AHRI Standard 810-2023 (SI/I-P)

2023 Standard for

Performance Rating of Automatic Commercial Ice-makers

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IMPORTANT

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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.

ICS Code: 27.200

Note:

This standard supersedes AHRI Standard 810-2016 (I-P) (with Addendum 1) and AHRI Standard 811-2016 (SI) (with Addendum 1)

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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 AHRI Standard 810, *Performance Rating of Automatic Commercial Ice-makers*, was prepared by the Automatic Commercial Ice-makers Standards Technical Committee. The standard was approved by the Refrigeration Standards Subcommittee on 19 July 2023.

Origin and Development of AHRI Standard 810

The initial publication was ARI Standard 810-1957, *Standard for Automatic Self-contained Ice-makers*. Subsequent revisions were:

AHRI Standard 810-1995, *Standard for Automatic Commercial Ice-makers*

AHRI Standard 810-2000, *Standard for Automatic Commercial Ice-makers*

AHRI Standard 810–2003, *Performance Rating of Automatic Commercial Ice-makers*

AHRI Standard 810-2007, *Performance Rating of Automatic Commercial Ice-makers*

AHRI Standard 810-2007 (with Addendum 1), *Performance Rating of Automatic Commercial Ice-makers*

ANSI/AHRI Standard 810 (I-P)-2013, *Performance Rating of Automatic Commercial Ice-makers*

ANSI/AHRI Standard 811 (SI)-2013, *Performance Rating of Automatic Commercial Ice-makers*

AHRI Standard 810 (I-P)-2016, *Performance Rating of Automatic Commercial Ice-makers*

AHRI Standard 811 (SI)-2016, *Performance Rating of Automatic Commercial Ice-makers*

AHRI Standard 810-2016 (I-P) (with Addendum 1), *Performance Rating of Automatic Commercial Ice-makers*

AHRI Standard 811-2016 (SI) (with Addendum 1), *Performance Rating of Automatic Commercial Ice-makers*

Summary of Changes

AHRI Standard 810 (SI/I-P) contains the following updates to the previous edition:

- Consolidated AHRI Standard 811 into AHRI Standard 810 to create a joint unit SI/I-P standard
- Incorporate 2018 Addendum 1 into the standard

Committee Personnel

Automatic Commercial Ice-makers Standards Technical Committee

Participant	Interest Category Classification	Voting Member Role	State or Province / Country
Stephen Schaefer Hoshizaki	Product Manufacturer	Chair	GA, USA
Aniruddh Roy Energy Solutions	Product Manufacturer	Primary	CA, USA
Jim Godiska Follett Products, LLC	Product Manufacturer	Primary	PA, USA
Bill Olson Manitowoc FSG Operations, LLC	Product Manufacturer	Primary	WI, USA
Raúl Perea ITV Ice Makers SL	Product Manufacturer	Primary	Valencia, Spain
Chris Salatino Scotsman Ice Systems	Product Manufacturer	Primary	IL, USA
Andrew Euclide Manitowoc FSG Operations, LLC	Product Manufacturer	Alternate to Bill Olson	WI, USA
Alan Shihab Manitowoc FSG Operations, LLC	Product Manufacturer	Alternate to Bill Olson	CT, USA
Jonathan Hartman Follett Products, LLC	Product Manufacturer	Alternate to Jim Godiska	OH, USA
Javier Rivera ITV Ice Makers SL	Product Manufacturer	Alternate to Raúl Perea	Valencia, Spain
AHRI Staff Liaison	James Spalding		

The Automatic Commercial Ice-makers Standards Technical Committee Scope:

The Automatic Commercial Ice-makers Standards Technical Committee (STC) is responsible for the development and maintenance of AHRI standards and guidelines pertaining to the performance ratings of Automatic Commercial Ice-makers and Ice Storage Bins.

