

ARI Standard 1160

**2008 Standard for
Performance Rating
of Heat Pump Pool Heaters**



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ARI uses its best efforts to develop standards/guidelines employing state-of-the-art and accepted industry practices. ARI 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 ARI Standard 1160-2007.

ARI CERTIFICATION PROGRAM PROVISIONS

Scope of the Certification Program

The certification program includes only Heat Pump Pool Heaters that are electrically driven, mechanical compression type systems as defined in the standard.

Equipment covered: The program applies to Heat Pump Pool Heaters having 60 Hz single-phase or three-phase compressors.

Certified Ratings

The following ratings are verified by test:

- a. Standard Rating Heating Capacity - High Air Temperature, Btu/h [W]
- b. Standard Rating COP - High Air Temperature, watts/watt [W/W]
- c. Standard Rating Heating Capacity - Low Air Temperature, Btu/h [W]
- d. Standard Rating COP - Low Air Temperature, watts/watt [W/W]

TABLE OF CONTENTS

SECTION	PAGE
Section 1. Purpose.....	1
Section 2. Scope.....	1
Section 3. Definitions.....	1
Section 4. Classifications.....	2
Section 5. Test Requirements	3
Section 6. Rating Requirements.....	3
Section 7. Minimum Data Requirements for Published Ratings	4
Section 8. Operating Requirements	4
Section 9. Marking and Nameplate Data	5
Section 10. Conformance Conditions	5

TABLES

Table 1. Classifications of Heat Pump Pool Heaters	2
Table 2. Standard Rating Conditions	3

APPENDICES

Appendix A. References – Normative.....	6
Appendix B. References – Informative.....	6

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.

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 rating and testing of complete factory-made Heat Pump Pool Heater refrigeration systems as defined in Section 3.

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

2.2 *Exclusions.* This standard does not apply to the following:

2.2.1 Individual assemblies.

2.2.2 Unitary Air-Conditioners as defined in ARI Standard 210/240, *Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment*, with capacities less than 65,000 Btu/h [19,000 W].

2.2.3 Unitary heat operated air-conditioning equipment.

2.2.4 Water-Source Heat Pumps as defined in ANSI/ARI/ASHRAE/ISO 13256-1, *Water-Source Heat Pumps – Testing and Rating for Performance – Part I: Water-to-Air and Brine-to-Air Heat Pumps*.

2.2.5 Commercial and Industrial Unitary Air Conditioning and Heat Pump Equipment with capacities of 65,000 Btu/h [19,000 W] or greater as defined in ARI Standard 340/360, *Performance Rating of Unitary Air Conditioning and Heat Pump Equipment*.

2.2.6 Single Package Vertical Air-Conditioners and Heat Pumps as defined in ARI Standard 390, *Performance Rating of Single Package Vertical Air-Conditioners and Heat Pumps*.

2.2.7 Package Terminal Air-Conditioners and Heat Pumps as defined in ARI Standard 310/380, *Standard for Packaged Terminal Air-Conditioners and Heat Pumps*, (CSA-C744-04).

Section 3. Definitions

All terms in this document follow the standard industry definitions in the current edition of *ASHRAE Terminology of Heating, Ventilation, Air Conditioning and Refrigeration* unless otherwise defined in this section.

3.1 *Coefficient of Performance (COP).* A ratio of the Heating Capacity in watts [W] to the power input values in watts [W] at any given set of Rating Conditions expressed in watts/watt [W/W]. For heating COP, supplementary resistance heat shall be excluded.

3.1.1 *Standard Coefficient of Performance.* A ratio of the capacity to power input value obtained at Standard Rating Conditions.

3.2 *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 may consist of more than one assembly to be used together for the purpose of cooling and heating air. Models with separated assemblies shall be designed to be used together, and the requirements of rating outlined in this standard are based upon the use of matched assemblies.

3.2.1 *Functions.* Heat Pump Pool Heaters shall provide the function of heating pool water to achieve a controlled temperature, but may include the functions of pool water cooling, air-heating, air cooling, air-circulating, air-cleaning, or dehumidifying.

3.3 *Heating Capacity.* The capacity associated with the change in water temperature, expressed in Btu/h [W].

3.4 *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 capacity 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.

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

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

3.5 *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.

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

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

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

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

Section 4. Classifications

Table 1. Classifications of Heat Pump Pool Heaters		
Types 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

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

Section 5. Test Requirements

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

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 Btu/h [W] in multiples of 500 [150] for units with ratings less than 50,000 Btu/h [15,000 W], or multiples of 1,000 [300] for units with ratings 50,000 Btu/h [15,000 W] and greater.

