



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

Eligibility Criteria DRAFT 1: Version 2.0

Following is the **DRAFT 1 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.¹

- 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.

Note: For purposes of aligning terms and definitions with other industry standards, particularly with the U.S. Department of Energy (DOE) Energy Conservation Standard for Automatic Commercial Ice Makers, the term Commercial Ice Machine has been changed to Automatic Commercial Ice Maker. In addition, definitions for potable water use, dump or purge water, harvest water, ice harvest rate and energy consumption rate have been added based on AHRI 810-2007 to more clearly define the qualifying metrics used to earn the ENERGY STAR. Stakeholders are encouraged to comment on these modifications.

- 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.

Note: The U.S. DOE's April 4, 2011 Test Procedure (TP) Notice of Proposed Rulemaking (NOPR) for Automatic Commercial Ice Makers proposed the addition of two new definitions, Batch-Type Ice Maker and Continuous-Type Ice Maker (see 76 FR 18428, 18444). For purposes of harmonization, EPA proposes to adopt the same terms and definitions. EPA believes that this also helps to further clarify product eligibility.

- 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.

¹ Definitions for Air-Cooled, Water-Cooled, IMH are uniquely defined herein. All other definitions are based on those provided in AHRI Standard 810-2007, *Performance Rating of Automatic Commercial Ice Makers*, and the U.S. Department of Energy Federal Register (see 76 FR 18428, 18444).

- E. Continuous-Type Ice Maker: An ice maker that continually freezes and harvests ice at the same time.
 - a) Flake: Ice maker that produces ice in a barrel-shaped evaporator. An auger inside the evaporator scrapes ice off the sides creating “flakes of ice” into a storage bin.
 - b) Nugget: Ice maker that uses the same process as flake machines to produce ice but compresses the ice flakes into nuggets.

Ice Machine Categories

- F. 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.
- G. 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 condensing units.
- H. Self-Contained Unit (SCU): A model in which the ice-making mechanism and storage compartment are in an integral cabinet.

Note: ENERGY STAR is intended to help consumers make energy efficient purchases while maintaining a diversity of technology options for the consumer. EPA proposes to preserve the technology categories IMH, RCU, SCU, batch, and continuous type machines. Industry representatives have suggested that purchases are first driven by form factor and application (i.e. end use, ice type, beverage) and then by energy efficiency. Despite similarities in performance across some of these categories, EPA believes that the applications and purchasing behaviors justify maintaining their separation and incentivizing innovation within each technology group. EPA welcomes comments on this approach and its assumptions about purchasing behavior.

Metric Definitions

- I. Energy 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, energy consumption rate shall include condenser fan energy.

Note: For continuous type ice makers, EPA has been asked to consider normalizing energy use by ice hardness to provide fair comparisons between machines that produce a wide array of hardness levels. EPA intends to utilize the same normalizing equation proposed in the DOE TP NOPR, however, in the initial data collection EPA received only a limited set of ice hardness data. Therefore, EPA asks manufacturers to provide additional ice hardness data so that EPA may propose appropriate levels. Stakeholders are also encouraged to provide any additional comments on the proposed normalizing equation calculation.

- J. Ice Harvest Rate: The gross weight of ice harvested, stated in lb/24 h [kg/24 h], stated in multiples of 1.
- K. 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.

Note: For purposes of harmonization, EPA has changed the number of decimals required when reporting metrics so as to align with the AHRI 810-2007.

- L. 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 type Automatic Commercial Ice-Maker.
- M. Harvest Water: The water that has been collected with the ice used to measure the machine's capacity.

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 RCU machines designed for connection to remote compressor racks are not eligible for ENERGY STAR.

Note: EPA recently learned that the energy consumption rates reported by manufacturers of RCU equipment designed for connection to a remote rack compressor do not take into account the energy used by the compressor and condenser or condensing unit. In such cases, the end user is not able to determine the total energy being consumed during the ice making process. The DOE TP NOPR proposed requiring a dedicated compressor be assigned to the RCU for testing, such that the energy used by the compressor is accounted for in the rating. 76 FR 18428, 18433. EPA intends to align with DOE, if it develops testing guidelines to address this issue. EPA proposes excluding RCU units designed for connection to remote rack compressors until a workable solution can be reached to address compressor energy use. EPA requests comments from manufacturers and stakeholders on this approach.

