AHRI Standard 370

2015 Standard for

Sound Performance Rating of Large Air-cooled Outdoor Refrigerating and Air-conditioning Equipment

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Note:

This standard supersedes ANSI/AHRI Standard 370-2011.

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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	4
Section 6.	Minimum Data Requirements for Published Ratings	5
Section 7.	Conformance Conditions	5

APPENDICES

Appendix A.	References – Normative	6
Appendix B.	References – Informative	7
Appendix C.	Expected Size of Measurement Errors – Informative	8
Appendix D.	Determining Sound Power Levels Using Sound Pressure Measurements Made in a Free Field Over a Reflecting Plane – Normative	9
Appendix E.	Determination of K_2 – Informative	13

TABLES FOR APPENDICES

Table D1.	Maximum Standard Deviations of Sound Power Level Reproducibility Determined in Accordance with this Standard	9
Table E1.	Required Number of RSS Positions Based on Parallelepiped Length	14

FIGURES FOR APPENDICES

Figure D1.	Plan View of Measurement Parallelepiped	10
Figure D2.	Elevation of Measurement Parallelepiped	10
Figure E1.	Schematic of RSS Locations Required for Determination of K_2	14

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LARGE AIR-COOLED OUTDOOR REFRIGERATING AND AIR-CONDITIONING EQUIPMENT

Section 1. Purpose

1.1 *Purpose.* The purpose of this standard is to establish methods for determining the sound ratings of the outdoor portions of factory-made commercial and industrial Large Air-cooled Outdoor Refrigerating and Air-conditioning Equipment. It establishes definitions; test requirements; rating requirements; minimum data requirements for Published Ratings; 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 air-cooled outdoor portions of factory-made commercial and industrial Large Air-cooled Outdoor Refrigerating and Air-conditioning Equipment greater than 40kW cooling capacity. This equipment is covered by AHRI Standard 340/360, *Performance Rating of Commercial and Industrial Unitary Air-conditioning* and *Heat Pump Equipment*, ANSI/AHRI Standards 365 (I-P) and 366 (SI), *Commercial and Industrial Unitary Air-conditioning Condensing Units*, ANSI/AHRI Standard 520, *Performance Rating of Positive Displacement Condensing Units*, ANSI/AHRI Standard 460, *Performance Rating of Remote Mechanical-draft Air-cooled Refrigerant Condensers*, AHRI Standards 490 (I-P) and 491 (SI), *Remote Mechanical-draft Evaporatively-cooled Refrigerant Condensers*, as well as AHRI Standards 550/590 (I-P) and 551/591 (SI), *Performance Rating of Water Chilling Packages Using the Vapor Compression Cycle*.

2.2 *Exclusions.* This standard does not apply to the outdoor portions of unitary air-conditioning or heat pump equipment which fall within the scope of AHRI Standard 270, *Sound Rating of Outdoor Unitary Equipment* (cooling capacity ratings of less than 40 kW).

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 *Comparison Method.* A method of determining Sound Power Level of the equipment under test in a reverberation room by comparing the average Sound Pressure Level of that equipment to the average Sound Pressure Level of a Reference Sound Source of known sound power level output. The difference in Sound Power Level is equal to the difference in Sound Pressure Level when conditions in the room are the same for both sets of measurements.

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

3.3 *Large Air-cooled Outdoor Refrigerating and Air-conditioning Equipment.* Equipment that consists of one or more assemblies, including an outdoor coil and outdoor fan, and which may include a compressor.

3.4 *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 Standard S1.11.

3.5 *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. The One-third Octave Bands used in this standard are those defined in ANSI Standard S1.11.

3.6 *Published Rating*. A statement of the assigned values of those performance characteristics, under stated Rating

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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.

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

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

3.7 *Rating Conditions*. Any set of operating conditions under which a single level of performance results, and which cause only that level of performance to occur.

3.7.1 *Standard Rating Conditions*. Rating Conditions used as the basis of comparison for performance characteristics.

3.8 *Reference Sound Source* (*RSS*). A portable, aerodynamic sound source that produces a known stable broad band sound power output.

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

3.11 *Sound Intensity Level, L_i*. Ten times the logarithm to the base ten of the ratio of the sound intensity component radiated by the source to a reference sound intensity, expressed in decibels (dB). The reference sound intensity used in this standard is 1 picowatt per square meter, pW/m^2 (internationally recognized units). The sound intensity component is the value of the intensity vector, normal to a measurement surface, directed out of a volume enclosing the sound source.

