

ANSI/AHRI Standard 1161-2023 (SI)

2023 Standard for

Performance Rating of Heat Pump Pool Heaters



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ICS Code: 27.080

Note:

This standard supersedes ANSI/AHRI Standard 1161-2014 (SI).

For I-P ratings, see ANSI/AHRI Standard 1160-2022 (I-P).

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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.

2023 Edition

This edition of ANSI/AHRI Standard 1161-2023 (SI), *Performance Rating of Heat Pump Pool Heaters*, was prepared by the Water Heaters Standards Technical Committee. It was approved by the Heating Standards Subcommittee on 14 August 2023. This standard was approved as an American National Standard (ANS) on 18 November 2023.

Origin and Development of AHRI 1161

AHRI 1161-2009 (SI) was published as a new standard and was approved as an American National Standard on 3 November 2011.

In 2014 the standard was revised and was approved as an American National Standard on 20 November 2014.

Summary of Changes

ANSI/AHRI Standard 1161-2023 (SI) contains the following updates to the previous edition:

- Updated Table 2 to remove the phrase “but no less than 2.0 L/s.”
- Updated 8.3.2 bullet 1) to refer to AHRI Standard 110, Table 3 instead of AHRI Standard 110, Table 1

Committee Personnel

Water Heaters Standards Technical Committee

Participant	Interest Category Classification	Voting Member Role	State or Province/ Country
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Jacob (Cobi) Waxman	AHRI Staff Liaison		

Water Heaters Standards Technical Committee Scope: This committee shall have responsibility for the development and maintenance of AHRI standards and guidelines pertaining to residential and commercial water heaters and pool heaters.

Heating Standards Subcommittee

Participant	Interest Category Classification	Voting Member Role	State or Province/ Country
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Bryan Ahee Bradford White Corp.	Manufacturer	Primary	IL, USA
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Karl Best	AHRI Staff Liaison		

Heating Standards Subcommittee Scope: The scope of the Heating Standards Subcommittee is standards and guidelines related to the end products that are part of the AHRI Heating Industry Sector. (The definition of and list of products associated with each sector are found on the AHRI website at www.ahrinet.org.)

These committee lists represent the membership at the time the Standards Working Group, Technical Committee, and Standards Subcommittee were balloted on the final text of this edition. Since that time, changes in the membership may have occurred. Membership on these committees shall not in and of itself constitute an endorsement by the committee members, employers of AHRI, or any document developed by the committee on which the member serves.

Heating Standards Consensus Body

Participant	Company / Organization	Interest Category Classification
Ronald Balneg	California Energy Commission	Regulatory Agency
Philip Cantin	mmic Medical Systems	Consumer/User
Paul Haydock	Carrier Corporation	Product Manufacturer
Caroline Henley	UL Solutions	Testing Laboratory
Jim Kendzel	American Supply Association	General Interest
Stephen Kowalski	Oak Ridge National Laboratory	Testing Laboratory
Reza Mossavi	Viessmann Manufacturing	Product Manufacturer
Aniruddh Roy	Energy Solutions	General Interest
Sebastian Wejchert	Swiss Rotors Inc.	Component Manufacturer

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PERFORMANCE RATING OF HEAT PUMP POOL HEATERS

Section 1. Purpose

1.1 Purpose

The purpose of this standard is to establish for Heat Pump Pool Heaters: definitions; classifications; test requirements; rating requirements; minimum data requirements for Published Ratings; operating requirements; marking and nameplate data; and conformance conditions.

Section 2. Scope

2.1 Scope

This standard applies to the rating and testing of complete factory-made Heat Pump Pool Heaters as defined in Section 3.

2.2 Energy Source

This standard applies only to air-source, electrically driven, mechanical compression type systems.

2.3 Exclusions

This standard does not apply to the following:

- 1) Individual assemblies
- 2) Unitary Air-Conditioners as defined in AHRI Standard 210/240 with capacities less than 19 000 W
- 3) Unitary heat operated air-conditioning equipment
- 4) Water-Source Heat Pumps as defined in AHRI/ASHRAE/ISO 13256-1:1998 (RA 2012)
- 5) Commercial and Industrial Unitary Air Conditioning and Heat Pump Equipment with capacities of 19 000 W or greater as defined in AHRI Standard 340/360
- 6) Single Package Vertical Air-Conditioners and Heat Pumps as defined in AHRI Standard 390
- 7) Package Terminal Air-Conditioners and Heat Pumps as defined in AHRI Standard 310/380

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.

3.1 Expressions of Provision

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”*

Indication of recommendations rather than requirements. In the negative form, a recommendation 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 *Coefficient of Performance (COP)*

A ratio of the Heating Capacity in watts to the power input values in watts at any given set of Rating Conditions expressed in watts/watt.

3.2.1.1 *Standard Coefficient of Performance.*

A ratio of the capacity to power input value obtained at Standard Rating Conditions.

3.2.2 *Heat Pump Pool Heater*

A factory-made assembly, which contains the air moving device, compressor, refrigerant-to-water heat exchanger and air-to-refrigerant heat exchanger using ambient air as the heat source. Models can consist of more than one assembly to be used together for the purpose of cooling and heating pool water. Models with separated assemblies are designed to be used together, and the requirements of rating outlined in this standard are based upon the use of matched assemblies.

