

ANSI/AHRI Standard 840-2021 (I-P)

2021 Standard for

Performance Rating of Unit Ventilators



Approved by ANSI on 9 June 2023



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ICS Code: 23.120

Note:

This standard supersedes AHRI Standard 840-2015 (I-P).
For SI ratings, see ANSI/AHRI Standard 841-2021 (SI).

This standard was approved as an American National Standard (ANS) on 9 June 2023.

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does not apply to room air-conditioners, which are covered in AHAM Standard RAC-1 and/or ANSI Standard Z234.1 (withdrawn).

2.2.2 This standard does not apply to central-station air-handling units, which are covered in AHRI Standard 430 (I-P).

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 AHRI Standard 1230 (I-P).

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 AHRI Standard 210/240, AHRI Standard 310/380, AHRI Standard 390, and 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 0.075 lb/ft³ that approximates dry air at 70 °F at a barometric pressure of 29.92 in Hg.

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, cfm.

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 airflow 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 0.50 in H₂O. 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 3000 cfm or less.

3.6.1 *Air-source Self-contained Unit Ventilators.* Any unit ventilator that also meets the definition of Packaged Terminal Air-conditioner or Packaged Terminal Heat pump as defined in AHRI 310/380.

3.6.2 *DX Fan-coil Unit Ventilators.* Any unit ventilator that also meets the definition of Indoor Unit, Air Handler as defined in AHRI 210/240.

3.6.3 *Hydronic Fan-coil Unit Ventilators.* Any unit ventilator that meets the definition of Hydronic Fan-coil per Appendix C, section C1.5.

3.6.4 *Single Package Vertical Unit Ventilators.* Any unit ventilator that also meets the definition of a Single Packaged Vertical Air-conditioner or Single Packaged Vertical Heat Pump as defined in AHRI 390.

3.6.5 *Water-source Self-contained Unit Ventilators.* Any unit ventilator that also meets the definition of a water-to-air heat pump or brine-to-air heat pump as defined in ISO 13256-1.

Section 4. Classifications

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

4.1.1 *By Unit Type.*

4.1.1.1 DX Fan-coil Unit Ventilators.

4.1.1.2 Hydronic Fan-coil Unit Ventilators.

4.1.1.3 Air-source Self-contained Unit Ventilators.

4.1.1.4 Single Package Vertical Unit Ventilators.

4.1.1.5 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 No. 1 as depicted in Figure 1 and as indicated in Table 1.

Table 1. Airflow Testing Conditions		
	Room Air Test	Ventilation Air Test
Inlet Air Temperature	70 °F to 80 °F dry bulb	70 °F to 80 °F dry bulb
Heating or cooling means	Not in operation	Not in operation
Static Pressure difference between room air inlet and outlet	0.0 in H ₂ O	Free discharge
Static Pressure at ventilation air inlet	N/A	Negative 0.05 in H ₂ O
Fan Speed Setting	The Fan speed setting used for the standard cooling rating test per the applicable standard referenced in Table 2 shall be used for the Room Air Test	The Fan speed setting used for the standard cooling rating test per the applicable standard referenced in Table 2 shall be used for the Ventilation Air Test
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
ASHRAE Standard 41.2-2018 Test Arrangements	See Figure 14 of ASHRAE Standard 41.2-2018	See Figure 13 of ASHRAE Standard 41.2-2018

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 No. 2 as depicted in Figure 1. Flowmeter No. 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 0.05 in H₂O measured at the ventilation air inlet to simulate the pressure drop of a typical device and as indicated in Table 1.

