

ANSI/AHRI Standard 911 (SI)

2014 Standard for
**Performance Rating
of Indoor Pool Dehumidifiers**



Approved by ANSI on July 8, 2016



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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 910-2011. The test requirements were deleted from Appendix C and replaced with a reference to ASHRAE Standard 190.

For I-P ratings, see ANSI/AHRI Standard 910 (I-P)-2014.

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PERFORMANCE RATING OF INDOOR POOL DEHUMIDIFIERS

Section 1. Purpose

1.1 *Purpose.* The purpose of this standard is to establish for Indoor Pool Dehumidifiers: 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 factory-made residential, commercial and industrial Indoor Pool Dehumidifiers, as defined in Section 3.

2.1.1 *Energy Source.* This standard applies to electrically operated, vapor-compression refrigeration systems.

2.2 *Exclusions.* This standard does not apply to the rating and testing of individual assemblies for separate use.

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>) unless otherwise defined in this section.

3.1 *Economizer.* Factory-made assembly installed in an electrically operated, vapor compression refrigeration system that takes advantage of favorable weather conditions to reduce cooling and thereby improve a building's energy performance by introducing up to 100% outside air into a building.

3.2 *Indoor Pool Dehumidifier.* A type of air-cooled or water-cooled electrically operated, vapor compression refrigeration system; factory assembled as a single package or split system, which includes an indoor cooling/dehumidifying coil, an air reheat coil, compressor(s) and an air moving device. It may also include a Refrigerant Heat Recovery Unit, an auxiliary refrigerant condenser, Economizer, and an air-to-air heat recovery device. It shall provide the function of dehumidifying, air circulation, air reheating and may include the function of air-cooling, air-cleaning, pool water heating and air-to-air heat recovery.

3.3 *Moisture Removal Capacity (MRC).* The amount of condensate produced by the unit which includes the effects of reheat coils, circulating fans and other components in the air stream; excluding supplementary heating, cooling or outdoor air; and expressed in kg of moisture/h.

3.4 *Moisture Removal Efficiency (MRE).* A ratio of the MRC in kg of moisture/h to the power input values in kW at any given set of Rating Conditions expressed in kg of moisture/kWh.

3.5 *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.

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

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

3.6 *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.

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

3.7 *Refrigerant Heat Recovery Unit.* A factory-made assembly of elements by which refrigerant vapor flow and water flow are maintained in such heat transfer relationship that the refrigerant vapor is desuperheated and the water is heated.

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

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

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

3.9 *Standard Air.* Air weighing 1.2 kg/m³ which approximates dry air at 21.0°C and at a barometric pressure of 101.3 kPa.

Section 4. Classification

Equipment covered within the scope of this standard shall be classified as shown in Table 1.

Table 1. Classification of Indoor Pool Dehumidifiers						
Designation	AHRI Type	Arrangement				
Single Package Indoor	SPI	FAN	COMP			
		EVAP	REHEAT			
	SPI-PH	FAN	COMP	POOL HEAT		
		EVAP	REHEAT			
Single Package Indoor Water-cooled	SPI-W	FAN	COMP			
		EVAP	REHEAT	COND		
	SPI-W-PH	FAN	COMP	POOL HEAT		
		EVAP	REHEAT	COND		
Single Package Indoor Air-cooled	SPI-A	FAN	COMP			
		EVAP	REHEAT	COND		
	SPI-A-PH	FAN	COMP	POOL HEAT		
		EVAP	REHEAT	COND		

Table 1. Classification of Indoor Pool Dehumidifiers (continued)						
Designation	AHRI Type	Arrangement				
Split System Indoor Air-cooled	SSI-A	FAN	COMP			
		EVAP	REHEAT	COND		
	SSI-A-PH	FAN	COMP	POOL HEAT	COND	
		EVAP	REHEAT			
Single Package Indoor with Economizer	SPI-E	FAN	COMP			
		EVAP	REHEAT	ECONOMIZER		
	SPI-PH-E	FAN	COMP	POOL HEAT		
		EVAP	REHEAT	ECONOMIZER		
Single Package Indoor Water-cooled with Economizer	SPI-W-E	FAN	COMP			
		EVAP	REHEAT	COND	ECONOMIZER	
	SPI-W-PH-E	FAN	COMP	POOL HEAT		
		EVAP	REHEAT	COND	ECONOMIZER	
Single Package Indoor Air-cooled with Economizer	SPI-A-E	FAN	COMP			
		EVAP	REHEAT	COND	ECONOMIZER	
	SPI-A-PH-E	FAN	COMP	POOL HEAT		
		EVAP	REHEAT	COND	ECONOMIZER	
Split System Indoor Air-cooled with Economizer	SSI-A-E	FAN	COMP	COND		
		EVAP	REHEAT	ECONOMIZER		
	SSI-A-PH-E	FAN	COMP	POOL HEAT	COND	
		EVAP	REHEAT	ECONOMIZER		

Section 5. Test Requirements

5.1 *Test Requirements.* Published Ratings shall be verified by tests conducted in accordance with the test method described in ASHRAE Standard 190 and at the Rating Conditions in Section 6.

