

## ANSI/AHRI Standard 220

# 2014 Standard for Reverberation Room Qualification and Testing Procedures for Determining Sound Power of HVAC Equipment



2111 Wilson Boulevard, Suite 500  
Arlington, VA 22201, USA  
[www.ahrinet.org](http://www.ahrinet.org)

PH 703.524.8800  
FX 703.562.1942

Approved by ANSI on November 6, 2015

**IMPORTANT**

***SAFETY DISCLAIMER***

AHRI does not set safety standards and does not certify or guarantee the safety of any products, components or systems designed, tested, rated, installed or operated in accordance with this standard/guideline. It is strongly recommended that products be designed, constructed, assembled, installed and operated in accordance with nationally recognized safety standards and code requirements appropriate for products covered by this standard/guideline.

AHRI uses its best efforts to develop standards/guidelines employing state-of-the-art and accepted industry practices. AHRI does not certify or guarantee that any tests conducted under its standards/guidelines will be non-hazardous or free from risk.

Note:

This standard supersedes ANSI/AHRI Standard 220-2012.

This standard describes the methodology for determination of Sound Power Levels of broad-band, and/or discrete-frequency noise, and narrow-band noise sources in reverberation rooms. It is based on ANSI S12.51/ISO 3741. The method described herein requires reverberation room pre-qualification through test and the use of the Comparison Method to determine Sound Power Levels. This standard specifies the physical environment, procedures and equipment to qualify the reverberation room by test. Pre-qualifying the room ensures adequate modal density with the use of one source location to obtain acceptable accuracy and repeatability of results. The Reference Sound Source (RSS) used for the Comparison Method relies on ANSI/AHRI Standard 250 to accurately calibrate the RSS at all frequencies of interest. The use of the Comparison Method reduces a number of potential sources of data collection and calculation errors. The standard contains information on instrumentation, installation and operation of the source, procedures for determining the number of microphone positions or length of traverse, and procedures for the calculation of Sound Power Levels.

This standard is more restrictive than ANSI Standard S12.51/ISO 3741, which allows the user to test using either the Direct Method or the Comparison Method and also allows the user to employ a space with general characteristics. The intent of ANSI S12.51/ISO 3741 is to have a room that shall provide a "good" environment for testing, with the understanding that if the end result has a variation that is too high the user can increase the number of measurement locations to improve the spatial averaging and thus lower the variation. This is not practical for sources that are difficult to move.

## TABLE OF CONTENTS

SECTION	PAGE
Section 1. Purpose.....	1
Section 2. Scope.....	1
Section 3. Definitions.....	2
Section 4. Requirements for Qualification of Reverberation Rooms .....	3
Section 5. Reverberation Room Qualification Procedures .....	5
Section 6. Sound Power Testing Requirements and Calculations .....	8
Section 7. Information to Be Recorded.....	12
Section 8. Test Report.....	12
Section 9. Conformance Conditions .....	13

## TABLES

Table 1. Maximum Standard Deviations of Sound Power Level Reproducibility Determined in Accordance with this Standard .....	1
Table 2. Broadband Standard Deviation Limits.....	3
Table 3. Discrete Frequency Standard Deviation Limits .....	3
Table 4. Test Frequencies for Discrete Frequency Qualification .....	7
Table 5. One-third Octave Band Frequency Range .....	8
Table 6. Background Correction Limits by One-third Octave Band .....	10
Table 7. One-third Octave Band Numbers and A-Weighting Factors .....	11

## APPENDICES

Appendix A. References – Normative .....	14
Appendix B. References – Informative .....	14
Appendix C. Sample Calculation Results – Informative .....	15

**TABLES FOR APPENDICES**

Table C1. One-third Octaves .....	15
Table C2. UUT $L_w$ .....	15

# REVERBERATION ROOM QUALIFICATION AND TESTING PROCEDURES FOR DETERMINING SOUND POWER OF HVAC EQUIPMENT

## Section 1. Purpose

**1.1 Purpose.** The purpose of this standard is to provide the methodology for the determination of Sound Power Levels of noise sources that emit Broadband Sound and/or Discrete Frequency Sounds/Tones in reverberation rooms. The method described herein requires reverberation room pre-qualification through test and the use of the Comparison Method to determine Sound Power Levels. This standard specifies the physical environment, procedures, and equipment used to qualify the reverberation room by test. Pre-qualifying the room ensures adequate modal density with the use of one source locations to obtain acceptable accuracy and repeatability of results. The Reference Sound Source (RSS) used for the Comparison Method relies on ANSI/AHRI Standard 250 to accurately calibrate the RSS at all frequencies of interest. Sound rating values are often useful for applications and design, therefore it is important to acquire data and qualify measurement rooms in One-third Octave Bands. The use of the Comparison Method reduces a number of potential sources of error. The standard contains information on instrumentation, installation and operation of the source, procedures for determining the number of microphone positions or length of traverse, and procedures for the calculation of Sound Power Level. Measurements made in conformity with this standard will, with very few exceptions, result in standard deviations equal to or less than specified in Table 1.

The frequencies covered in this standard range from the 50 Hz to the 10,000 Hz One-third Octave Band (63 Hz to 8000 Hz Octave Bands). The 50 to 80 Hz one-third octave band sound for HVAC equipment affects product applications and often cannot be ignored. The product specific AHRI standard will specify the frequency range of interest for qualification, calculation, and reporting. This standard is based on ANSI S12.51/ISO 3741 but provides additional exceptions and extensions.

<b>Table 1. Maximum Standard Deviations of Sound Power Level Reproducibility Determined in Accordance with this Standard</b>	
One-third Octave Band Center Frequency, Hz	One-third Octave Band Maximum Standard Deviation of Reproducibility, $\sigma_{R0}$ , dB
50 - 80	4.0
100 - 160	3.0
200 - 315	2.0
400 - 5000	1.5
6000 - 10000	3.0

**1.1.1 Intent.** This standard is intended for the guidance of the industry, including manufacturers, engineers, installers, contractors and users.

**1.1.2 Review and Amendment.** This standard is subject to review and amendment as technology advances.

## Section 2. Scope

**2.1 Scope.** This standard applies to HVAC products where sound power is determined by measurement using the Comparison Method in a reverberation room that meets the qualification requirements as defined in Section 4 of this standard.