

**AHRI Standard 841 (SI**

**2015 Standard for**

# **Performance Rating of Unit Ventilators**



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## **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 840-98.  
See AHRI Standard 840 for I-P ratings.

### **AHRI CERTIFICATION PROGRAM PROVISIONS**

#### **Scope of the Certification Program**

The certification program includes Unit Ventilators, as defined in Section 3, with outside air ventilation and return air dampers capable of providing ventilation air of at least 80% of rated standard airflow with the capability of providing any combination of these functions: humidity control, circulation, heating, cooling and filtering of air.

#### **Certified Ratings**

Refer to the Unit Ventilators Operations Manual for the certified ratings.

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# PERFORMANCE RATING OF UNIT VENTILATORS

## Section 1. Purpose

**1.1** *Purpose.* The purpose of this standard is to establish, for Unit Ventilators: definitions; classifications; test requirements; rating requirements; minimum data requirements for Published Ratings; operating requirements; 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 Unit Ventilators, defined in Section 3.6.

**2.2** *Exclusions.* This standard does not apply to equipment as defined in the following standards:

**2.2.1** This standard does not apply to room air-conditioners, which are covered in AHAM Standard RAC-1 and/or ANSI Standard Z234.1.

**2.2.2** This standard does not apply to central-station air-handling units, which are covered in ANSI/AHRI Standard 431 (SI).

**2.2.3** This standard does not apply to variable refrigerant flow multi-split air conditioners and multi-split heat pumps, which are covered in ANSI/AHRI Standard 1230.

## 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>) and in ANSI/AHRI Standard 210/240, ANSI/AHRI Standard 440, ANSI/AHRI/CSA Standard 310/380, ANSI/AHRI Standard 390, and ANSI/AHRI/ASHRAE/ISO Standard 13256-1.

**3.1** *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.

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

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

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

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

**3.2.2** *Application Rating Conditions.* Rating conditions that are not the standard rating conditions.

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

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

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

**3.4** *Standard Air.* Air weighing 1.204 kg/m<sup>3</sup> which approximates dry air at 21.1°C at a barometric pressure of 101.3 kPa.

**3.5** *Standard Ventilation Rate.* The outdoor airflow to be provided in the breathing zone to dilute contaminants generated by space occupants and contents of the building contaminants, m<sup>3</sup>/s.

**3.6** *Unit Ventilator.* A factory-made assembly, equipped with outside air ventilation and return air dampers capable of introducing ventilation air of at least 80% of rated air flow of Standard Air, while also having the capability to provide any combination of the following functions: humidity control, heating, cooling, and filtering of air. The source of humidity control, heating or cooling supplementary to that from ventilation air, may be remote or an integral part of the unit itself. This equipment is designed for free delivery of air into a room, but may be applied with minimal ductwork having a static resistance not exceeding 125 Pa. This equipment can be either vertical floor standing or horizontally mounted, in or adjacent to the space it serves. This equipment is provided with air capacities of 1415 m<sup>3</sup>/s or less.

**3.6.1** *DX Fan-coil Unit Ventilators.* Any equipment as defined in ANSI/AHRI Standard 210/240 with ventilation capabilities as defined in Section 3.6.

**3.6.2** *Hydronic Fan-coil Unit Ventilators.* Any equipment as defined in ANSI/AHRI Standard 440 with ventilation capabilities as defined in Section 3.6.

**3.6.3** *Self-contained Unit Ventilators.* Any equipment as defined in ANSI/AHRI/CSA Standard 310/380 with ventilation capabilities as defined in Section 3.6.

**3.6.4** *Single Package Vertical Unit Ventilators.* Any equipment as defined in ANSI/AHRI Standard 390 with ventilation capabilities as defined in Section 3.6.

**3.6.5** *Water-source Self-contained Unit Ventilators.* Any equipment as defined in ANSI/AHRI/ASHRAE/ISO Standard 13256-1 with ventilation capabilities as defined in Section 3.6.