5.1.1 *Equipment.* Indoor Pool Dehumidifiers shall be tested using all components as recommended by the manufacturer.

5.1.2 *Electrical Conditions.* Nameplate voltages for 60 Hz systems are 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. Tests shall be performed at the nameplate rated voltages and frequencies unless otherwise specified in this standard.

For equipment which is rated with 208/230 dual nameplate voltages, standard rating tests shall be performed at 230V.

For all other dual nameplate voltage equipment covered by this standard, the standard rating tests shall be performed at both voltages or at the lower voltage if only a single Standard Rating is to be published.

Section 6. Rating Requirements

6.1 *Standard Ratings.* Standard Ratings shall be established at the Standard Rating Conditions specified in Table 2 and in Section 6.3.

6.1.1 *Applicability.* Direct conversion of values from testing performed under AHRI Standard 910 (I-P) shall not be used.

6.2 All Standard Ratings shall be verified by tests in accordance with Section 5.

6.2.1 *Values of Standard Ratings.* Standard Ratings relating to MRC shall be a net value, including the effects of circulating fan heat, but not including supplementary heat. Power input shall be the total power input for the operation of the compressor(s), fan(s), control(s), safety device(s), pump power adjustment (Table 2) and other items required as part of the system for normal operation excluding heating devices.

Airflow rates shall be expressed in m³/h of Standard Air to the nearest 20.0 m³/h.

Capacity designation shall be expressed in W and kg of moisture/h to the nearest 0.1.

Moisture Removal shall be expressed in kg of moisture/h to the nearest 0.1.

MRE shall be expressed in kg of moisture/kWh to the nearest 0.1.

Water flow rate shall be expressed in L/s to the nearest 0.01 L/s up to and including 1 L/s and to the nearest 0.05 L/s for over 1 L/s.

Water pressure drop shall be expressed to the nearest 4.0 kPa.

Table 2. Conditions for Standard Rating Tests and Operating Requirements

Unit Configurations for Testing ⁶			Return Air Entering		Outdoor Ambient ³	Liquid Temperature Entering Heat Exchanger ¹		
			Dry-bulb °C	Wet-bulb °C	Dry-bulb °C	Pool Water	Chiller	Other Liquid
						°C	°C	°C
Dehumidification	“A”	100% Internal Air Rejection	28.0	22.0 ²	N/A	N/A	N/A	N/A
	“B”	100% Remote Rejection	28.0	22.0 ²	35.0	27.0	7.0	30.0 or 43.0 ⁸
	“C”	Internal Air Plus Pool Water Rejection or Another Rejection ⁷	28.0	22.0 ²	28.0	27.0	7.0	30.0 or 43.0 ⁸
		Maximum High-Temperature Operating Conditions	32.0	29.0 ⁴	46.0	32.0	32.0	32.0 or 46.0 ⁸
		Insulation Effectiveness	28.0	25.0 ⁵	27.0	27.0	27.0	27.0

Notes:

- Unit inlet water flow rate shall be specified by the manufacturer.
- 28.0°C dry-bulb and 22.0°C wet-bulb is equivalent to 60% RH at sea level.
- The wet-bulb temperature condition is not required when testing air-cooled condensers which do not evaporate condensate.
- 32.0°C dry-bulb and 29.0°C wet-bulb is equivalent to 80% RH at sea level.
- 28.0°C dry-bulb and 25.0°C wet-bulb is equivalent to 80% RH at sea level.
- Manufacturer must select at least configuration “A” or “C” as a minimum certification requirement. B can be added to either configuration A or C.
- Manufacturer must list both means of simultaneous methods of refrigerant heat rejection, such as domestic water storage tanks, etc.
- When testing with a dry cooler.

6.3 Standard Rating Conditions. The conditions of test for Standard Ratings shall be established at the Standard Rating Conditions specified in Table 2.

