



ENERGY STAR® Program Requirements Product Specification for Automatic Commercial Ice Makers

Eligibility Criteria Final DRAFT: Version 2.0

Following is the **Final DRAFT Version 2.0** product specification for ENERGY STAR qualified Automatic Commercial Ice Makers. A product shall meet all of the identified criteria if it is to earn the ENERGY STAR.

1) Definitions: Provided below are definitions of the relevant terms in this document.

- A. Automatic Commercial Ice Maker: A factory-made assembly (not necessarily shipped in one package) consisting of 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 up to 4,000 lbs of ice per day, and may also include means for storing or dispensing ice, or both.
- B. Air-Cooled: An ice maker wherein motor driven fans or centrifugal blowers move air through the condenser to remove heat from the refrigerant.
- C. Water-Cooled: An ice maker that utilizes water running through the condenser to remove heat from the refrigerant.
- D. Batch-Type Ice Maker: An ice maker having alternate freezing and harvesting periods. This includes automatic commercial ice makers that produce cube type ice, ~~tube type automatic commercial ice makers,~~ and other batch technologies. ~~Also Referred to as cube type ice maker in AHRI Standard 810.-2007. AHRI Standard 810-2007's definition clarifies that "cube" does not reference a specific size or shape and includes all automatic commercial ice makers with alternate freezing and harvesting periods.~~
- E. Cube Type Ice: means ice that is fairly uniform, hard, solid, usually clear, and generally weighs less than two ounces (60 grams) per piece, as distinguished from flake, crushed, or fragmented ice. Note that this conflicts and takes precedence over the definition established in AHRI 810 (incorporated by reference, see § 431.133), which indicates that "cube" does not reference a specific size or shape.
- F. Continuous-Type Ice Maker: An ice maker that continually freezes and harvests ice at the same time. The following ice types are produced by continuous machines:
 - a) Flake: typically used for cooling food, commercial and industrial process cooling, and special medical and scientific cooling applications.
 - b) Nugget: typically used for cooling water and beverage drinks, and for a chewable ice with a softer consistency than cube ice.

Ice Machine Categories

- G. Ice Making Head (IMH): A model with the ice-making mechanism and the condensing unit in a single package, but with a separate ice storage bin.

- H. Remote Condensing Unit (RCU) or Split System Unit: A model in which the ice-making mechanism and condenser or condensing unit are in separate sections. This includes ice makers with and without remote compressor.
- I. Self-Contained Unit (SCU): A model in which the ice-making mechanism and storage compartment are in an integral cabinet.

Metric Definitions

- J. Energy Use Consumption Rate: Total energy input rate, stated in kWh/100 lb [kWh/45.0 kg] of ice, stated in multiples of 0.1. For ~~RCU systems remote condensing (but not remote compressor) automatic commercial ice makers and remote condensing and remote compressor automatic commercial ice makers,~~ total energy consumed ~~energy consumption rate~~ shall include the energy use of the ice-making mechanism, the compressor, and the remote condenser or condensing unit ~~condenser fan energy~~.
- K. Ice Harvest Rate: The gross weight of ice harvested, stated in lb/24 h [kg/24 h], stated in multiples of 1.

Ice Hardness Factor: ~~For Continuous Type Ice Makers only, the ice hardness factor is~~ The latent heat capacity of ice harvested ice (Btu/lb) [W/kg], as defined in ASHRAE Standard 29, Table A1, line 15, divided by 144 Btu/lb ~~{92.9 W/kg}, multiplied by 100, %~~ expressed as a percent.
- ~~L. Calorimeter Constant: The inverse of the ice hardness factor expressed as a decimal. The calorimeter constant is the ratio of the latent heat of fully frozen ice and the latent heat capacity of the ice harvested (a mix of frozen and liquid water) of the same weight.~~
- L. Potable Water Use: 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 expressed in gal/100 lb [L/45.0 kg] of ice, stated in multiples of 0.1. Alternatively, the amount of water entering the icemaker per cycle can be measured.
- M. Dump or Purge Water. The water from the ice making process that is not frozen at the end of the freeze cycle and is discharged from a batch and continuous type Automatic Commercial Ice-Maker.
- N. Harvest Water: The water that has been collected with the ice used to measure the machine's capacity.
- O. Basic Model: All units of a given type manufactured by one manufacturer, having the same primary energy source, and which have essentially identical electrical, physical, and functional (or hydraulic) characteristics that affect energy consumption, energy efficiency, water consumption, or water efficiency.