## **Section 4. Classifications**

**4.1** *Methods of Classification.* Unit ventilators shall be classified according to the following:

**4.1.1** *By Unit Type.*

**4.1.1** DX Fan-coil Unit Ventilators.

**4.1.2** Hydronic Fan-coil Unit Ventilators.

**4.1.3** Self-contained Unit Ventilators.

**4.1.4** Single Package Vertical Unit Ventilators.

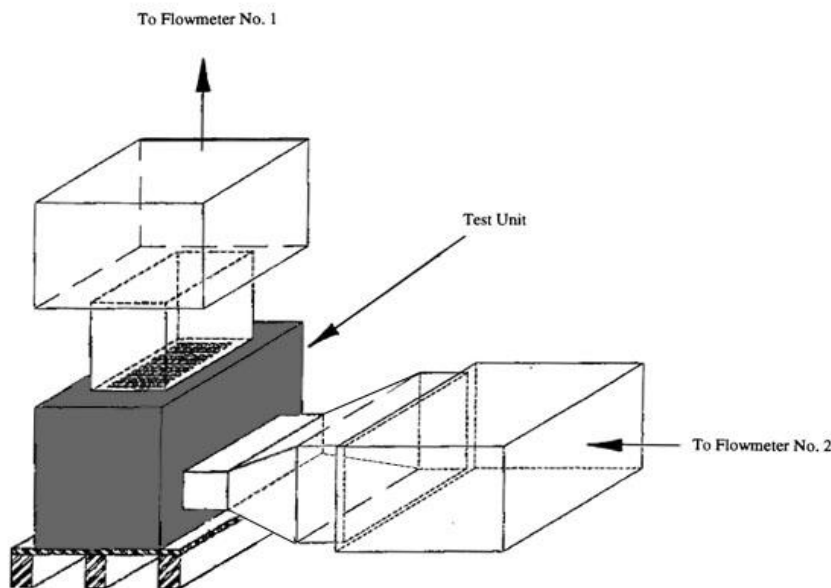
**4.1.5** Water-source Self-contained Unit Ventilators.

## Section 5. Test Requirements

**5.1 Testing Requirements.** All ratings shall be verified by tests conducted in accordance with ANSI/ASHRAE Standard 79.

**5.1.1 Room Air Test.** The room air test shall be conducted with the ventilation air inlet opening sealed so that no airflow enters the unit except from the room side. The airflow rate shall be the value measured from flowmeter 1 as depicted in Figure 1 and as indicated in Table 1.

**5.1.2 Ventilation Air Test.** The ventilation air test shall be conducted with an airflow rate measuring apparatus connected to the ventilation air opening. The airflow rate shall be the value measured from flowmeter 2 as depicted in Figure 1. Flowmeter 1 and any associated ductwork shall be removed for this test. Units shall be tested without any outside air intakes, louvers, wall boxes, etc. in place. The unit shall be tested with an external static of negative 0.01 kPa measured at the ventilation air inlet to simulate the pressure drop of a typical device and as indicated in Table 1.



**Figure 1. Standard Ventilation Rate Test Set-up**

## Section 6. Rating Requirements

**6.1 Standard Ratings.**

**6.1.1 Standard Performance Ratings.** All applicable cooling capacity, heating capacity, power input, efficiency, standard airflow rate, fluid flow rate, and pressure drop ratings shall be verified by tests conducted at the Standard Rating Conditions, in accordance with the applicable standard(s) referenced in Sections 3.6.1, 3.6.2, 3.6.3, 3.6.4 and 3.6.5.

**6.1.2 Standard Ventilation Rate.** The Standard Ventilation Rate, expressed in percent, shall be determined in accordance with ANSI/ASHRAE Standard 79 by conducting two separate tests at the conditions specified in Table 1. References may also be made to ANSI/ASHRAE Standard 79 for a typical duct connection arrangement.

**6.2 Electrical Conditions.** All Standard Rating tests shall be performed at the nameplate rated voltage and frequency. For units with dual nameplate voltage ratings, standard rating tests shall be performed at both voltages, or at the lower of the two voltages, if only a single standard rating is to be published.