6.3.1 Indoor-side airflow rate shall be determined at an indoor-side airflow rate outlined below.

6.3.1.1 Ducted equipment shall be tested at the airflow rate delivered when operating against the minimum external static pressure specified in Table 3 or at a lower airflow rate if so specified by the manufacturer. Non-filtered ducted equipment shall be tested at the airflow rate delivered when operating against the minimum external static pressure specified in Table 3 with an additional 0.02 kPa of external static pressure.

6.3.1.2 Non-ducted equipment shall be tested at the airflow rates obtained at zero external static pressure. All power consumed by the fan(s) shall be included in the power input to the unit.

6.3.1.3 The manufacturer shall specify a single airflow rate for all tests required in this part of the standard unless the equipment provides automatic adjustment of airflow rate. A separate control signal output for each step of airflow rate shall be considered as an automatic adjustment.

Table 3. Minimum External Resistance	
Standard Dehumidifier Airflow, m ³ /h	Minimum External Resistance ¹ , kPa
≤ 5940	0.12
> 5940	0.25
Note: 1. For units tested without an air filter installed, increase the applicable tabular value by 0.02 kPa.	

6.3.2 Outdoor-side airflow rate shall be determined at the outdoor-side airflow rate specified by the manufacturer where the fan drive is adjustable. Where the fan drive is non-adjustable, ratings shall be determined at the outdoor-side airflow rate inherent in the equipment when operated with all of the resistance elements associated with inlets, louvers, and any ductwork and attachments considered by the manufacturer as normal installation practice. Once established, the outdoor-side air circuit of the equipment shall remain unchanged throughout all tests prescribed herein. Airflow rates shall be expressed in m³/h of Standard Air.

6.3.3 *Liquid Flow Rates.*

6.3.3.1 For Indoor Pool Dehumidifiers with integral liquid pumps, ratings shall be determined at a liquid flow rate specified by the manufacturer.

6.3.3.2 For Indoor Pool Dehumidifiers without integral liquid pumps, ratings shall be determined at a liquid flow rate specified by the manufacturer.

6.3.3.3 The manufacturer shall specify a single liquid flow rate for all of the tests required in this part of the standard unless automatic adjustment of the liquid flow rate is provided by the equipment. A separate control signal output for each step of liquid flow rate will be considered as an automatic adjustment.

6.3.4 *Power Input of Liquid Pumps.* If a unit has a Refrigerant Heat Recovery Unit, a pump power adjustment is to be added to the power consumed by the unit, using Equation 1. Table 4 shall apply to all units that include a refrigerant to liquid heat recovery device.

$$PP = WF [(PP_B \cdot \Delta P) + C] \tag{1}$$

Where:

- C = 400 W/(L/s) based on 6.0 m external head.
- PP = Pump power adjustment, W
- PP_B = Basic Pumping Penalty (Table 4), W/(L/s·kPa)
- ΔP = Water-pressure drop measured across liquid heat exchanger, kPa
- WF = Liquid flow rate, L/s

Table 4. Basic Pumping Penalty (PP _B) vs. Liquid Flow Rate (WF)	
Liquid Flow Rate (WF), L/s	Basic Pumping Penalty (PP _B), W/(L/s·kPa)
.06 - .25	11.50
.26 - .50	8.92
.50 - .75	6.19
.76 - 1.00	5.34
1.01 - 1.25	4.92
1.26 and above	4.65

6.3.5 *Requirements for Separated Assemblies.* All Standard Ratings for Indoor Pool Dehumidifiers in which the outdoor section is separated from the indoor section, as in Types SSI-A, SSI-A-PH, SSI-A-E and SSI-A-PH-E (Section 4), shall be determined with at least 7.6 m of interconnecting tubing on each line, of the size recommended by the manufacturer. Such dehumidifiers in which the interconnecting tubing is furnished as an integral part of the machine not recommended for cutting to length shall be tested with the complete length of tubing furnished, or with 7.6 m of tubing, whichever is greater. The line sizes, insulation and details of installation shall be in accordance with the manufacturer's published recommendations.

6.3.6 *Test Liquid.* The test liquid for Indoor Pool Dehumidifiers shall be water and sufficiently free of gas to ensure that the measured result is not influenced by its presence.

6.4 *Application Ratings.* Ratings at conditions other than those specified in 6.3 may be published as Application Ratings, and shall be based upon data determined by the method of testing described in Section 5.

6.5 *Publication of 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.

6.6 *Tolerances.* To comply with this standard, Published Ratings shall be based on data obtained in accordance with the provisions of Sections 5 and 6 of this standard and shall be such that any production unit, when tested, shall meet these ratings within the following tolerances:

6.6.1 MRC and Moisture Removal Efficiency shall not be less than 95 percent of the Published Rating.

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 ANSI/AHRI Standard 911 (SI)." All claims to ratings outside the scope of this standard shall include the statement "Outside the scope of ANSI/AHRI Standard 911 (SI)." Wherever Application Ratings are published or printed, they shall include a statement of the conditions at which the ratings apply.