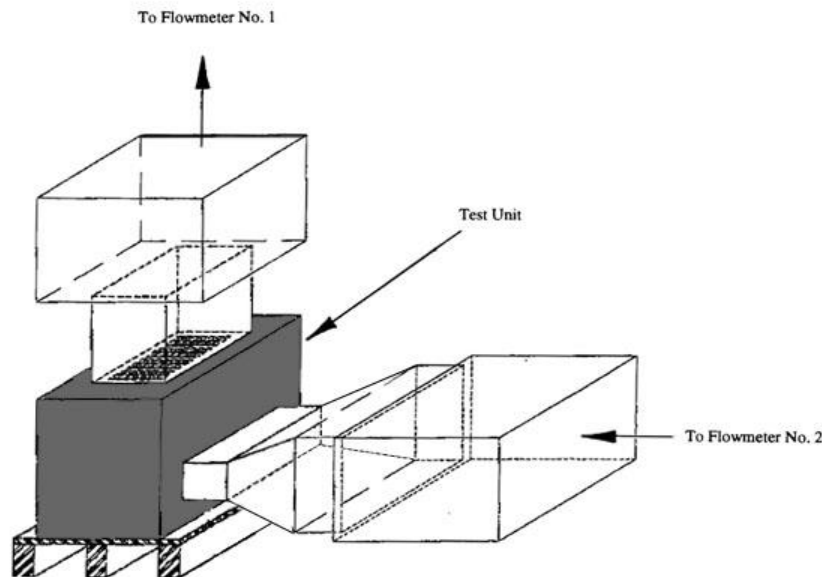


Figure 1. Standard Ventilation Rate Test Set-up

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 specified in Table 2.

Table 2. Standard Rating Conditions for Unit Ventilators					
Published Ratings	Air-source 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	Per AHRI Standard 310/380	Per AHRI Standard 390	Per Appendix C, Section C3.3.1	Per AHRI Standard 210/240	Per ISO Standard 13256-1
Cooling Efficiency			N/A		
Heating Capacity			N/A		
Heating Efficiency			N/A		
Sensible Cooling Capacity	N/A	N/A	Per Appendix C, Section C3.3.1	N/A	N/A
Standard Ventilation Rate	Per Section 5.1.2				
Power Input	N/A	N/A	Per Appendix C, Section C3.3.3	N/A	N/A

6.1.2 Standard Ventilation Rate. The Standard Ventilation Rate, expressed in percent, shall be determined in accordance with ASHRAE Standard 79 by conducting two separate tests at the conditions specified in Table 1. References may also be made to 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. Equipment such as filters, inlet or discharge Grilles, or other components regularly furnished as part the manufacturers basic model unit ventilator shall be in place during all tests.

6.4 The Standard Ventilation Rate shall be the ratio of airflow rate measured in accordance with Section 5.1.2 divided by the published standard airflow rate, 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 per Table 2.

6.6 Tolerances. To comply with this standard, published or reported cooling capacity, heating capacity, power input, efficiency, 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 per Table 2.

The tested Standard Airflow Rate shall be no less than 95% of the Published Rating as tested per Section 5.1.1.

The tested Ventilation Air volume as measured per Section 5.1.2 shall be no less than 80% of the published standard airflow rate.

Section 7. Minimum Data Requirements for Published Ratings

7.1 Published Ratings. Wherever application ratings are published or printed, they shall include or be accompanied by the Standard Rating clearly designated as such, including a statement of the conditions at which the ratings apply. All Published Ratings listed in Table 3 shall be per the Standard Rating Conditions shown in Table 2.

Published Rating Point	Air-source Self-contained Unit Ventilators	Single Packaged Vertical Unit Ventilators	Hydronic Fan-coil Unit Ventilators	DX Fan-coil Unit Ventilators	Water-source Self-contained Unit Ventilators
Airflow Rating, scfm	√	√	√	√	√
Standard Ventilation Rate, cfm	√	√	√	√	√
Cooling Capacity, Btu/h	Full load	Full load	Full load	Full load	Full load, Part load if applicable
Sensible Cooling Capacity, Btu/h			Full load		
Cooling Efficiency, EER	At full load	At full load		At full load	At full load, at part load if applicable
Heating Capacity, Btu/h	Full load, if Air-source Heat Pump	Full load, if Heat Pump		Full load, if Air-source Heat Pump	Full load, Part load if applicable
Heating Efficiency, COP	Full Load, if Air-source Heat Pump	Full Load, if Heat Pump		Full Load, if Air-source Heat Pump	At full load, at part load if applicable
Region IV Heating Seasonal Performance Factor, HSPF				If Air-source Heat Pump	
Part Load Rating (IPLV), kW		√			
Power Input, W			√		

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 Air-source Self-contained Unit Ventilators. All performance tests for Self-contained Unit Ventilators shall be tested in accordance with the provisions of AHRI 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 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 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 Appendix C.

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 AHRI Standard 210/240.

Section 9. Marking and Nameplate Data

9.1 *Nameplate Data.* As a minimum, the nameplate on Fan-coil Units shall display the manufacturer's name, model designation, and electrical characteristic.

