AHRI Standard 260-2024 (SI/I-P)

Sound Rating of Ducted Air Moving and Conditioning Equipment

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IMPORTANT

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ICS Code: 17.140.01

Note:

This standard supersedes AHRI Standard 260-2017 (I-P) and AHRI Standard 261-2017 (SI).

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Intent

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

Review and Amendment

This standard is subject to review and amendment as technology advances.

2024 Edition

This edition of AHRI Standard 260 (SI/I-P), *Sound Rating of Ducted Air Moving and Conditioning Equipment*, was prepared by the Airside Standards Technical Committee. The standard was approved by the Standards Committee on 11 December 2024.

Origin and Development of AHRI Standard 260

ARI 260-2001 was published as a new standard in 2001

Addendum 1 was published to replace Equation 5 in Section 5.3.1 in August 2002

Revised in 2011 to update Hertz *octave band* requirement, align sound power determination with AHRI 220 and ISO 9614, align duct end correction determination with ASHRAE Technical Report 1314, align acoustic test elbow corrections method, and was approved as an American National Standard (ANS) on 27 April 2012

In 2012, AHRI 261-2012 (SI) was published as a new standard that that was partitioned from AHRI Standard 260-2012 (I-P) and both were approved as an ANS on 26 June 2013

AHRI 260-2017 (I-P) and AHRI 261-2017 (SI) revised sound power determination to align with AHRI 230 if *sound intensity* is used, and revised sound rating predictions for untested fan operating points

Summary of Changes

AHRI 260-2024 (SI/I-P) contains the following updates to the previous edition:

- Combined AHRI 260 (I-P) and AHRI 261 (SI) to use joint units.
- The SI units used correspond to what is used internationally, not necessarily a direct conversion from I-P units.
- Updated language to clarify that the standard covers variable speed units, not just fixed speed.
- Updated figures to be more clear and align nomenclature to the body text.

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Maria Woodbury		AHRI Staff Liaison

Airside Standards Technical Committee Scope:

The Airside STC is responsible for development and maintenance of standards and guidelines related to sound and vibration of equipment whose primary function is to move or condition air, or both.

Out of scope for this STC are standards whose primary purpose is not sound and vibration performance, or that are common to both airside and water/refrigeration.

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SOUND RATING OF DUCTED AIR MOVING AND CONDITIONING EQUIPMENT

Section 1. Purpose

1.1 Purpose

This standard establishes definitions, requirements for acquiring sound data, sound level calculations, equipment sound ratings, and conformance conditions for factory-assembled ducted air moving and conditioning equipment.

1.2 Rationale

Ducted equipment presents unique challenges when providing sound ratings because their ratings are used to both compare products and to provide the information necessary to predict application sound levels. For these reasons, the sound ratings define the sound coming from portions of the equipment (*sound components*). The *sound components* are the *sound sources* that impact the application sound paths.

Ducted air-conditioning equipment can have ducted discharge, ducted inlet, and casing radiated *sound components*. Depending on the applied configuration of the ducted air-conditioning equipment, free discharge (or free inlet) combined with the casing radiated *sound component* can be required. All *sound components* are acoustically described/rated by utilizing a *mapped sound rating* approach that references a product's fan operating map, supply fan map, or return/exhaust fan map. The supply fan is contained in the *base unit* of the product. In addition, this standard defines an approach to account for the acoustical effects of product *appurtenances* (such as modulation devices or inlet/discharge plena) and other *sound sources* (such as the refrigeration circuit and return and exhaust fans) to the *base unit mapped sound rating*. Thus, a *mapped sound rating* can be developed for a given product configuration and each of the *sound components* defining the sound for any product operating condition.

Figure 1 presents an example of a product application showing the relationship between the product *sound components* and the application sound paths. Figure 2 presents an example of a vertically ducted product depicting the contribution of product *sound sources* on *sound components*.

All *sound components* are tested utilizing either a reverberation room (qualified by test) or using *sound intensity*. Reverberation room tests are conducted using the *comparison method* and a calibrated *reference sound source (RSS)*, while the *sound intensity* tests are conducted using measurements made at discrete points or by the scanning method. Sound ratings are in the form of *octave band sound power levels*, dB, from 63 Hz to 8000 Hz derived from *one-third octave band* measurements. In addition to the stated *octave band* ratings, this standard can be used to provide *one-third octave band sound* ratings from 50 Hz to 10,000 Hz.

In the example presented in

Figure 1, there are two *sound components* present, ducted discharge and free inlet combined with casing radiated. The ducted discharge *sound component* affects or defines the source strength for two of the four application sound paths shown in

Figure 1: 1) the supply airborne sound and 2) the supply breakout sound. The free inlet combined with casing radiated *sound component* affects or defines the source strength for the 3) return airborne and 4) wall transmission application sound paths.