3) Qualification Criteria:

- A. Energy and Water Efficiency Requirements: The compliance level for the Energy Consumption Rate is a function of harvest rate in the form of $L = A * H^a - b$, where H is the ice harvest rate for the system under evaluation, L is the energy consumption rate compliance level, 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	Energy Consumption Rate (kWh/100 lbs ice)	Potable Water Use (gal/100 lbs ice)
IMH	$\leq 38.76 * H^{-0.297} - 0.24$	≤ 20.0
RCU	$\leq 38.76 * H^{-0.297} - 0.01$	≤ 20.0
SCU	$\leq 38.76 * H^{-0.297} + 0.60$	≤ 25.0

Equipment Type	Energy Consumption Rate (kWh/100 lbs ice)	Potable Water Use (gal/100 lbs ice)
IMH	$\leq 36.55 * H^{-0.315} - 0.38$	≤ 12.0
RCU	$\leq 36.55 * H^{-0.315} + 0.01$	≤ 12.0
SCU	$\leq 36.55 * H^{-0.315} - 0.38$	≤ 12.0

Equipment Type	Energy Consumption Rate (kWh/100 lbs ice)	Potable Water Use (gal/100 lbs ice)
IMH	$\leq 57.346 * H^{-0.368} - 0.60$	≤ 12.0
RCU	$\leq 57.346 * H^{-0.368} - 0.03$	≤ 12.0
SCU	$\leq 57.346 * H^{-0.368} - 0.28$	≤ 12.0

Note: EPA proposes utilizing power curves for setting the energy consumption rate levels to more accurately depict the overall relationship between ice harvest rate and energy use than multiple linear curves. An additional benefit to using power curve equations is that ice harvest bins are no longer needed.

The power curve equations were generated by curve fitting the nugget data set, flake data set, and batch data set, resulting in three overall curves. For each equipment type (IMH, RCU, and SCU) the lines were offset to achieve a desired ENERGY STAR level. This proved most helpful for small data sets, such as RCU Nugget, where limited data was available. The achieved qualification rates ranged from 16% (for RCU Nugget category) to 25% (for cube category where a larger data set was available) to 33% of models (for SCU Batch where levels were reached to provide broader manufacturer qualification).

EPA also determined that due to wide range in potable water use for batch systems, the levels could be lowered to better differentiate products. For continuous type systems, due to the lack of diversity in potable water use, a cap was set. EPA welcomes comments on the proposed levels, the methodology for setting the level lines, and also on the data plots that are available on the ENERGY STAR Commercial Ice Machines Specification Development webpage: http://www.energystar.gov/index.cfm?c=revisions.commercial_ice_machine_spec

B. 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.
- c. Directly measured or calculated values that are submitted for reporting on the ENERGY STAR website shall be rounded to the nearest significant digit as expressed in the corresponding specification limit and definitions section.

4) Test Requirements:

- A. Representative Models shall be selected for testing. The representative model shall be equivalent to that which is intended to be marketed and labeled as ENERGY STAR. Qualification based on product family is not acceptable under this specification. Each individual model shall be tested and meet the requirements of this specification to be qualified as ENERGY STAR.
- B. When testing commercial ice machines, the following test methods shall be used to determine ENERGY STAR qualification:

ENERGY STAR Requirement	Test Method Reference
Energy Consumption Rate (kWh/100 lbs ice)	AHRI Standard 810-2007, <i>Performance Rating of Automatic Commercial Ice-Makers</i>
Potable Water Use (gal/100 lbs ice)	

Note: For those product categories that are covered both by DOE standards and ENERGY STAR, EPA is committed to harmonizing with DOE regarding the test procedures used to determine compliance. This greatly reduces confusion and burden on manufacturer partners. DOE has proposed using AHRI Standard 810-2007, in its rulemaking process. While changes may be made to the procedure, DOE has indicated that it does not anticipate these changes will impact existing performance ratings, although the comment process is still ongoing. EPA's data set will continue to represent available model performance. DOE expects the test procedure to be finalized early Winter 2011. This timing corresponds with EPA's efforts to revise this specification, also scheduled to be finalized by early Winter 2011. Once final, EPA intends to reference the DOE test procedure as defined in the Federal Register in Table 4 above.

- 5) Effective Date:** The ENERGY STAR Automatic Commercial Ice Maker specification shall take effect on **August 1, 2012**. 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 November 1, 2011. EPA will provide a 9 month transition between the final and effective dates for covered products to qualify to the new specification. As such, August 1, 2012 is the anticipated effective date for batch type ice makers.

Continuous type ice makers, a new product category covered by this specification, would be eligible to qualify to this ENERGY STAR specification as soon as it is final.

Please note that to earn ENERGY STAR qualification manufacturers must have their products third-party certified by an EPA-recognized Certification Body (CB) to the Version 2.0 requirements.

- 6) 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.