9.2 *Nameplate Voltages.* Nameplate voltages for 60 Hz systems shall include one or more of the utilization voltages shown in Table 1 of 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*, 2020, Association of Home Appliance Manufacturers, 1111 19th Street, NW, Suite 402 Washington, DC 20036, U.S.A.

A1.2 ANSI/AHRI Standard 110-2016, *Air Conditioning, Heating, and Refrigerating Equipment Nameplate Voltages*, 2012, Air-Conditioning, Heating, and Refrigeration Institute, 2311 Wilson Boulevard, Suite 400, Arlington, VA 22201, U.S.A.

A1.3 AHRI Standard 210/240-2017 with Addendum 1, *Unitary Air-Conditioning and Air-Source Heat Pump Equipment*, 2012, Air-Conditioning, Heating, and Refrigeration Institute, 2311 Wilson Boulevard, Suite 400, Arlington, VA 22201, U.S.A.

A1.4 AHRI Standard 310/380/CSA-C744-17 *Packaged Terminal Air-Conditioners and Heat Pumps*, 2017, Air-Conditioning, Heating and Refrigeration Institute, 2311 Wilson Boulevard, Suite 400, Arlington, VA 22201, U.S.A.

A1.5 AHRI Standard 390-2003, *Performance Rating of Single Package Vertical Air-Conditioners and Heat Pumps*, 2003, Air-Conditioning, Heating and Refrigeration Institute, 2311 Wilson Boulevard, Suite 400, Arlington, VA 22201, U.S.A.

A1.6 AHRI Standard 430 (I-P)-2020 *Performance Rating of Central Station Air-handling Unit Supply Fans*, 2014, Air-Conditioning, Heating and Refrigeration Institute, 2311 Wilson Boulevard, Suite 400, Arlington, VA 22201, U.S.A.

A1.7 AHRI Standard 1230-2021, *Performance Rating of Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and Heat Pump Equipment*, 2014, Air-Conditioning, Heating and Refrigeration Institute, 2311 Wilson Boulevard, Suite 400, Arlington, VA 22201, U.S.A.

A1.8 ANSI/AHRI/ASHRAE/ISO Standard 13256-1: 1998 (RA 2012), *Water-to-Air and Brine-to-Air Heat Pumps — Testing and Rating for Performance*, 1998, International Organization for Standardization, Case postale 56, CH-1211 Geneva 21, Switzerland.

A1.9 ANSI/ASHRAE 41.2-2018, *Standard Methods for Laboratory Airflow Measurement*, 2018 ASHRAE, 180 Technology Parkway, Peachtree Corners, GA 30092, U.S.A.

A1.10 ANSI/ASHRAE 79-2015, *Methods for Rating Room Fan-coil Air Conditioners*, 2015, ASHRAE, 180 Technology Parkway, Peachtree Corners, GA 30092, U.S.A.

A1.11 ASHRAE Terminology website (<https://www.ashrae.org/resources--publications/free-resources/ashrae-terminology>), 180 Technology Parkway, Peachtree Corners, GA 30092, U.S.A.

A1.12 IEC Standard 60038, *IEC Standard Voltages*, 2009, International Electrotechnical Commission, 3, rue de Varembe, 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.

APPENDIX C. TEST PROVISIONS FOR HYDRONIC FAN-COIL UNIT VENTILATORS - NORMATIVE

C1 Definitions.

C1.1 Capacity.

C1.1.1 Cooling Capacity. The capacity associated with the change in air enthalpy which includes both the Latent and Sensible Capacities expressed in Btu/h.

C1.1.1.1 Latent Capacity. Capacity associated with a change in humidity ratio.

C1.1.1.2 Sensible Capacity. Capacity associated with a change in dry-bulb temperature.

C1.2 Fan. A device for moving air which utilizes a power-driven rotating impeller.

C1.3 Forced-air Circulation. Air circulation caused by a difference in pressure produced by a Fan.

C1.4 Grille. Lattice or grating covering the delivery or intake opening of an air passage.

C1.5 Hydronic Fan-coil. A factory-made assembly which provides the functions of cooling, heating, or cooling and heating, but which does not include the source of cooling or heating. This device is designed for free-delivery of air into a room, but may be applied with minimal ductwork having a static resistance generally not exceeding 0.50 in H₂O. These devices may be designed for furred-in application, or with an enclosure for application within the conditioned space.