Heat Pump Pool Heaters are capable of heating pool water to achieve a controlled temperature and can include the capabilities of pool water cooling, air-heating, air cooling, air-circulating, air-cleaning, or dehumidifying.

3.2.3 *Heating Capacity*

The capacity associated with the change in water temperature, expressed in W.

3.2.4 *Published Rating*

A statement of the assigned values of those performance characteristics, under stated Rating Conditions, where a unit can be chosen to fit the application. These values apply to all units of the same nominal size and type (identification) produced by the same manufacturer. This 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.

3.2.4.1 *Application Rating*

A rating based on tests performed at rating conditions other than Standard Rating Conditions.

3.2.4.2 *Standard Rating*

A rating based on tests performed at Standard Rating Conditions.

3.2.5 *Rating Conditions*

Any set of operating conditions where a single level of performance results and causes only that level of performance to occur.

3.2.5.1 *Standard Rating Conditions*

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

Section 4. Classifications

4.1 *Classifications*

A Heat Pump Pool Heater within the scope of this standard shall be classified by Functions as shown in Table 1.

Section 5. Test Requirements

5.1 *Test Requirements*

All Standard Ratings shall be verified by tests conducted in accordance with ASHRAE Standard 146.

Table 1 Classifications of Heat Pump Pool Heaters

Designation	Unit type	
	Pool Heating Only	Pool Heating and Cooling
Single Package	SPPH-H	SPPH-H/C
Split System	SSPH-H	SSPH-H/C

Section 6. Rating Requirements**6.1 Standard Rating**

Standard Ratings shall be established by tests conducted at the Standard Rating Conditions specified in Table 2.

6.1.1 Values for Standard Ratings

Standard Ratings relating to Heating Capacity shall be net values. If a circulating pump is within the unit and energized under normal operation, that electrical energy shall be included in the total power input to the unit. Supplementary electric heat shall not be included in the Standard Ratings of the unit.

6.1.1.1 Values for Standard Heating Capacity Ratings

Standard Heating Capacity ratings shall be expressed only in terms of W in multiples of 100 W for units with ratings less than 15 000 W, or multiples of 200 W for units with ratings 15 000 W and greater.

6.1.1.2 Values for Standard Coefficient of Performance

Standard Coefficient of Performance shall be expressed in multiples of 0,1.

6.1.2 Electrical Conditions

Standard rating tests shall be conducted at nameplate rated voltage and frequency. For models with dual voltage nameplate ratings, the tests shall be conducted at the higher of the two voltages.

6.1.3 Requirements for Separated Assemblies

When a model consists of two separate assemblies, the length of the interconnecting refrigerant tubing shall not be less than 8 m. The line sizes, insulation and details of installation shall be per the manufacturer's installation instructions.

6.2 Application Ratings

Application Ratings shall be established by tests conducted using Rating Conditions other than those specified in Table 2.

Table 2 Standard Rating Conditions

Temperature and Humidity (% RH)	Air Temperature Surrounding Unit		Water Temperature Entering Unit, °C	Water Flow Rate, L/s
	Dry-bulb, °C	Wet-bulb, °C		
Standard Air Temperature - Mid Humidity (70% RH)	15,0	12,0	26,0	1) Use 0,03 per 300 watts Or 2) Manufacturer can specify a flow rate lower than 0,03 per 300 watts

6.3 Tolerances

To comply with this standard, measured test results for Heating Capacity and COP shall not be less than 95% of Published Ratings.

Section 7. Minimum Data Requirements for Published Ratings

7.1 *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 1161 (SI).” All claims to ratings outside the scope of this standard shall include the statement “Outside the scope of AHRI Standard 1161 (SI).” Application Ratings within the scope of the standard shall include a statement of the conditions at which the ratings apply.

Section 8. Operating Requirements

8.1 *Performance Requirements*

To comply with this standard, Heat Pump Pool Heaters shall be designed and produced in such a manner that any production unit will meet the requirements of this section.

8.2 *Maximum Operating Conditions Test*

Heat Pump Pool Heaters shall be designed and produced to pass the following maximum operating conditions test.

8.2.1 *Temperature Conditions*

- 1) Air temperature surrounding unit:
 - a) 30,0°C dry-bulb
 - b) 20,0°C wet-bulb
- 2) Water temperature entering unit: 38,0°C
- 3) Water flow rate: Same flow rate as established in Standard Air Temperature - Mid Humidity (70% RH) condition in Table 2.

8.2.2 *Voltages*

The test shall be run at the Range A minimum utilization voltage from AHRI Standard 110, Table 1, based upon the unit’s nameplate rated voltage(s). This voltage shall be supplied at the unit’s service connection and at rated frequency.

8.2.3 *Procedure*

The equipment shall be operated for one hour at the temperature conditions and voltage specified.

8.2.4 *Requirements*

The equipment shall operate continuously without interruption for any reason for one hour.

