

**AHRI Standard 810 (I-P)  
with Addendum 1**

**2016 Standard for  
Performance Rating  
of Automatic Commercial  
Ice-makers**



**Air-Conditioning, Heating,  
and Refrigeration Institute**

2111 Wilson Boulevard, Suite 500  
Arlington, VA 22201, USA  
[www.ahrinet.org](http://www.ahrinet.org)

PH 703.524.8800  
FX 703.562.1942

# AHRI STANDARD 810-2016 WITH ADDENDUM 1

## Performance Rating of Automatic Commercial Ice-makers

January 2018

Addendum 1 of AHRI Standard 810-2016, is provided as follows. The following changes have been incorporated (deletions are shown by ~~strike-throughs~~ and additions by **shading**) into the already published 2016 version of AHRI Standard 810 to avoid confusion:

The changes include:

- 1) Edits to Certified Ratings and Section 3.2.

### Certified Ratings

The following Certification Program ratings are verified by test at the Standard Rating Conditions:

- a. Ice Harvest Rate, lb/24 h
- b. Potable Water Use Rate, gal/100 lb of ice (Batch Type Ice-makers only)
- c. Condenser Water Use Rate, gal/100 lb of ice
- d. Energy Consumption Rate, kWh/100 lb of ice
- e. ~~Bin Theoretical Storage Capacity~~ Bin Measured Internal Volume, **lb-ft<sup>3</sup>** (Self-contained Model Ice-makers only)
- f. Ice Hardness Factor, % (Continuous Type Ice-makers only)

**3.2** ~~Bin Theoretical Storage Capacity~~ **Measured Internal Volume**. For Self-contained Model Ice-makers only, the ~~theoretical storage capacity measured internal volume~~ and the storage effectiveness of the ice storage bin shall be determined in accordance with AHRI Standard 820 (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.

- 2) Added Section 3.5.1.

**3.5.1** **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 according to Code of Federal Regulations (CFR) Title 10 §431.134 for Continuous Type Ice-makers.

3) Edits to Section 5.2.2.

**5.2.2 Standard Ratings.** Standard Ratings shall include Bin Theoretical Storage Capacity Measured Internal Volume, 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 Equations 1 and 2 to calculate ice hardness adjustment factor ( $I_{HAF}$ ) then multiple  $I_{HAF}$  and Energy Consumption Rate to calculate the Adjusted Energy Consumption Rate.

$$\text{Ice Hardness Factor} = \left( \frac{\text{Net Cooling Effect per lb}}{144 \frac{\text{Btu}}{\text{lb}}} \right) \cdot 100 \quad I_{HF} = \left( \frac{CE_N/m}{K} \right) \cdot 100 \quad 1$$

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

Where:

$CE_N$  = Net Cooling Effect, Btu  
 $I_{HAF}$  = Ice hardness adjustment factor, Unitless  
 $I_{HF}$  = Ice Hardness Factor, %  
 $m$  = Mass, lb  
 $C$  = 38 Btu/lb (Constant)  
 $K$  = 144 Btu/lb (Constant)

4) Added a New Reference under Appendix A.

A1.6 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](http://www.ecfr.gov).

## IMPORTANT

### ***SAFETY DISCLAIMER***

AHRI does not set safety standards and does not certify or guarantee the safety of any products, components or systems designed, tested, rated, installed or operated in accordance with this standard/guideline. It is strongly recommended that products be designed, constructed, assembled, installed and operated in accordance with nationally recognized safety standards and code requirements appropriate for products covered by this standard/guideline.

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 810 (I-P)-2012.

For SI ratings, see AHRI Standard 811 (SI)-2016.

## **AHRI CERTIFICATION PROGRAM PROVISIONS**

### **Scope of the Certification Program**

The Certification Program includes all Automatic Commercial Ice-makers as defined in Section 3 and includes all Ice Storage Bins as defined in Section 3 of AHRI Standard 820 (I-P)-2012, *Performance Rating of Ice Storage Bins*.