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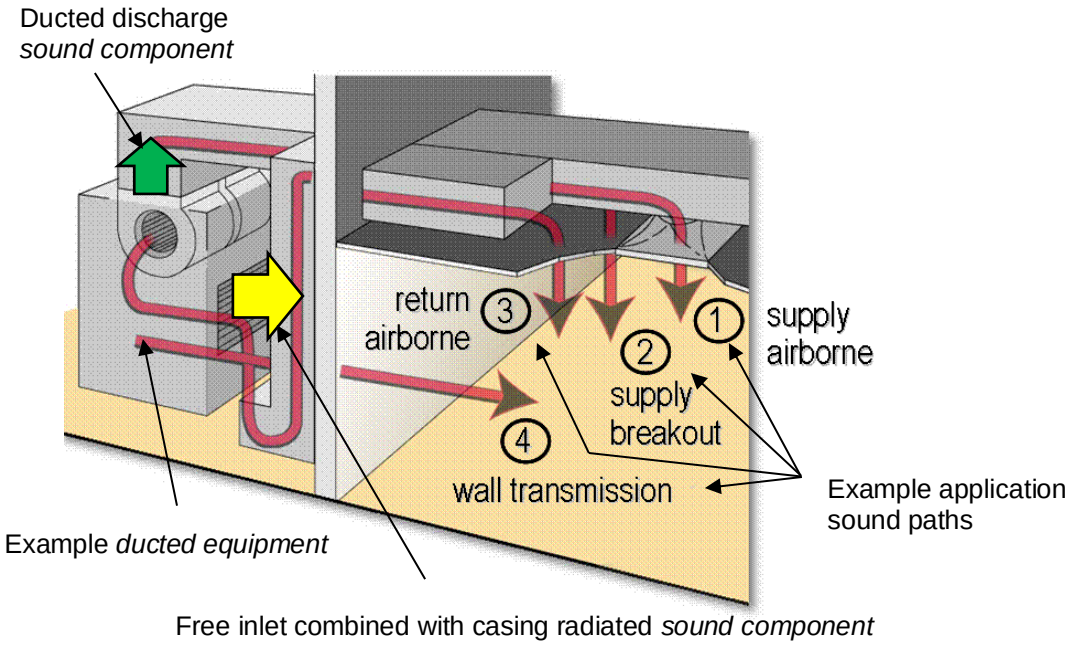


Figure 1 Example of a Ducted Product Application (Informative)

Figure 2 shows a vertical ducted unit with *sound components* and their contributing product *sound sources*. In this example, there are two *sound components*, the ducted discharge and the ducted inlet. The ducted discharge *sound component* is first defined by the supply fan discharge sound in the *base unit* coupled with the discharge plenum. The contribution of *appurtenance* sound from supply fan discharge airflow impinging the heat exchanger in the discharge plenum is added to the supply fan discharge sound. Finally, the effects of the other sources on the ducted discharge sound from the condenser fans and the refrigerant circuit are included. For the ducted inlet *sound component*, the sound from the inlet side of the return and inlet side of the supply fan are included.

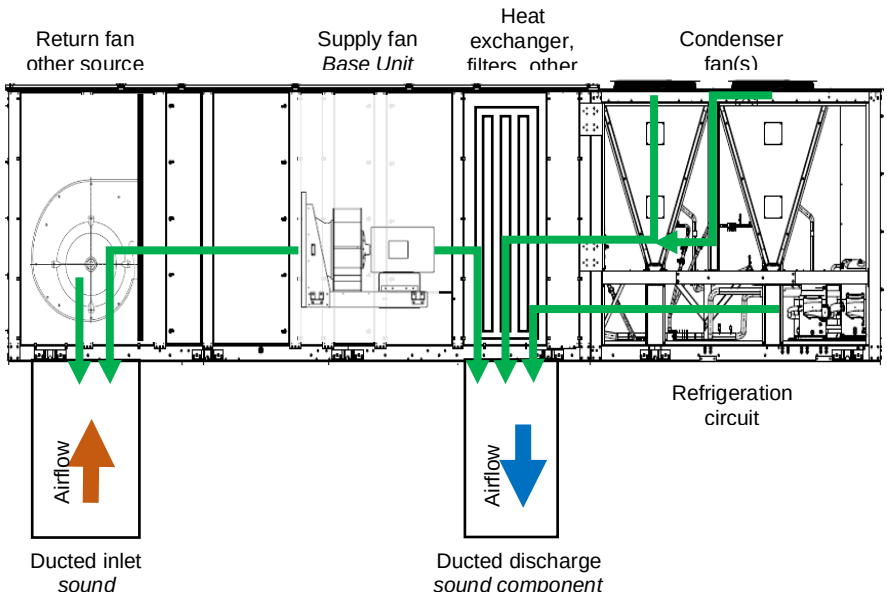


Figure 2 Example Relationship Between Sound Components and Sound Sources (Informative)