Refrigeration Standards Subcommittee

Participant	Interest Category Classification	Voting Member Role	State or Province / Country
Mike Straub Heat Transfer Products Group, LLC	Product Manufacturer	Chair	AL, USA
Kunal Bansal Heatcraft Worldwide Refrigeration LLC	Product Manufacturer	Primary	GA, USA
Steve Combs Everidge	Product Manufacturer	Primary	VA, USA
Bruce Hierlmeier Zero Zone, Inc.	Product Manufacturer	Primary	WI, USA
Jennifer Kane Trane Technologies	Product Manufacturer	Primary	MO, USA
Scott Martin Hillphoenix	Product Manufacturer	Primary	GA, USA
Ron Shebik Hussmann Corporation	Product Manufacturer	Primary	MO, USA
Vince Zolli KeepRite Refrigeration	Product Manufacturer	Primary	ON, Canada
Karl Best	AHRI Staff Liaison		

Refrigeration Standards Subcommittee Scope:

The scope of the Refrigeration Standards Subcommittee is standards and guidelines related to the end products that are part of the AHRI Refrigeration Industry Sector. (The definition of and list of products associated with each sector are found on AHRI's website.)

These lists represent the membership at the time the Standards 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 or their employers of any document developed by the committee on which the member serves.

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APPENDICES

PERFORMANCE RATING OF AUTOMATIC COMMERCIAL ICE-MAKERS

Section 1. Purpose

This standard establishes definitions, test requirements, rating requirements, minimum data requirements for *published ratings*, marking and nameplate data, and conformance conditions for *automatic commercial ice-makers*.

Section 2. Scope

This standard applies to factory-made *automatic commercial ice-makers* as defined in Section 3.

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 Expression of Provisions

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 Adjusted Energy Consumption Rate

Total energy input rate adjusted by the *ice hardness factor*, stated in kW·h/100 lb of ice expressed in multiples of 0.01 kW·h/100 lb of ice as defined by Code of Federal Regulations (CFR) Title 10 §431.134 for *continuous type ice-makers*.

3.2.2 Automatic Commercial Ice-maker (ACIM)

A factory-made assembly (can be shipped in more than one package) including a condensing unit and ice-making section operating as an integrated unit, with means for making and harvesting ice. An assembly that makes not less than 50.0 lb (23.0 kg) of ice per day and up to 4000.0 lb (1800.0 kg) of ice per day at *standard ratings conditions* and can include means for storing or dispensing ice, or both.

3.2.2.1 Batch Type Ice-maker

An *ACIM* that has alternate freezing and harvesting periods.

3.2.2.2 Combined Ice-maker and Dispenser

A machine that makes and dispenses ice.

3.2.2.3 Continuous Type Ice-maker

An *ACIM* that freezes and harvests ice at the same time.

3.2.2.4 Self-contained Model Ice-maker

A model with the ice-making mechanism and storage compartment in an integral cabinet.

3.2.2.5 Split System Ice-maker

A model with the ice-making mechanism and condenser or condensing unit in separate sections.

3.2.2.5.1 Remote Condenser Systems

A type of *ACIM* that has the ice-making mechanism with compressor and condenser are in separate sections.

3.2.2.5.2 Remote Condensing Unit Systems

A type of *ACIM* that has a condenser and compressor remote from the ice-making mechanism section.

3.2.3 Bin Measured Internal Volume

For *self-contained model ice-makers* only, the measured internal volume of the ice storage bin is determined in accordance with AHRI 820 (SI/I-P). For these models, the internal volume is the volume calculated up to the intended shut-off level. The intended shut-off level is defined as the height of the thermostat bulb; the bottom of the curtain or the height of the electric eye, depending upon the mechanism used to shut off the ice-maker.

3.2.4 Condenser Water Use Rate

The amount of water used by the condensing unit (if water cooled), expressed in gal/100 lb (L/45.0 kg) of ice, stated in multiples of 1 gal/100 lb (1 L/45.0 kg) of ice according to ASHRAE 29.

