AHRI Standard 350

2015 (R2021) Standard for

Sound Performance Rating of Non-ducted Indoor Air-conditioning and Heat Pump Equipment

AIR-CONDITIONING, HEATING, & REFRIGERATION INSTITUTE
we make life better®

2311 Wilson Boulevard, Suite 400
Arlington, VA 22201, USA
www.ahrinet.org
PH 703.524.8800
FX 703.562.1942

Documents
Document Sharing Hub

Full document details: AHRI Standard 350-2015 R2021 - Sound Performance Rating of Non ducted Indoor Air conditioning and Heat Pump Equipment

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 AHRI Standard 350-2008.

Foreword

- This standard references the sound intensity test method defined in ANSI/AHRI Standard 230, as an alternate method of test to the reverberation room test method defined in ANSI/AHRI Standard 220 for determination of sound power ratings.
- Provisions for addressing Concealed versus Exposed Equipment test configurations have been added.

Price $10.00 (M) $20.00 (NM)
Printed in U.S.A.

©Copyright 2021, by Air-Conditioning, Heating, and Refrigeration Institute
Registered United States Patent and Trademark Office

Documents
Document Sharing Hub
Full document details: AHRI Standard 350-2015 R2021 - Sound Performance Rating of Non ducted Indoor Air conditioning and Heat Pump Equipment

TABLE OF CONTENTS

SECTION		PAGE
Section 1.	Purpose	1
Section 2.	Scope	1
Section 3.	Definitions	1
Section 4.	Test Requirements	2
Section 5.	Rating Requirements	5
Section 6.	Minimum Data Requirements for Published Ratings	6
Section 7.	Marking and Nameplate Data	6
Section 8.	Conformance Conditions	6

TABLES

Table 1.	Reproducibility in the Determination of Non-ducted Equipment Sound Power Levels	5

FIGURES

Figure 1.	Location of Equipment in the Test Room	3

APPENDICES

Appendix A.	References – Normative	7
Appendix B.	References – Informative	9
Appendix C.	Examples of Various Types of Exposed and Concealed Equipment – Informative	10

FIGURES FOR APPENDICES

Figure C1.	Exposed Sill Unit	10
Figure C2.	Exposed Vertical Stack Unit	10
Figure C3.	Exposed Horizontal Fan Coil Unit	11
Figure C4.	Concealed Sill Unit	12
Figure C5.	Concealed Vertical Stack Unit	12
Figure C6.	Concealed Horizontal Fan Coil Unit	13
Figure C7.	Concealed Vertical Stack Unit Test Setup – 5cm x 10cm Studs Cladded with 1.3cm Thick Drywall	14
Figure C8.	Concealed Horizontal Stack Unit Test Setup – Cladded with 1.3cm Thick Drywall	14

Documents
Document Sharing Hub

Full document details: AHRI Standard 350-2015 R2021 - Sound Performance Rating of Non ducted Indoor Air conditioning and Heat Pump Equipment

SOUND PERFORMANCE RATING OF NON-DUCTED INDOOR AIR-CONDITIONING AND HEAT PUMP EQUIPMENT

Section 1. Purpose

1.1 *Purpose.* The purpose of this standard is to establish for Non-ducted Indoor Air-conditioning and Heat Pump Equipment definitions; test requirements; rating requirements; minimum data requirements for Published Ratings; marking and nameplate data; and conformance conditions.

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 the indoor portions of factory-made Non-ducted Air-conditioning and Heat Pump Equipment as defined in ANSI/AHRI Standards 210/240, 340/360, 310/380, 440 and 1230. Products covered include but are not limited to: fan coils, air-source unitary heat pumps as well as unitary air-conditioners, water-source heat pumps, packaged terminal equipment, and variable refrigerant flow (VRF) systems.

Section 3. Definitions

All terms in this document will follow the standard industry definitions in the *ASHRAE Terminology* website (https://www.ashrae.org/resources--publications/free-resources/ashrae-terminology) unless otherwise defined in this section.

3.1 *Concealed Equipment.* Non-ducted Indoor Air-conditioning and Heat Pump Equipment that is designed to be located outside of the occupied space such that the casing radiated noise is acoustically isolated from the inlet and discharge sound. Refer to Appendix C for examples of various types of Concealed Equipment configurations.