**6.3 Equipment.** Filters, any air-mixers, air-inlets, grilles, deflecting vanes, and any other regularly-furnished equipment shall be in place during all tests.

<b>Table 1. Air Flow Testing Conditions</b>		
	Room Air Test	Ventilation Air Test
Inlet Air Temperature	21°C to 27°C dry bulb	21°C to 27°C dry bulb
Heating or cooling means	Not in operation	Not in operation
Static Pressure difference between room air inlet and outlet	0.0 kPa	Free discharge
Static Pressure at ventilation air inlet	N/A	Negative 0.01 kPa
Fan Speed Setting	Same as for standard cooling rating condition	Same as for standard cooling rating condition
Inside /Outside Damper Position	Adjusted for full room air (no ventilation air)	Adjusted for full ventilation air (no room air)
Face/Bypass Damper Position (if equipped)	Adjusted for full face, 0% bypass	Adjusted for full face, 0% bypass
ANSI/ASHRAE Standard 41.2 Test Arrangements	See Figure 14 of ANSI/ASHRAE Standard 41.2	See Figure 13 of ANSI/ASHRAE Standard 41.2

**6.4** The Standard Ventilation Rate shall be the ratio of air flow rate measured in accordance with Section 5.4.2 divided by the air flow rate measured in accordance with Section 5.4.1 expressed as a percent.

**6.5 Application Ratings.** Ratings at conditions other than the Standard Rating Conditions may be published as application ratings, and shall be based on data determined by the methods of testing prescribed in the applicable standards referenced in Sections 3.6.1, 3.6.2, 3.6.3, 3.6.4 and 3.6.5.

**6.6 Tolerances.** To comply with this standard, published or reported cooling capacity, heating capacity, power input, efficiency, standard air flow rate, fluid flow rate, and pressure drop shall be based on data obtained in accordance with the provisions of this section, and shall be such that any production unit selected at random and tested in accordance with the standard shall achieve 100% of rated or published value, less the allowable tolerance specified in the applicable standard(s) referenced in 3 Sections 3.6.1, 3.6.2, 3.6.3, 3.6.4 and 3.6.5.

The tested Standard Ventilation Rate shall be no less than 95% of the rated value and no less than 80% of the airflow rate measured in Section 6.4.

**Section 7. Minimum Data Requirements for Published Ratings**

**7.1 Published Ratings.** Wherever application ratings are published or printed, they shall include or be accomplished by the Standard Rating clearly designated as such, including a statement of the conditions at which the ratings apply. All Published Ratings shall include the Standard Ventilation Rate, as well as the information required per product type as shown in Table 2.

**Table 2. Standard Rating Conditions for Unit Ventilators**

Published Ratings	Self-Contained Unit Ventilators	Single Package Vertical Unit Ventilator	Hydronic Fan-coil Unit Ventilators	DX Fan-coil Unit Ventilators	Water-source Self-contained Unit Ventilators
Cooling Capacity	Full load at standard temperature	Full load at standard temperature	Full load at standard temperature	Full load at high temperature	Full load at standard temperature and part load at low temperature
Cooling Efficiency	Part load IPLV	Part load IPLV	N/A	N/A	N/A
Heating Capacity	Full load at standard temperature	Full load at standard temperature		Full load at high temperature	Full load at standard temperature and part load at low temperature
Heating Efficiency	Full load COP	Full load COP		Full load and part load HSPF	Full load and part load COP
Sensible Cooling Capacity	N/A	N/A	Applicable	N/A	N/A
Standard Ventilation Rate	Applicable	Applicable	Applicable	Applicable	Applicable
Power Input	N/A	N/A	Applicable	N/A	N/A

**7.1.1** Cooling Capacity, W

**7.1.2** Heating Capacity, if applicable, W

**7.1.3** Heating Coefficient of Performance (COP), if applicable

**7.1.4** Part Load Rating (IPLV), kW

**7.1.5** Region IV Heating Seasonal Performance Factor, HSPF, Minimum Design Heating Requirement, if applicable

**7.1.6** Power Input, W

**7.1.7** Standard Ventilation Rate, m<sup>3</sup>/s

**Section 8. Operating Requirements**

**8.1** *Performance Requirements.* To comply with this standard, unit ventilators shall be designed and produced so as to perform in accordance with the provisions of this section, in such a manner that any production unit will meet the requirements detailed herein.