3.2.5 Dump or Purge Water

The water from the ice making process that was not frozen at the end of the freeze cycle and is discharged from the machine for a *batch type ice-maker*.

Note: This is a departure from the term as defined by ASHRAE 29 but is more functional for *ACIM* testing purposes.

3.2.6 Energy Consumption Rate

Total energy input rate, stated in kWh/100 lb (kWh/45.0 kg) of ice expressed in multiples of 0.01 kWh/100 lb (0.01 kWh/45.0 kg) of ice according to ASHRAE 29. For *split system ice-makers*, total power input includes condenser fan power.

3.2.7 Harvest Water

The water that has been collected with the ice used to measure the machine's capacity.

3.2.8 Ice Hardness Factor

For *continuous type ice-makers* only, the ice hardness is defined in ASHRAE 29 based on *net cooling effect*.

3.2.9 Ice Harvest Rate

The gross weight of ice harvested, expressed in lb/24 h (kg/24 h) and in multiples of 1 lb/24 h (1 kg/24 h) according to ASHRAE 29.

3.2.10 Net Cooling Effect

Heat flow per mass to change the initial state of ice as produced by the *ACIM* to a liquid state at 32ºF (0ºC).

3.2.11 Potable Water Use Rate

The amount of potable water used in making ice that is equal to the sum of the ice harvested, *dump* or *purge water*, and the *harvest water* in gal/100 lb (L/45.0 kg) of ice, expressed in multiples of 0.1 gal/100 lb (0.1 L/45.0 kg) of ice according to ASHRAE 29. Alternatively, the amount of water entering the *ACIM* per cycle can be measured.

3.2.12 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*.

3.2.12.1 Application Rating

A rating based on tests performed at *rating conditions* other than *standard rating conditions*.

3.2.12.2 Standard Rating

A rating based on tests performed at *standard rating conditions*.

3.2.13 Rating Conditions

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

3.2.13.1 Standard Rating Conditions

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

Section 4. Test Requirements

The performance of *ACIMs* shall be verified by tests conducted in accordance with ASHRAE 29 and Section 4.1 through Section 4.4 of this standard. The calorimeter test need not be performed on *batch type ice-makers*.

4.1 Equipment

ACIMs shall be tested using all components as recommended by the manufacturer.

4.2 Electrical Conditions.

All *standard rating* tests shall be performed at the nameplate rated voltage(s) and frequency.

For *ACIMs* 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 published.

4.3 Requirements for Split System Ice-makers.

All *standard ratings* for *remote condenser systems* and *remote condensing unit system*s shall be determined with at least 25 ft (7.5 m) of interconnection tubing on each line. The line sizes, insulation and details of installation shall be in accordance with the manufacturer's published literature.

4.4 Test Set Up

The test unit shall be set up for testing per the manufacturer's written instructions provided with the unit.

Section 5. Rating Requirements

5.1 Published Ratings

Published ratings shall include *standard ratings* and can include *application ratings*.

5.2 Standard Ratings

Standard ratings shall be established at the *standard rating conditions* specified in Section 5.2.1. All *standard ratings* shall be verified by tests as required in Section 4. When the condenser or condensing unit is intended only for indoor installation, all literature pertaining to such *split system ice-makers* shall state that the *split system ice-makers* shall be installed only indoors.

5.2.1 Standard Rating Conditions

The conditions of test for *standard ratings* for *batch type ice-makers*, C*ontinuous type ice-makers*, *self-contained model ice-makers*, *split system ice-makers*, and *combined ice-makers and dispensers* are as follows:

1) Ambient temperature: 90.0°F (32.0ºC) (For a *split system ice-maker*, the condenser air inlet temperature shall be 90.0°F with the indoor ambient temperature at 90.0°F (32.0ºC))
2) Water inlet temperature: 70.0°F (21.0ºC)
3) Water inlet pressure as water is consumed: 30.0 ±3.0 psig (210 ± 20.0 kPa)

5.2.2 Standard Ratings

Standard ratings shall include *bin measured internal volum*e, *condenser water use rate*, *energy consumption rate*, *ice hardness factor*, *ice harvest rate*, and *potable water use rate*. To calculate *ice hardness factor*, use Equation 1. To calculate *adjusted energy consumption rate* for *continuous type ice-makers*, use Equation 1 and Equation 2 to calculate ice hardness adjustment factor (I_{HAF}), then multiple I_{HAF} and *energy consumption rate* to calculate the *adjusted energy consumption rate*.