3.2 *Exposed Equipment.* Non-ducted Indoor Air-conditioning and Heat Pump Equipment that is in the occupied space such that the casing radiated noise is included with the inlet and discharge sound. Refer to Appendix C for examples of various types of Exposed Equipment configurations.

3.3 *Hertz (Hz).* A unit of frequency equal to one cycle per second.

3.4 *Non-ducted Indoor Air-conditioning and Heat Pump Equipment*. For the purposes of this standard, non-ducted equipment communicates with the occupied space by free delivery and inlet or through enclosed airways with lengths less than 1 effective duct diameter.

3.5 *Octave Band*. A band of sound covering a range of frequencies such that the highest is twice the lowest. The Octave Bands used in this standard are those defined in ANSI/ASA Standard S1.11.

3.6 *One-third Octave Band.* A band of sound covering a range of frequencies such that the highest frequency is the cube root of two times the lowest frequency. The One-third Octave Bands used in this standard are those defined in ANSI/ASA Standard S1.11.

3.7 *Published Rating.* A statement of the assigned values of those performance characteristics, under stated rating conditions, by which a unit may be chosen to fit its application. These values apply to all units of like nominal size and type (identification) produced by the same manufacturer. As used herein, the term Published Rating includes the rating of all performance characteristics shown on the unit or published in specifications, advertising or other literature controlled by the manufacturer, at stated rating conditions.

AVA Documents
Document Sharing Hub

Full document details: AHRI Standard 350-2015 R2021 - Sound Performance Rating of Non ducted Indoor Air conditioning and Heat Pump Equipment

3.7.1 *Application Rating.* A rating based on tests performed at application Rating Conditions (other than Standard Rating Conditions).

3.7.2 *Standard Rating.* A rating based on tests performed at Standard Rating Conditions.

3.8 *Reference Sound Source (RSS).* Portable, aerodynamic sound source that produces a known stable broad band sound power output as defined in ANSI/AHRI Standard 250.

3.9 *Reproducibility*. Deviations in test results are obtained with the same method on identical test items in different laboratories with different operators using different equipment.

3.10 *"Shall" or "Should".* "Shall" or "should" shall be interpreted as follows:

3.10.1 *Shall.* Where "shall" or "shall not" is used for a provision specified, that provision is mandatory if compliance with the standard is claimed.

3.10.2 *Should. "Should"* is used to indicate provisions which are not mandatory but which are desirable as good practice.

3.11 *Sound Power Level, L_w*. Ten times the logarithm to the base ten of the ratio of the sound power radiated by the source to a reference sound power, expressed in decibels, dB. The reference sound power used in this standard is 1 picowatt, pW.

3.11.1 *A-weighted Sound Power Level, L_{wA}*. The logarithmic summation of A-weighted, one-third octave band Sound Power Levels.

3.12 *Sound Pressure Level, L_p.* Twenty times the logarithm to the base ten of the ratio of a given sound pressure to a reference sound pressure of 20 μPa, expressed in decibels, dB.

3.13 *Sound Quality Indicator (SQI).* The calculated metric determined when following the procedure contained in ANSI/AHRI Standard 1140 for quantifying sound quality whereby measured sound levels are weighted to adjust for psychoacoustic sensitivity to frequency distribution and any discrete tones which may be present and then converted to a single number Sound Quality Indicator.

Section 4. Test Requirements

4.1 *Test Requirements.* Unit Sound Power Level shall be determined by tests conducted in a reverberation room or using sound intensity.

4.1.1 If the reverberation room method is used, Sound Power Levels for the unit under test shall be determined according to ANSI/AHRI Standard 220. The reverberation room shall meet the requirements of and be qualified in accordance with ANSI/AHRI Standard 220, except as noted within the body of this standard. A RSS shall be used that meets the performance requirements and is calibrated per ANSI/AHRI Standard 250

4.1.2 If the sound intensity method is used, Sound Power Levels for the unit under test shall be conducted in accordance with ANSI/AHRI Standard 230.