**8.1.1** *Self-contained Unit Ventilators.* All performance tests for Self-contained Unit Ventilators shall be tested in accordance with the provisions of ANSI/AHRI/CSA Standard 310/380.

**8.1.2** *Single Package Vertical Unit Ventilator.* All performance tests for Single Package Vertical Unit Ventilator shall be tested in accordance with the provisions of ANSI/AHRI Standard 390.

**8.1.3** *Water-source Self-contained Unit Ventilators.* All performance tests for Water-source Self-contained Unit Ventilators shall be tested in accordance with the provisions of ANSI/AHRI/ASHRAE/ISO Standard 13256-1.



**8.1.4** *Hydronic Fan-coil Unit Ventilators.* All performance tests for Hydronic Fan-coil Unit Ventilators shall be tested in accordance with the provisions of ANSI/AHRI Standard 440.

**8.1.5** *DX Fan-coil Unit Ventilators.* All performance tests for DX Fan-coil Unit Ventilators shall be tested in accordance with the provisions of ANSI/AHRI Standards 210/240.

### **Section 9. Marking and Nameplate Data**

**9.1** *Marking and Nameplate Data.* The unit nameplate shall display, as a minimum:

**9.1.1** The name of the manufacturer and/or the supplier responsible for the performance ratings.

**9.1.2** The model number of the equipment.

**9.2** If the nameplate shows electrical characteristics, then nameplate voltages for 60 Hz systems shall include one or more of the equipment nameplate voltage ratings shown in Table 1 of ANSI/AHRI Standard 110. Nameplate voltages for 50 Hz systems shall include one or more of the utilization voltages shown in Table 1 of IEC Standard 60038.

### **Section 10. Conformance Conditions**

**10.1** *Conformance.* While conformance with this standard is voluntary, conformance shall not be claimed or implied for products or equipment within the standard's Purpose (Section 1) and Scope (Section 2) unless such product claims meet all of the requirements of the standard and all of the testing and rating requirements are measured and reported in complete compliance with the standard. Any product that has not met all the requirements of the standard cannot reference, state, or acknowledge conformance to the standard in any written, oral, or electronic communication.

## APPENDIX A. REFERENCES - NORMATIVE

**A1** Listed here are all standards, handbooks and other publications essential to the formation and implementation of the standards. All references in this appendix are considered as part of the standard.

**A1.1** AHAM RAC-1, *Room Air Conditioners*, 2014, Association of Home Appliance Manufacturers, 1111 19th Street, NW, Suite 402 Washington, DC 20036, U.S.A.

**A1.2** ANSI Standard Z234.1, *Room Air Conditioners*, 1972, American National Standards Institute, 11 West 42nd Street, New York, NY 10036 U.S.A.

**A1.3** ANSI/AHRI Standard 110-2012, *Air Conditioning, Heating, and Refrigerating Equipment Nameplate Voltages*, 2012, American National Standards Institute/Air-Conditioning, Heating, and Refrigeration Institute, 11 West 42nd Street, New York, NY 10036 U.S.A./2111 Wilson Boulevard, Suite 500, Arlington, VA 22201, U.S.A.

**A1.4** ANSI/AHRI Standard 210/240-2008 with Addenda 1 and 2, *Unitary Air-Conditioning and Air-Source Heat Pump Equipment*, 2012, American National Standards Institute/Air-Conditioning, Heating, and Refrigeration Institute, 11 West 42nd Street, New York, NY 10036 U.S.A./2111 Wilson Boulevard, Suite 500, Arlington, VA 22201, U.S.A.

