the sound power in a duct</i>
Notes: A seldom used method for rating fans by testing in a specifically designed test duct.				
<b>HVAC Units</b>	Application	ARI	275-1997	<i>Application of sound rating levels of outdoor unitary equipment</i>
Notes: Applications standard to using ratings from ARI 270 and 35.0				
	Application	ARI	575-1994	<i>Method of measuring machinery sound within an equipment space</i>
Notes: Field measurement standard for equipment rooms.				
	Ratings	ARI	530-1995	<i>Method of rating sound and vibration of refrigerant compressors</i>
Notes: Rating standard for stand-alone compressor ratings.				
	Ratings	ARI	300-2000	<i>Sound rating and sound transmission loss of packaged terminal equipment</i>
Notes: Rating standard for packaged terminal units such as water source heat pumps.				

Device	Type	Organization	Standard	Title
HVAC Units (continued)	Ratings	ARI	260-2001	<i>Sound rating of ducted air moving and conditioning equipment (with addendum)</i>
Notes: The primary ARI sound rating standard for ducted inlet and outlet sound as well as cabinet radiated sound. Utilized AMCA 300 and ANSI S12.51 reverberant room methods.				
	Ratings	ARI	270-1995	<i>Sound rating of outdoor unitary equipment</i>
Notes: Rating test procedure for determining outdoor radiated sound. Becoming increasingly more important as new and more stringent "lot line" sound ordinances are being incorporated into building codes.				
	Ratings	ARI	350-2000	<i>Sound rating of non-ducted indoor air-conditioning equipment</i>
Notes: Rating standard for Packaged non-ducted air conditioners (PTACs).				
	Ratings	ARI	370-2001	<i>Sound rating of large outdoor refrigerating and air-conditioning equipment</i>
Notes: Rating standards for large equipment including chillers.				
	Guideline	ARI	Guideline L-1997	<i>Assessing the impact of air-conditioning outdoor sound levels in the residential community</i>
Notes: A guideline paper on the effect of outdoor equipment on lot line sound.				

available at [www.amca.org](http://www.amca.org)

The Air-conditioning Refrigeration Institute (ARI) provides the acoustical application standard ARI Standard 885-1998, *Procedure for estimating occupied space sound levels in the application of air terminals and air outlets*. This standard provides a collection of

tables and equations for predicting room sound pressure levels. Most of the information is extracted from the ASHRAE Handbooks, but some is unique, based on tests and data obtained from manufacturers and industry sources. It presents a step-by-step method of converting octave band sound power data to room sound pressure predictions, and provides guidance in the application of these factors. It assumes that sound power is determined using ARI Standard 880 (see table).

In addition, the latest version of the Standard provides a table of suggested attenuation values in an appendix. If end-use sound estimations, typically as NC values, are provided by manufacturers, the ARI Air Terminal Certification program now requires that they use the values in Appendix E when presenting these estimations in their catalogs. It is hoped that this process will allow better comparisons of acoustical performance between different manufacturers, as well as providing more consistent performance ratings.

While intended for use with VAV Air terminals, much of the data is applicable for other types of products as well. The major exception is found in the values for plenum-room effect that are based on tests with VAV terminals in a typical installation including a 3-ft deep plenum and standard acoustical tiles. These values have not been validated with other types of equipment.

**CONCLUSION**

To learn more about these codes, standards, guidelines, and certified ratings programs, visit the Website of the authoring organization: ASHRAE ([www.ashrae.org](http://www.ashrae.org)), ANSI ([www.ansi.org](http://www.ansi.org)), NIST([www.nist.gov](http://www.nist.gov)), ARI ([www.ari.org](http://www.ari.org)), ASTM ([www.astm.org](http://www.astm.org)), ISO ([www.iso.org](http://www.iso.org)), and AMCA ([www.amca.org](http://www.amca.org)).