4.1.3 Measured sound data shall be in One-third Octave Bands (100 Hz to 10,000 Hz are required, 50 Hz to 80 Hz are optional) in accordance with the procedures specified above for the method of test being used. A record shall be made of the actual equipment thermal rating conditions under which the equipment was tested. In addition, the equipment volumetric flow rate, m^3/s, and external static pressure, kPa gage, shall be recorded.

4.2 *Setup of Equipment for Testing*. Equipment shall be mounted in a way that is representative of a design application of the product.

4.2.1 Position A (Figure 1) – Mounted away from wall.

4.2.2 Position B (Figure 1) – Mounted against or through the wall with the bottom of equipment on the floor. The equipment shall be mounted at the minimum manufacturer's recommended projection into the room.

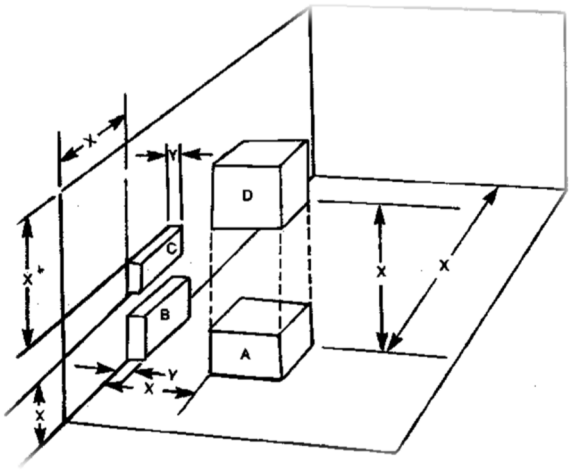
AVA Documents
Document Sharing Hub

Full document details: AHRI Standard 350-2015 R2021 - Sound Performance Rating of Non ducted Indoor Air conditioning and Heat Pump Equipment

4.2.3 Position C (Figure 1) – Mounted against or through the wall but the bottom of equipment is not on the floor. The equipment shall be mounted at the minimum manufacturer's recommended projection into the room.

4.2.4 Position D (Figure 1) – Ceiling mounted equipment may be suspended from the sound room ceiling or from a frame device or mounted on rails rigidly supported, for example, by concrete blocks.

4.2.5 All equipment shall be mounted according to the manufacturer's installation instructions. If any deviations from these instructions are necessary, they shall be done in a manner that will not affect the acoustic performance of the equipment.



A = Location for equipment used away from a wall
B = Location for equipment used against or through the wall on the floor
C = Location for equipment mounted against or through a wall
D = Location for equipment suspended or fastened to ceiling
X = 1.5 m minimum to adjoining room surfaces(s) other than mounting plane
Y = Manufacturers recommended minimum

Figure 1. Location of Equipment in the Test Room

4.2.6 In the case of wall-mounted equipment, the mounting wall shall be a heavy masonry or equivalent construction, or auxiliary mounting platform shall be provided, to minimize wall vibration effects.

4.2.7 Exposed, non-ducted equipment shall be setup in the test room without enclosure or ductwork.

4.2.8 Concealed Equipment shall be installed with the casing radiated noise acoustically isolated from the measured combined inlet and discharge sound and operated at free-delivery conditions. Acoustic isolation shall be achieved with either:

4.2.8.1 A stud construction enclosure with a minimum of 12 mm drywall or equivalent. The enclosure shall not be in contact with the equipment under test except at the inlet and outlet. Installation shall be mid-wall style (conforming to Figure 1, and as suggested in Figure C7), unless otherwise specified in the manufacturer's installation, operation and maintenance (IOM) manual.

4.2.8.2 Direct attachment of 12 mm drywall to the equipment with sheet metal screws or adhesive.

The laboratory shall record details of the construction enclosure, including: stud type, orientation and spacing, drywall thickness, spacing between the equipment and drywall and sound absorptive material if present. If direct attached the attachment method shall be noted.

A description of any grills, diffusers or acoustic panels used in the test setup shall be recorded.

AVA Documents
Document Sharing Hub

Full document details: AHRI Standard 350-2015 R2021 - Sound Performance Rating of Non ducted Indoor Air conditioning and Heat Pump Equipment