7.1.1 *MRC Designations.* MRC used in published specifications, literature or advertising, controlled by the manufacturer, for equipment rated under this standard, shall be expressed in kg of moisture/h at the Standard Rating Conditions specified in Section 6.

7.1.2 *MRE Designations.* Moisture Removal Efficiencies used in published specifications, literature or advertising, controlled by the manufacturer, for equipment rated under this standard, shall be expressed in kg of moisture/kWh at the Standard Rating Conditions specified in Section 6.

7.1.3 Net Sensible Cooling Capacity if applicable, kW.

7.1.4 Total Heat of Rejection to Indoor Air, kW.

7.1.5 Total Heat of Rejection to Outdoor Air if applicable, kW.

7.1.6 Total Heat of Rejection to Liquid if applicable, kW.

7.1.7 Total Input Power, kW.

Section 8. Operating Requirements

8.1 *Operating Requirements.* To comply with this standard, any production unit shall meet the requirements detailed herein.

8.2 *Maximum High-Temperature Operating Conditions Test.* Indoor Pool Dehumidifier equipment shall pass the maximum high-temperature operating conditions test with an indoor-side and an outdoor-side airflow rate as specified in

Sections 6.3.1 and 6.3.2 respectively. In all cases, the equipment shall be set to prevent the use of reheat or desuperheat or a source of heat rejection.

8.2.1 *Temperature Conditions.* Temperature conditions shall be maintained as specified in Table 2.

8.2.2 *Voltages.* Tests shall be run at the minimum and maximum utilization voltages of Voltage Range B as shown in Table 1 of ANSI/AHRI Standard 110, at the unit's service connection and at rated frequency.

8.2.3 *Procedure.*

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

8.2.3.2 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 be restored.

8.2.4 *Requirements.*

8.2.4.1 During the test, the equipment shall operate without failure of any of its parts.

8.2.4.2 The equipment shall resume continuous operation within one hour of restoration of power and shall then operate continuously for one hour. Operation and resetting of safety devices prior to establishment of continuous operation is permitted.

8.2.4.3 Equipment with liquid heat exchangers shall be capable of operation under the maximum conditions at a water pressure drop not to exceed 100 kPa measured across the exchanger.

8.3 *Insulation Effectiveness Test.* Indoor Pool Dehumidifiers shall pass the insulation effectiveness test when operating with indoor-side and outdoor-side airflow rates as specified in Sections 6.3.1 and 6.3.2, also with controls, dampers and grills set to produce the maximum tendency to sweat, provided such settings are not contrary to the manufacturer's instructions to the user.

8.3.1 *Temperature Conditions.* Temperature conditions shall be maintained as specified in Table 2.

8.3.2 *Procedure.* After establishment of the specified temperature conditions, the unit shall be operated continuously for a period of four hours.

8.3.3 *Requirements.* During the test, no condensed water shall drip, run, or blow off from the unit's casing.

8.4 *Tolerances.* The conditions for the tests outlined in Section 8 are average values subject to tolerances stated in ASHRAE Standard 190.

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, and electrical characteristics.

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 shall not 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 the standard. All references in this appendix are considered as part of the standard.

A1.1 ANSI/AHRI Standard 110-2012, *Air-conditioning, Heating and Refrigerating Equipment Nameplate Voltages*, Air-conditioning, Heating, and Refrigeration Institute, 2012, 2111 Wilson Blvd., Suite 500, Arlington, VA 22201, U.S.A.

A1.2 ANSI/AHRI Standard 910 (I-P)-2014, *Performance Rating of Indoor Pool Dehumidifiers*, Air-conditioning, Heating, and Refrigeration Institute, 2014, 2111 Wilson Blvd., Suite 500, Arlington, VA 22201, U.S.A.

A1.3 ANSI/ASHRAE Standard 190-2013, *Method of Testing for Rating Indoor Pool Dehumidifiers*, 2013, American Society of Heating, Refrigerating and Air-conditioning Engineers, Inc., 1791 Tullie Circle, N.E., Atlanta, GA 30329, U.S.A.

A1.4 ASHRAE, *Terminology*, <https://www.ashrae.org/resources--publications/free-resources/ashrae-terminology>, 2014, American Society of Heating, Refrigerating and Air-conditioning Engineers, Inc., 1791 Tullie Circle, N.E., Atlanta, GA 30329, U.S.A.

A1.5 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 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.