C1.5.1 Free Delivery Units. Fan-coil Units intended to be installed in the conditioned space and have no duct attached to distribute conditioned air. The units operate at an External Static Pressure of 0.0 in H₂O and may be furnished with both integral and Grilles on the unit. Free Delivery Units is equal to Non-ducted.

C1.5.2 Ducted Units. A Fan-coil Unit that has provisions for an air passage (duct) to supply Airflow to or from a space. The duct could be on the supply, return or both

C1.5.3 Hydronic Fan-coil Motors.

C1.5.3.1 Shaded Pole Motor. Single phase AC motor with offset start winding and no capacitor.

C1.5.3.2 PSC Motor. Single phase AC motor with offset start winding with capacitor.

C1.5.3.3 EC Motor. AC electrically commutated permanent magnet DC motor.

C2 Test Requirements.

C2.1 Test Requirements. All Published Ratings shall be verified by tests conducted in accordance with the provisions set forth in ASHRAE Standard 79 and Sections C2.1.1 through C2.1.3.

C2.1.1 Free Delivery Units. Free Delivery Units furnished with filters and Grilles shall be tested with an external static pressure of 0.0 in H₂O.

C2.1.2 Ducted Units. Furred-in Fan-coils shall be tested at an external static pressure of 0.05 in H₂O, and without filters and Grilles.

C2.1.3 High Static Units. The Standard Rating test shall be conducted at the unit's designed external static value between a minimum external static pressure of 0.20 in H₂O and not exceeding 0.50 in H₂O.

C3 *Rating Requirements.*

C3.1 *Published Ratings.* Published Ratings of Hydronic Fan-coils shall include the information specified in Section C4.2 and shall include or be accompanied by the Standard Rating, properly identified as such. Application ratings shall clearly define the pertinent conditions.

C3.2 *Standard Ratings.* Standard Ratings shall be established at the Standard Rating Conditions specified in Section C3.3. All Standard Ratings shall be verified by tests conducted in accordance with Section C2. In these ratings, capacity shall be expressed in terms of Btu/h (in multiples of 100 Btu/h), airflow rate shall be expressed in terms of cfm (in multiples of 10 cfm), power input shall be expressed in W (in multiples of 1 W), and water pressure drop shall be expressed in ft H₂O (in multiples of 0.1 ft H₂O).

C3.3 *Standard Rating Conditions.* Standard Ratings shall be determined by tests, using the methods of testing set forth in C1 and performed under the following:

C3.3.1 *Cooling Rating Conditions:*

- C3.3.1.1** Entering temperatures of air to be conditioned: 80.0 °F dry-bulb, 67.0 °F wet-bulb;
- C3.3.1.2** Entering water temperature (all units): 45 °F;
- C3.3.1.3** Leaving water temperature: 55.0 °F for normal temperature rise units and 60.0 °F for high temperature rise units;
- C3.3.1.4** Water flow rate determined using the Standard Rating water temperature conditions specified above, gpm;
- C3.3.1.5** 0.00 in H₂O static pressure difference between air inlet and outlet of the Hydronic Fan-coil (except for equipment covered in Sections C2.1.2 and C2.1.3);
- C3.3.1.6** Highest Fan speed setting; and
- C3.3.1.7** Outside air dampers closed.

C3.3.2 *Electrical Conditions.* Standard rating tests shall be performed at the nameplate rated voltage(s) 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.

C3.3.3 *Airflow and Electric Power Input Rating Conditions.* Standard airflow and electric power input ratings shall be determined by tests using the methods of testing set forth in Section 5 and performed under the following Standard Rating Conditions:

- C3.3.3.1** Entering air dry-bulb temperature: 80.0 °F;
- C3.3.3.2** No water flow through coil;
- C3.3.3.3** 0.00 in H₂O static pressure difference between air inlet and outlet of Hydronic Fan-coils (except for equipment covered in Sections C2.1.2 and C2.1.3); and
- C3.3.3.4** High Fan speed setting.