**A1.5** ANSI/AHRI Standard 390-2003, *Performance Rating of Single Package Vertical Air-Conditioners and Heat Pumps*, 2003, American National Standards Institute/Air-Conditioning, Heating and Refrigeration Institute, / 11 West 42nd Street, New York, NY 10036 U.S.A./2111 Wilson Boulevard, Suite 500, Arlington, VA 22201, U.S.A./178 Rexdale Boulevard, Etobicoke, Ontario, M9W 1R3, Canada.

**A1.6** ANSI/AHRI Standard 431 (SI)-2014, *Performance Rating of Central Station Air-handling Unit Supply Fans*, 2014, American National Standards Institute /Air-Conditioning, Heating, and Refrigeration Institute, 11 West 42nd Street, New York, NY 10036 U.S.A./2111 Wilson Boulevard, Suite 500, Arlington, VA 22201, U.S.A.

**A1.7** ANSI/AHRI Standard 440-2008 with Addendum 1, *Performance Rating of Room Fan-coils*, 2008, American National Standards Institute /Air-Conditioning, Heating, and Refrigeration Institute, 11 West 42nd Street, New York, NY 10036 U.S.A./2111 Wilson Boulevard, Suite 500, Arlington, VA 22201, U.S.A.

**A1.8** ANSI/AHRI Standard 1230-2010 with Addendum 2, *Performance Rating of Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and Heat Pump Equipment*, 2010, American National Standards Institute /Air-Conditioning, Heating, and Refrigeration Institute, 11 West 42nd Street, New York, NY 10036 U.S.A./2111 Wilson Boulevard, Suite 500, Arlington, VA 22201, U.S.A.

**A1.9** ANSI/AHRI/ASHRAE/ISO Standard 13256-1-2012, *Water-to-Air and Brine-to-Air Heat Pumps — Testing and Rating for Performance*, 2012, International Organization for Standardization, Case postale 56, CH-1211 Geneva 21, Switzerland.

**A1.10** ANSI/AHRI/CSA Standard 310/380/CSA-C744-14 *Packaged Terminal Air-Conditioners and Heat Pumps*, 2014, American National Standards Institute/Air-Conditioning, Heating and Refrigeration Institute, /Canadian Standards Association, 11 West 42nd Street, New York, NY 10036 U.S.A./2111 Wilson Boulevard, Suite 500, Arlington, VA 22201, U.S.A./178 Rexdale Boulevard, Etobicoke, Ontario, M9W 1R3, Canada.

**A1.11** ANSI/ASHRAE 41.2-1992, *Standard Methods for Laboratory Airflow Measurement*, 1992, American National Standards Institute/American Society of Heating, Refrigeration, and Air-Conditioning Engineers, Inc., 11 West 42nd Street, New York, NY 10036 U.S.A./1791 Tullie Circle, N.E., Atlanta, Georgia, 30329, U.S.A.

**A1.12** ANSI/ASHRAE 79-2015, *Methods for Rating Room Fan-coil Air Conditioners*, 2015, American National Standards Institute/American Society of Heating, Refrigeration, and Air-Conditioning Engineers, Inc., 11 West 42nd Street, New York, NY 10036 U.S.A./1791 Tullie Circle, N.E., Atlanta, Georgia, 30329, U.S.A.

**A1.13** ASHRAE Terminology website (<https://www.ashrae.org/resources--publications/free-resources/ashrae-terminology>), 2015, American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., 1791 Tullie Circle N.E., Atlanta, GA 30329, U.S.A.

**A1.14** IEC Standard 60038, *IEC Standard Voltages*, 2002, International Electrotechnical Commission, 3, rue de Varembé, P.O. Box 131, 1211 Geneva 20, Switzerland.

## APPENDIX B. REFERENCES – INFORMATIVE

**B1** Listed here are standards, handbooks and other publications which may provide useful information and background but are not considered essential. References in this appendix are not considered part of the standard.

None.