Note: The U.S. Environmental Protection Agency (EPA) has adopted the U.S. Department of Energy (DOE) Automatic Commercial Ice Maker (ACIM) Final Test Procedure (TP) definitions. The following definitions have been slightly altered or added as compared to the Draft 2 specification in order to align with the DOE ACIM Final Test Procedure: Batch type ice maker, Cube type ice, Energy use, and Ice hardness factor. EPA has removed the “calorimeter constant” definition due to DOE removing the term from the Ice Hardness Adjustment Factor equation.

2) Scope:

- A. Included Products: Products that meet the definition of an Automatic Commercial Ice Maker as specified herein are eligible for ENERGY STAR qualification, with the exception of products listed

in Section 2.B. Air-cooled batch and continuous type, IMH, RCU, and SCU designs can qualify for ENERGY STAR.

- B. Excluded Products: Water cooled ice makers and ice and water dispensing systems RCU machines designed for connection to remote compressor racks are not eligible for ENERGY STAR.

Note:

In its final rule, DOE clarified that remote condensing units (RCUs) sold exclusively to be connected to remote compressor racks are not subject to DOE regulations. However, EPA is still interested in including these products within the specification's scope if consistent with the ENERGY STAR program guiding principles and program timing. To that end, DOE has provided an ENERGY STAR ACIM Draft Test Method including draft guidance on how to test RCU units designed for connection to a compressor rack such that the compressor energy is accounted for its energy consumption value. EPA anticipates that these product types will be able to be included in the scope of the ENERGY STAR ACIM program, but if we are unable to come to resolution on how to account for these RCUs sold without a dedicated compressor, EPA will defer including them in this specification. The DOE drafted test method is included as a separate attachment. EPA will be hosting a discussion with stakeholders on February 1 to discuss this draft test method.

EPA has decided to exclude Ice and Water dispensers from Version 2.0 and may address these products in the next Version of the specification. Absent data representing multiple manufacturers, EPA cannot adequately consider the effect water dispensing functions have on energy use.

3) Qualification Criteria:

- A. Measure the energy use and potable water use of each covered product by conducting the test procedure set forth in Section 4. Compare the Energy Use and the measured Potable Water Use values to the ENERGY STAR minimum values presented in Tables 1 and 2.

Note: EPA has adopted the DOE final test procedure specific to the use of the Ice Hardness Adjustment Factor to recognize the direct relationship between ice quality and energy consumption for Continuous-type ice makers and does not apply the Ice Hardness Adjustment Factor to Batch-type ice maker energy use measurements. Aligning with DOE's test procedure, EPA uses the term ice "hardness" instead of ice "quality" to describe frozen water content in the ice product.

Based on stakeholder feedback, EPA will post both the adjusted and non-adjusted energy use values for continuous systems on its qualified product listing, thus allowing consumers to compare the non-adjusted values of nugget and batch products.

- B. Energy Consumption Rate: The Energy Consumption Rate requirement is a function of harvest rate in the form of $L = A * H^a - b$, where L is the energy consumption rate requirement level, H is the ice harvest rate for the system under evaluation, A is a coefficient, a is an exponent, and b is a constant.

Table 1: ENERGY STAR Requirements for Air-Cooled Batch Type Ice Makers			
Equipment Type	Applicable Ice Harvest Rate Range (lbs of ice/24 hrs)	Energy Consumption Rate (kWh/100 lbs ice)	Potable Water Use (gal/100 lbs ice)
IMH	<u>$200 \leq H \leq 1600$</u>	<u>$\leq 37.72 * H^{-0.298}$</u>	≤ 20.0
RCU	<u>$400 \leq H \leq 1600$</u>	<u>$\leq 22.95 * H^{-0.258} + 1.00$</u>	≤ 20.0
	<u>$1600 \leq H \leq 4000$</u>	<u>$\leq -0.00011 * H + 4.60$</u>	≤ 20.0
SCU	<u>$50 \leq H \leq 450$</u>	<u>$\leq 48.66 * H^{-0.326} + 0.08$</u>	≤ 25.0