C3.4 *Application Rating Conditions.* Application ratings shall permit selection of units for at least a range of conditions commonly encountered, and shall be based on corresponding ranges of the following selection parameters:

- C3.4.1** Entering air dry-bulb temperature, °F;
- C3.4.2** Entering air wet-bulb temperature, °F (cooling only);
- C3.4.3** Entering water temperature, °F;
- C3.4.4** Water temperature difference, °F or water flow rate, gpm; and
- C3.4.5** Fan motor speed control setting.

C3.5 *Similar Models.* Where more than one model of a particular size of Hydronic Fan-coil is produced having identical blowers and coils, similar motor speeds, and identical arrangement of parts relative to each other, a representative sample shall be tested by the manufacturer to obtain ratings for these units. Such a representative sample shall be the standard model of this particular size having the lowest air delivery.

C3.6 Tolerances. The Standard Rating shall be such that any Hydronic Fan-coil selected at random and tested in accordance with this standard has an airflow rate, total Cooling Capacity and sensible Cooling Capacity not less than 95% of the Standard Ratings, and an electrical power input not more than 110% of the Standard Ratings.

C4 Minimum Data Requirements for Published Ratings.

C4.1 Minimum Data Requirements for Published Ratings. As a minimum, Published Ratings shall include all Standard Ratings. All claims to ratings within the scope of this standard shall include the statement “Rated in accordance with AHRI Standard 840 (I-P)”. All claims to ratings outside the scope of this standard shall include the statement “Outside the scope of AHRI Standard 840 (I-P)”. Wherever Application Ratings are published or printed, they shall include or be accompanied by the Standard Rating clearly designated as such, including a statement of the conditions at which the ratings apply.

C4.2 Content of Published Ratings. Published Ratings shall consist of the following information:

- C4.2.1** Airflow rate at dry-coil conditions with an entering air dry-bulb temperature of 80.0 °F, cfm;
- C4.2.2** Electric power input, (measured at conditions in C4.2), W;
- C4.2.3** Capacity, Btu/h;
 - C4.2.3.1** Cooling;
 - C4.2.3.2** Total Cooling;
 - C4.2.3.3** Sensible;
- C4.2.4** Fluid Flow rate, gpm; and
- C4.2.5** Fluid pressure drop through the coil, ft H₂O.

C4.3 Published Rating Data. Published Ratings shall include, or be accompanied by, the following data:

- C4.3.1** Nameplate Electrical data;
 - C4.3.1.1** Voltage, V;
 - C4.3.1.2** Full-load current, amp;
- C4.3.2** Minimum Grille free areas, in²;
 - C4.3.2.1** Inlet;
 - C4.3.2.2** Outlet;
- C4.3.3** Filter data as supplied or recommended by manufacturer;
 - C4.3.3.1** Type;
 - C4.3.3.2** Size, in x in;
 - C4.3.3.3** Thickness, in; and
- C4.3.4** Drawings indicating essential dimensions, including the height and depth of the enclosure, sizes of inlet and outlet openings and Grilles (if used), and size and location of piping and electrical connections.

C5 Operating Requirements.

C5.1 Insulation Efficiency Test. Hydronic Fan-coils shall pass the following insulation efficiency test:

C5.1.1 Test Conditions.

- C5.1.1.1** Ambient air temperature: 80.0 °F dry-bulb, 75.0 °F wet-bulb;
- C5.1.1.2** Entering water temperature: 42 °F; and
- C5.1.1.3** Water flow rate from standard cooling rating test.

C5.1.2 Procedure. After establishing specified temperature conditions, the unit shall operate continuously at its lowest Fan speed for a period of two hours at the following external static pressure:

- C5.1.2.1** Free Delivery 0.0 in H₂O;
- C5.1.2.2** Furred-in 0.0 in H₂O; and
- C5.1.2.3** High-Static 0.050 in H₂O.

For equipment with motor speed taps, the unit shall be set to the lowest Fan speed tap. For equipment without motor speed taps, the unit shall be run at a Fan speed which produces between 60% and 70% of the airflow at which the standard cooling rating test was conducted, with instructions provided by the manufacturer on how to adjust the motor controls to achieve this setting.

For equipment with a single Fan speed, the external static pressure specified in the standard cooling rating test shall be used.

C5.1.3 *Requirements.* During the test, no condensed water shall drip, run, or blow off from the unit.

C5.2 *Low Voltage Test.* Hydronic Fan-coils shall start and operate at 90% of nameplate rated voltage at all Fan speed settings.