8.3 *Voltage Tolerance Test*

Heat Pump Pool Heaters shall pass the following voltage tolerance test with the same water flow rate as established in Standard Air Temperature – Mid Humidity (70% RH) condition in Table 2.

8.3.1 *Temperature Conditions*

Temperature conditions shall be maintained at the steady state conditions as shown in Table 2.

8.3.2 *Voltages*

- 1) Tests shall be run at the Range B minimum and maximum utilization voltages from AHRI Standard 110, Table 3, based upon the unit’s nameplate rated voltage(s). These voltages shall be supplied at the unit’s service connection and at rated frequency. A lower minimum or a higher maximum voltage shall be used, if listed on the nameplate.
- 2) The power supplied to single phase equipment shall be adjusted just prior to the shut-down period (Section 8.3.3(2)) so that the resulting voltage at the unit’s service connection is 86% of nameplate rated voltage when the compressor motor is on locked-rotor. (For 200 V or 208 V nameplate rated equipment, the restart voltage shall be set at 180 V when the compressor motor is on locked rotor.) Open circuit voltage for three-phase equipment shall not be greater than 90% of nameplate rated voltage.
- 3) Within one minute after the equipment has resumed continuous operation (Section 8.3.4(3)), the voltage shall be restored to the values specific in Section 8.3.2(1).

8.3.3 *Procedure*

- 1) The equipment shall be operated for one hour at the temperature conditions and voltage(s) specified.
- 2) All power to the equipment shall be interrupted for a period (not to exceed five seconds) to cause the compressor to stop and then be restored.

8.3.4 *Requirements*

- 1) During testing, the equipment shall operate without failure of any parts.
- 2) The equipment shall operate continuously without interruption for any reason for the one hour period preceding the power interruption.
- 3) The unit shall resume continuous operation within two hours of restoration of power and shall then operate continuously for one half hour. Operation and resetting of safety devices prior to establishment of continuous operation is permitted.

Section 9. Marking and Nameplate Data

9.1 *Marking and Nameplate Data*

As a minimum, the nameplate shall display the manufacturer's name, model designation, refrigerant, and electrical characteristics.

Nameplate voltages for 60 Hertz systems shall include one or more of the equipment nameplate voltage ratings shown in Table 1 of AHRI Standard 110. Nameplate voltages for 50 Hertz 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 shall not reference, state, or acknowledge the standard in any written, oral, or electronic communication

APPENDIX A. REFERENCES – NORMATIVE

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

- A.1. AHRI Standard 110-2016, *Air-Conditioning, Heating, and Refrigerating Equipment Nameplate Voltages*, 2016, Air-Conditioning, Heating and Refrigeration Institute, 2311 Wilson Blvd., Suite 400, Arlington, VA 22201, USA.
- A.2. ANSI/ASHRAE Standard 146-2020, *Methods of Testing and Rating Pool Heaters*, 2020, ASHRAE, 180 Technology Parkway, Peachtree Corners, GA 30092, USA.
- A.3. ASHRAE Terminology. ASHRAE. Accessed October 19, 2021. <https://www.ashrae.org/technical-resources/free-resources/ashrae-terminology>.
- A.4. IEC Standard 60038, *IEC Standard Voltages*, 2002, International Electrotechnical Commission, 3, rue de Varembe, P.O. Box 131, 1211 Geneva 20, Switzerland.

APPENDIX B. REFERENCES – INFORMATIVE

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.

APPENDIX C. BIBLIOGRAPHY

- C.1. AHRI Standard 210/240-2023 (2020) (I-P), *Unitary Air-Conditioning and Air-Source Heat Pump Equipment*, 2020, Air-Conditioning, Heating and Refrigeration Institute, 2311 Wilson Blvd., Suite 400, Arlington, VA 22201, USA.
- C.2. AHRI Standard 310/380-2017 (CSA-C744-17) (SI/IP), *Standard for Packaged Terminal Air-Conditioners and Heat Pumps*, 2017, Air-Conditioning, Heating and Refrigeration Institute, 2311 Wilson Blvd., Suite 400, Arlington, VA 22201, USA.
- C.3. AHRI Standard 340/360-2022 (I-P), *Commercial and Industrial Unitary Air Conditioning and Heat Pump Equipment*, 2022, Air-Conditioning, Heating and Refrigeration Institute, 2311 Wilson Blvd., Suite 400, Arlington, VA 22201, USA.
- C.4. AHRI Standard 390-2021, *Performance Rating of Single Package Vertical Air-Conditioners and Heat Pumps*, 2021, Air-Conditioning, Heating and Refrigeration Institute, 2311 Wilson Blvd., Suite 400, Arlington, VA 22201, USA.
- C.5. AHRI/ASHRAE/ISO 13256-1:1998 (RA 2012), *Water-Source Heat Pumps-Testing and Rating for Performance-Part 1: Water-to-Air and Brine-to-Air Heat Pumps*, 2012, International Organization for Standardization, Case Postale 56, CH-1211, Geneva 20, Switzerland
- C.6. NF Standard 414, *Certification Reference Heat Pump – NF Mark*, 2021, AFNOR Certification 11, rue Francies de Pressense 93571 LA PLAINE ST DENIS Cedex.