For I-P units see Equation 1 and Equation 2.

$$I_{HF} = \left(\frac{CE_N/m}{K}\right) \cdot 100 \quad (1)$$

$$I_{HAF} = \left[\frac{K + C}{K \cdot \left(\frac{I_{HF}}{100}\right) + C}\right. \quad (2)$$

Where:

I_{HF}	=	*Ice hardness factor*, %
I_{HAF}	=	Ice hardness adjustment factor, unitless
CE_N	=	*Net cooling effect*, Btu
m	=	Mass, lb
C	=	38 Btu/lb (constant)
K	=	144 Btu/lb (constant)

For SI units see Equation 3

$$I_{HF} = \left(\frac{CE_N/m}{K}\right) \cdot 100 \quad (3)$$

Where:

IH	=	*Ice hardness factor*, %
CEN	=	*Net cooling effect*, kJ
m	=	Mass, kg
K	=	335 kJ/kg (constant)

5.3 Application Ratings

Ratings at conditions other than those specified in Section 5.2.1 may be published as *application ratings* and shall be based on data determined by the test requirements prescribed in Section 4.

5.4 Tolerances

To comply with this standard, *published ratings* shall be based on data obtained in accordance with the provisions of Section 4 and Section 5 of this standard and shall be such that any production unit, when tested, shall have an *ice harvest rate* not less than 95% of the *published rating* and an *energy consumption rate* not more than 105% of the *published rating*. The *potable* and *condenser water use rates* shall not be more than 110% of the *published ratings*. The *ice hardness factor* shall not be less than 95% of the *published rating*.

Section 6. 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 810 (SI/I-P)". All claims to ratings outside the scope of this standard shall include the statement "Outside the scope of AHRI Standard 810 (SI/I-P)". *Application ratings* within the scope of the standard shall include a statement of the conditions under which the ratings apply.

Section 7. Marking and Nameplate Data

As a minimum, the nameplate shall display the manufacturer's name, model designation, 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 110. Nameplate voltages for 50 Hertz systems shall include one or more of the utilization voltages shown in Table 1 of IEC Standard Publication 60038.

Section 8. Conformance Conditions

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

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 Boulevard, Suite 400, Arlington, VA 22201, USA.

A.2. AHRI Standard 820-2023 (SI/I-P), *Performance Rating of Ice Storage Bins*, 2023, Air-Conditioning, Heating and Refrigeration Institute, 2311 Wilson Boulevard, Suite 400, Arlington, VA 22201, USA

A.3. ANSI/ASHRAE Standard 29-2015 (RA 2018), *Methods of Testing Automatic Ice-makers*, 2018, ASHRAE, 180 Technology Parkway, Peachtree Corners, GA 30092, USA.

A.4. ASHRAE Terminology. ASHRAE. Accessed August 16, 2022. https://www.ashrae.org/resources--publications/free-resources/ashrae-terminology

A.5. IEC Standard 60038, *IEC Standard Voltages*, 2009, International Electrotechnical Commission, 3, rue de Varembe, P.O. Box 131, 1211 Geneva 20, Switzerland.

A.6. Title 10, Code of Federal Regulations (CFR), Part 431, Subpart H, §431.134, *Uniform Test Method for the Measurement of Energy and Water Consumption of Automatic Commercial Ice Makers*, U.S. National Archives and Records Administration, 8601 Adelphi Road, College Park, MD 20740-6001 or www.ecfr.gov

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.

None.