6.1.1.2 *Values for Standard Coefficients of Performance.* Standard Coefficients 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 25 ft (7.6 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					
	Air Temperature Surrounding Unit		Water Temperature Entering Unit	Water Flow Rate (or Less if Specified by the Manufacturer)	
	Dry-bulb °F [°C]	Wet-bulb °F [°C]	°F [°C]	gpm	L/s
High Air Temperature - Mid Humidity (62% RH)	80.6 [27.0]	70.7 [21.5]	80.0 [26.7]	0.450 per 1000 Btu/h	0.028 per 293.1 Watts
Low Air Temperature - Mid Humidity (63% RH)	50.0 [10.0]	44.2 [6.78]	80.0 [26.7]	Same flow rate as established in High Air Temperature - Mid Humidity (62% RH)	

6.3 *Tolerances.* To comply with this standard, measured test results for Heating Capacity and Coefficient of Performance 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 ARI Standard 1160." All claims to ratings outside the scope of this standard shall include the statement "Outside the scope of ARI Standard 1160." Wherever Application Ratings are published or printed, they 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.*

Air temperature surrounding unit:

86.0°F [30.0°C] dry-bulb

68.0°F [20.0°C] wet-bulb

Water temperature entering unit:

101.0°F [38.3°C]

Water flow rate: Same flow rate as established in High Air Temperature - Mid Humidity (62% RH) in Table 2.

8.2.2 *Voltages.* The test shall be run at the Range A minimum utilization voltage from ARI 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 High Air Temperature – Mid Humidity (62% RH) 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.*

8.3.2.1 Tests shall be run at the Range B minimum and maximum utilization voltages from ARI Standard 110, Table 1, 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.

8.3.2.2 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 200V or 208V nameplate rated equipment, the restart voltage shall be set at 180V 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.

8.3.2.3 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.*

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

8.3.3.2 All power to the equipment shall be interrupted for a period sufficient to cause the compressor to stop (not to exceed five seconds) and then restored.

8.3.4 *Requirements.*

8.3.4.1 During both tests, the equipment shall operate without failure of any of its parts.

8.3.4.2 The equipment shall operate continuously without interruption for any reason for the one hour period preceding the power interruption.

8.3.4.3 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 ARI 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 cannot reference, state, or acknowledge 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 this standard. All references in this appendix are considered part of the standard.

A1.1 ANSI/ARI/ASHRAE/ISO 13256-1, *Water-Source Heat Pumps-Testing and Rating for Performance-Part 1: Water-to-Air and Brine-to-Air Heat Pumps*, 1998, International Organization for Standardization, Case Postale 56, CH-1211, Geneva 20, Switzerland.

A1.2 ANSI/ASHRAE Standard 146-2006 *Methods of Testing and Rating Pool Heaters*, 2006, American National Standards Institute/ American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., 25 West 43rd Street, 4th Fl., New York, NY, 10036, U.S.A./1791 Tullie Circle, N.E., Atlanta, GA 30329, U.S.A.

A1.3 ARI Standard 110-2002, *Air-Conditioning and Refrigerating Equipment Nameplate Voltages*, 2002, Air-Conditioning and Refrigeration Institute, 4100 North Fairfax Drive, Suite 200, Arlington, VA 22203, U.S.A.

A1.4 ARI Standard 210/240-2006, *Unitary Air-Conditioning and Air-Source Heat Pump Equipment*, 2006, Air-Conditioning and Refrigeration Institute, 4100 North Fairfax Drive, Suite 200, Arlington, VA 22203, U.S.A.

A1.5 ARI Standard 310/380-2004, *Standard for Packaged Terminal Air-Conditioners and Heat Pumps (CSA-C744-04)*, Air-Conditioning and Refrigeration Institute, 4100 North Fairfax Drive, Suite 200, Arlington, VA 22203, U.S.A.

A1.5 ANSI/ARI Standard 340/360-2007, *Commercial and Industrial Unitary Air Conditioning and Heat Pump Equipment*, 2007, Air-Conditioning and Refrigeration Institute, 4100 North Fairfax Drive, Suite 200, Arlington, VA 22203, U.S.A.

A1.6 ANSI/ARI Standard 390-2003, *Performance Rating of Single Package Vertical Air-Conditioners and Heat Pumps*, 2003, American National Standards Institute and Air-Conditioning & Refrigeration Institute, 4100 North Fairfax Drive, Suite 200, Arlington, VA 22203, U.S.A.

A1.7 ASHRAE *Terminology of Heating, Ventilation Air Conditioning and Refrigeration*, Second Edition, 1991, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., 1791 Tullie Circle, N.E. Atlanta, GA 30329, U.S.A.

A1.8 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

None.