3.12 *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).

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

3.13 *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.

3.14 *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 discreet tones which may be present and then converted to a single number Sound Quality Indicator.

3.15 *Unit Under Test (UUT).* HVAC equipment for which the sound power is to be determined.

Section 4. Test Requirements

4.1 *Test Requirements.* All standard sound power level ratings shall be determined by tests conducted in a qualified reverberation room, anechoic room, or an indoor or outdoor space that is an essentially free field over a reflecting plane.

4.1.1 Sound tests in a reverberation room shall be conducted in a reverberation room meeting the requirements of and is qualified per ANSI/AHRI Standard 220. Sound tests shall be conducted in accordance with ANSI/AHRI Standard 220 using a RSS that meets the performance requirements of and is calibrated per ANSI/AHRI Standard 250.

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4.1.2 Sound tests in a hemi-anechoic room which affords a free field condition above the measurement space or above a reflecting plane shall be conducted in accordance ISO 3745, as adapted for Large Air-cooled Outdoor Refrigerating and Air-conditioning Equipment in Appendix C of this standard.

4.1.3 Sound tests in indoor or outdoor spaces that qualify as an essentially free field over a reflecting plane shall be conducted in accordance with ISO 3744, as adapted for Large Air-cooled Outdoor Refrigerating and Air-conditioning Equipment in Appendix C of this standard.

4.1.4 Sound tests using sound intensity shall be conducted in accordance with ANSI/AHRI Standard 230, as adapted for Large Air-cooled Outdoor Refrigerating and Air-conditioning Equipment. For this equipment, the sound component of interest as discussed in Section 7 of ANSI/AHRI Standard 230 is the entire unit. The measurement grid shall enclose the entire unit.

4.2 *Test Conditions*. Standard sound ratings shall be based on sound tests conducted with the unit operating at rated voltage (V), phase, and frequency (Hz) as specified on the unit nameplate and measured at the service connection. Sound tests shall be conducted as prescribed below:

4.2.1 *Standard Sound Ratings*. Standard sound ratings shall be based on sound tests conducted with the unit operating at rated voltage, V, phase and frequency, Hz, as specified on the unit nameplate and measured at the service connection. The sound measurements shall be made with the equipment operating at the AHRI standard thermal rating condition.

4.2.2 *Application Sound Rating (Optional).* Application Sound Ratings for conditions other than the AHRI standard thermal rating condition shall be based on sound tests conducted with the equipment operating at those conditions.

Note: Where applicable, manufacturers should account for contributions from exhaust fan(s), return fan(s), and indoor fan(s) which would be measured per ANSI/AHRI Standards 260 (I-P) and 261 (SI) and be added to AHRI Standard 370 Sound Rating.

4.2.3 *Fan(s) Only Sound Rating (Optional)*. The compression equipment shall be turned off and sound readings taken with only the outdoor fans operating. The speed of the fan shall be controlled to match within ± 3% of the speed during the rating condition.

4.2.4 *Test Condition Tolerances*. During sound rating tests, the equipment operating conditions shall not deviate from the specified operating conditions by more than the following tolerances

4.2.4.1 *Testing with Air Temperature Control*. When not simulating indoor or outdoor load, the air temperature shall be controlled to ± 1°C.

4.2.4.2 *Testing with Simulated Indoor-side Load*. When the indoor-side loading is simulated by a method not requiring air temperature control, the following tolerances apply during sound rating tests:

Evaporator pressure……± 15 kPa

4.2.4.3 *Testing with Simulated Outdoor-side Load*. When the outdoor-side loading is simulated by a method not requiring air temperature control, the following tolerances apply during sound rating tests:

Compressor discharge pressure……. ± 70 kPa

4.3 *Data to be Taken.* Sound level data taken shall be in One-third Octave Bands (50 Hz to 10,000 Hz are required) in accordance with the procedure specified for the type of test being conducted.

4.4 *Air Velocity at Measurement Positions.* Sound pressure level measurements shall not be made when the air velocity over the microphone exceeds 2.0 m/s. A foam windscreen shall be installed on the microphone which shall not affect the microphone response by more than ± 1 dB for frequencies of 20 to 4,000 Hz or ± 1.5 dB for frequencies above 4,000 Hz. Sound Intensity Level measurements in airflow shall meet the requirements of ANSI/AHRI Standard 230 Section 6.3.

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