### **Certified Ratings**

The following Certification Program ratings are verified by test at the Standard Rating Conditions:

- a. Ice Harvest Rate, lb/24 h
- b. Potable Water Use Rate, gal/100 lb of ice (Batch Type Ice-makers only)
- c. Condenser Water Use Rate, gal/100 lb of ice
- d. Energy Consumption Rate, kWh/100 lb of ice
- e. ~~Bin Theoretical Storage Capacity~~ Bin Measured Internal Volume, ~~lb~~ ft<sup>3</sup> (Self-contained Model Ice-makers only)
- f. Ice Hardness Factor, % (Continuous Type Ice-makers only)

## TABLE OF CONTENTS

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

## APPENDICES

Appendix A. References – Normative.....	5
Appendix B. References – Informative .....	5

# PERFORMANCE RATING OF AUTOMATIC COMMERCIAL ICE-MAKERS

## Section 1. Purpose

**1.1** *Purpose.* The purpose of this standard is to establish for Automatic Commercial Ice-makers: definitions; test requirements; rating requirements; minimum data requirements for Published Ratings; 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 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 (<https://www.ashrae.org/resources--publications/free-resources/ashrae-terminology>), unless otherwise defined in this section.

**3.1** *Automatic Commercial Ice-maker (ACIM).* A factory-made assembly (not necessarily shipped in one package) including a condensing unit and ice-making section operating as an integrated unit, with means for making and harvesting ice. It is an assembly that makes no less than 50.0 lbs of ice per day and up to 4,000.0 lbs of ice per day at Standard Ratings Conditions and may also include means for storing or dispensing ice, or both.

**3.1.1** *Combined Ice-maker and Dispenser.* A machine that makes and dispenses ice.

**3.1.2** *Continuous Type Ice-maker.* An ACIM that freezes and harvests ice at the same time.

**3.1.3** *Batch Type Ice-maker.* An ACIM that has alternate freezing and harvesting periods. ANSI/ASHRAE Standard 29 refers to this as a cube-type ice maker.

**3.1.4** *Self-contained Model Ice-maker.* A model in which the ice-making mechanism and storage compartment are in an integral cabinet.

**3.1.5** *Split System Ice-maker.* A model in which the ice-making mechanism and condenser or condensing unit are in separate sections.

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

**3.1.5.2** *Remote Condenser Systems.* A type of ACIM in which the ice-making mechanism with compressor and condenser are in separate sections.

**3.2** *Bin Theoretical Storage Capacity Measured Internal Volume.* For Self-contained Model Ice-makers only, the ~~theoretical storage capacity~~ *measured internal volume* of the ice storage bin shall be determined in accordance with AHRI Standard 820 (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.

**3.3** *Condenser Water Use Rate.* The amount of water used by the condensing unit (if water cooled), expressed in gal/100 lb of ice, stated in multiples of 1 gal/100 lb of ice according to ANSI/ASHRAE Standard 29.

**3.4** *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 ANSI/ASHRAE Standard 29 but is more functional for ACIM testing purposes.

**3.5** *Energy Consumption Rate.* Total energy input rate, stated in kWh/100 lb of ice expressed in multiples of 0.01 kWh/100 lb of ice according to ANSI/ASHRAE Standard 29. For Split System Ice-makers, total power input shall include condenser fan power.

**3.5.1** *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 according to Code of Federal Regulations (CFR) Title 10 §431.134 for Continuous Type Ice-makers.

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

**3.7** *Ice Hardness Factor.* For Continuous Type Ice-makers only, the ice hardness is defined in ANSI/ASHRAE Standard 29 based on Net Cooling Effect.

**3.8** *Ice Harvest Rate.* The gross weight of ice harvested, expressed in lb/24 h and in multiples of 1 lb/24 h according to ANSI/ASHRAE Standard 29.

**3.9** *Net Cooling Effect.* Heat flow per mass to change the state of ice from its initial state as produced by the ACIM to a liquid state at 32°F.

**3.10** *Potable Water Use Rate.* The amount of potable water used in making ice, which is equal to the sum of the ice harvested, Dump or Purge Water, and the Harvest Water in gal/100 lb of ice, expressed in multiples of 0.1 gal/100 lb of ice according to ANSI/ASHRAE Standard 29. Alternatively, the amount of water entering the ACIM per cycle can be measured.

**3.11** *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. The term Published Rating includes the ratings of all performance characteristics shown on the unit or published in specifications, advertising or other literature controlled by the manufacturer, at stated Rating Conditions.