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Section 2. Scope

2.1 Scope

This standard applies to *ducted equipment* containing fans and specifies methods for determining the sound power ratings, using sound data for rating the product *sound components* across the operating range. *Mapped sound ratings* reported are *octave band sound power levels* from 63 Hz to 8000 Hz. In addition to the stated *octave band mapped sound ratings*, this standard can be used to provide *one-third octave band mapped sound ratings* from 50 Hz to 10,000 Hz.

2.2 Exclusions.

This standard does not apply to the following AHRI classes of equipment:

1) Outdoor heat rejection sections of equipment addressed in AHRI 270 and AHRI 370
2) Non-ducted equipment addressed in AHRI 300 and AHRI 350
3) Terminal equipment addressed in AHRI 880 (I-P) and AHRI 881 (SI)
4) Ductless fan coil units addressed in AHRI 440 (I-P)
5) Active chilled beams addressed in AHRI 1240 (I-P) and AHRI 1241 (SI)

Section 3. Definitions

All terms in this document shall follow the standard industry definitions in the ASHRAE Terminology website unless otherwise defined in this section. For acoustic-related terms, refer to the ASA Standard Term Database.

3.1 Expression of Provisions

Terms that provide clear distinctions between requirements, recommendations, permissions, options, and capabilities.

3.1.1 "Can" or "cannot"

Express an option or capability.

3.1.2 "May"

Signifies a permission expressed by the document.

3.1.3 "Must"

Indication of unavoidable situations and does not mean that an external constraint referred to is a requirement of the document.

3.1.4 "Shall" or "shall not"

Indication of mandatory requirements to strictly conform to the standard and where deviation is not permitted.

3.1.5 "Should" or "should not"

An expression of alternatives rather than requirements. In the negative form, an alternative is the expression of potential choices or courses of action that is not preferred but not prohibited.

3.2 Standard Specific Definitions

3.2.1 Acoustic Baffle

A barrier that creates a well-defined duct termination and test surface for a ducted *sound intensity* measurement. The barrier is rigid and non-absorbing.

3.2.2 Acoustic Test Duct

A duct used to convey the sound of the unit configuration under test to the reverberation room or intensity surface during a ducted discharge or ducted inlet *sound component* test.

3.2.3 Acoustic Test Duct Elbow

An elbow that can be added to the *acoustic test duct* to facilitate testing.

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3.2.4 Acoustic Test Duct Elbow Correction (E_2)

A correction in a frequency band to account for insertion loss effects of the elbow on the sound propagating through the *acoustic test duct* (see Appendix C).

3.2.5 Appurtenance

An addition to a *base unit* for purposes including air modulation, heat transfer, control, isolation, safety, and static pressure regain. Examples include:

- Coil(s)
- Electric heater(s)
- Air filter(s)
- Damper(s)
- Moisture eliminator(s)
- Fan-motor drive(s)
- Gas heat exchanger(s)
- Inlet or discharge plena
- Air mixing device(s)
- Flow straightener(s)
- Modulation device(s) in the fan inlet/discharge
- Application duct geometry(s) (such as duct elbow configurations)
- Alternate unit casing construction(s) (such as double walled, lined, perforated face)

3.2.6 Base Unit

A factory-made encased assembly consisting of one or more fans meant to be connected to a duct and other necessary equipment to perform one or more of the functions of circulating, cleaning, heating, cooling, humidifying, and mixing of air, and can include a source of heating or cooling.

3.2.7 Comparison Method

A method of determining *sound power level* by comparing the average sound pressure level produced in the room to an *RSS* 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.

3.2.8 Ducted Equipment

Heating, ventilating, and air-conditioning equipment having one or more supply fans that employ ductwork to convey the conditioned air to or from the selected space, or both, and can have combinations of discharges and inlets as follows:

1) Ducted discharge(s) and ducted inlet(s)
2) Ducted discharge(s) with free inlet(s)
3) Ducted inlet(s) with free discharge(s)

This equipment can be ducted in horizontal and vertical configurations, and can incorporate multiple inlets and outlets.

3.2.9 Duct End Correction (E_1)

A correction in a frequency band that accounts for the acoustic energy in an *acoustic test duct* that is prevented from entering the test space by the impedance mismatch created by the termination of the *acoustic test duct*.

3.2.10 Effective Diameter (D_e)

The diameter of a circular duct equal in area to a specific *acoustic test duct*.

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