Table 2: ENERGY STAR Requirements for Air-Cooled Continuous Type Ice Makers		
Equipment Type	Energy Consumption Rate (kWh/100 lbs ice)	Potable Water Use (gal/100 lbs ice)
IMH	<u>$\leq 9.18 * H^{-0.057}$</u>	≤ 15.0
RCU	<u>$\leq 6.00 * H^{-0.162} + 3.50$</u>	≤ 15.0
SCU	<u>$\leq 59.45 * H^{-0.349} + 0.08$</u>	≤ 15.0

Note:

Stakeholders expressed concern that the proposed Draft 2 ENERGY STAR level lines didn't adequately represent energy efficient systems across the entire capacity range for IMH and RCU Batch, and IMH and SCU Continuous Ice Maker categories. Also stakeholders expressed concern regarding the intersection between V 1.0 and the proposed V 2.0 level lines on the low and high end of the capacity ranges for Batch Type Ice Makers. To resolve these issues, in the final draft, EPA set high and low qualification limits for Batch Type Ice Makers and also made slight adjustments to the eligibility criteria for the four categories mentioned to capture a more balanced representation across the size spectrum.

EPA believes the qualification limits for Continuous Type Ice Maker qualification rates are appropriate and provide representation across all capacities and provide consumers with sufficient choice among types and manufacturers, while also more evenly representing flake and nugget systems.

C. Significant Digits and Rounding:

- a. All calculations shall be carried out with directly measured (unrounded) values.
- b. Unless otherwise specified, compliance with specification limits shall be evaluated using directly measured or calculated values without any benefit from rounding.

Directly measured or calculated values that are submitted for reporting on the ENERGY STAR website shall be rounded to 0.1 for energy consumption rate and potable water.

5) Test Requirements:

- A. Units shall be selected for testing per the sampling requirements defined in 10 CFR § 429.45, which references 10 CFR § 429.11.

Note: EPA has added the basic model definition and the sampling requirements to be more specific to the requirements as defined under 10 CFR section 429.45.

- B. When testing commercial ice machines, the following test methods shall be used to determine ENERGY STAR qualification:

Table 3: Test Methods for ENERGY STAR Qualification	
ENERGY STAR Requirement	Test Method Reference
Energy Consumption Rate (kWh/100 lbs ice)	ENERGY STAR Program Requirements - Product Specification for Automatic Commercial Ice Makers Test Method
Potable Water Use (gal/100 lbs ice)	

Note:
For those product categories that are covered both by DOE standards and the ENERGY STAR program, EPA is committed to harmonizing with DOE regarding the test procedures used to determine compliance. As a result, the test method referred to in this specification is the ENERGY STAR Test Method for ACIMs provided by DOE that references the DOE ACIM Test Method (10 CFR Part 431 Subpart H) for Energy Use testing, and AHRI Standard 810-2007 for potable water use testing. It also includes guidance on how to test RCU units designed for connection to a compressor rack such that the compressor energy is accounted for its energy consumption value.

DOE tested and addressed several stakeholder concerns relevant to the AHRI Standard 810-2007 during the ACIM TP rule making process, and has set tolerance requirements and amendments to the test procedure, which can be found in 10 CFR Part 431 Subpart H.

- 6) **Effective Date:** The ENERGY STAR Automatic Commercial Ice Maker specification shall take effect on **January 1, 2013**. To qualify for ENERGY STAR a product model shall meet the ENERGY STAR specification in effect on the model's date of manufacture. The date of manufacture is specific to each unit and is the date on which a unit is considered to be completely assembled.

Note: EPA intends to finalize the Version 2.0 specification by the **March 1, 2012**. Upon its finalization, all systems covered by this specification that have been certified as meeting the Version 2.0 requirements by an EPA recognized Certification Body (CB) may qualify immediately. **Effective January 1, 2013**, all currently qualified units must meet the Version 2.0 requirements and be third party certified to remain on the ENERGY STAR Qualified Product List. Manufacturers of products that do not meet eligibility and certification requirements as of this date must cease using the ENERGY STAR mark to promote those

- 7) **Future Specification Revisions:** EPA reserves the right to change the specification should technological and/or market changes affect its usefulness to consumers, industry, or the environment. In keeping with current policy, revisions to the specification are arrived at through industry discussions. In the event of a specification revision, please note that the ENERGY STAR qualification is not automatically granted for the life of a product model.