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

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

**3.12** *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.

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

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

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

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

**Section 4. Test Requirements**

**4.1 Test Requirements.** The performance of ACIMs shall be verified by tests conducted in accordance with ANSI/ASHRAE Standard 29 and Sections 4.1.1 through 4.1.4 of this standard. The calorimeter test need not be performed on Batch Type Ice-makers.

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

**4.1.2 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 to be published.

**4.1.3 Requirements for Split System Ice-makers.** All Standard Ratings for Remote Condenser Systems and Remote Condensing Unit Systems shall be determined with at least 25 ft. of interconnection tubing on each line. The line sizes, insulation and details of installation shall be in accordance with the manufacturer's published literature.

**4.1.4 Test Set Up.** The test unit shall be set up for testing per the manufacturer's written instructions provided with the unit. However, no adjustments of any kind shall be made to the test unit prior to or during the test that would affect the ice capacity, energy usage, or water usage of the test sample.

**Section 5. Rating Requirements**

**5.1 Published Ratings.** Published Ratings shall include Standard Ratings, and may also 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 they are to be installed only indoors.

For machines with adjustable size ice cube settings, Standard Ratings require the publication of ratings for the largest size cube setting and for the smallest size cube setting. Ratings for any other intermediate size cube settings may be published as Application Ratings. The ice cube size setting shall accompany all Published Ratings.

**5.2.1 Standard Rating Conditions.** The conditions of test for Standard Ratings for Batch Type Ice-makers, Continuous Type Ice-makers, Self-contained Model Ice-makers, Split System Ice-makers, and Combined Ice-makers and Dispensers are as follows:

Ambient temperature: 90.0°F (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)

Water inlet temperature: 70.0°F

Water inlet pressure as water is consumed: 30.0 ±3.0 psig

**5.2.2 Standard Ratings.** Standard Ratings shall include Bin ~~Theoretical Storage Capacity~~ Measured Internal Volume, 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 Equations 1 and 2 to calculate ice hardness adjustment factor (I<sub>HAF</sub>) then multiple I<sub>HAF</sub> and Energy Consumption Rate to calculate the Adjusted Energy Consumption Rate.

$$\text{Ice Hardness Factor} = \left( \frac{\text{Net Cooling Effect per kg}}{144 \frac{\text{Btu}}{\text{lb}}} \right) \cdot 100 \quad I_{\text{HF}} = \left( \frac{\text{CE}_{\text{N/m}}}{\text{K}} \right) \cdot 100 \quad 1$$



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

Where:

- CE<sub>N</sub> = Net Cooling Effect, Btu
- I<sub>HAF</sub> = Ice hardness adjustment factor, Unitless
- I<sub>HF</sub> = Ice Hardness Factor, %
- m = Mass, lb
- C = 38 Btu/lb (Constant)
- K = 144 Btu/lb (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 Sections 4 and 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

**6.1 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 810 (I-P)”. All claims to ratings outside the scope of this standard shall include the statement “Outside the scope of AHRI Standard 810 (I-P)”. Wherever Application Ratings are published or printed, they shall include a statement of the conditions at which the ratings apply.

### Section 7. Marking and Nameplate Data

**7.1 Marking and Nameplate Data.** As a minimum, the nameplate shall display the manufacturer's name, model designation and electrical characteristics.

Nameplate voltages for 60 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 Publication 60038.

### Section 8. Conformance Conditions

**8.1 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 the standard. All references in this appendix are considered as part of this standard.

**A1.1** AHRI Standard. 110-2016, Air-conditioning, Heating and Refrigerating Equipment Nameplate Voltages, 2016, Air-Conditioning, Heating, and Refrigeration Institute, 2111 Wilson Blvd., Suite 500, Arlington, VA 22201, U.S.A.

**A1.2** AHRI Standard 820 (I-P)-2017, *Performance Rating of Ice Storage Bins*, 2017, Air-Conditioning, Heating and Refrigeration Institute, 2111 Wilson Blvd., Suite 500, Arlington, VA 22203, U.S.A.

**A1.3** ANSI/ASHRAE Standard 29-2015, *Methods of Testing Automatic Ice-makers*, 2015, 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/ashraeterminology>, 2018, 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.

**A1.6** 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](http://www.ecfr.gov).

## 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.