



ENERGY STAR® Program Requirements Product Specification for Commercial Dishwashers

Eligibility Criteria DRAFT 2: Version 2.0

Following is the **Draft 2 Version 2.0** product specification for ENERGY STAR qualified commercial dishwashers. A product shall meet all of the identified criteria if it is to earn the ENERGY STAR.

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

- A. Dishwashing Machine: A machine designed to clean and sanitize plates, glasses, cups, bowls, utensils, and trays by applying sprays of detergent solution (with or without blasting media granules) and a sanitizing final rinse.
- B. Stationary Rack Machine: A warewashing machine in which a rack of dishes remains stationary within the machine while subjected to sequential wash and rinse sprays. This definition also applies to machines in which the rack revolves on an axis during the wash and rinse cycles.
 - a) Under Counter: A machine with an overall height 38 inches or less, designed to be installed under food preparation workspaces. Under counter dishwashers can be either chemical or hot water sanitizing, with an internal booster heater for the latter.
 - b) Single Tank, Door Type: A machine designed to accept a standard 20x20 dish rack which requires the raising of a door to place the rack into the wash/rinse chamber. Closing of the door typically initiates the wash cycle. Subcategories of stationary door type machines include: single and multiple wash tank, double rack, pot, pan and utensil washers, chemical dump type and hooded wash compartment ("hood type"). Single tank, door type models can be either chemical or hot water sanitizing, with an internal or external booster heater for the latter.
 - c) Pot, Pan, and Utensil: A single tank, door type machine designed to clean and sanitize pots, pans, and kitchen utensils.
 - d) Glasswashing: A machine specifically designed to clean and sanitize glasses.

Note: A request was made to provide a more detailed definition for single tank, door type dishwashers that describes the basic design of the machine, similar to the under counter definition. In addition, definitions for pot, pan, and utensil and glasswashing machines have been added to this section based on the NSF/ANSI 170-2009 Standard: *Glossary of Food Equipment Terminology*. Stakeholders are encouraged to provide additional details regarding product design and/or application for inclusion in these definitions.

- C. Conveyor Machine: A warewashing machine that employs a conveyor or similar mechanism to carry dishes through a series of wash and rinse sprays within the machine.
 - a) Single Tank Conveyor: A conveyor type machine that includes a tank for wash water followed by a final sanitizing rinse. This type of machine does not have a pumped rinse tank but may include a pre-washing section ahead of the washing section. Single tank conveyor dishwashers can be either chemical or hot water sanitizing, with an internal or external booster heater for the latter.
 - b) Multiple Tank Conveyor: A conveyor type machine that includes one or more tanks for wash water and one or more tanks for pumped rinse water, followed by a final sanitizing rinse. This type of machine may include a pre-washing section before the washing section and an

auxiliary rinse section between the power rinse and final rinse section. Multiple tank conveyor dishwashers can be either chemical or hot water sanitizing, with an internal or external booster heater for the latter.

- c) Flight Type Conveyor: A conveyor type machine, as defined above, that utilizes permanently installed, vertical pegs to carry dishware through the wash and rinse cycle(s). This machine is also referred to as a rackless conveyor.

Note: The definition for single tank conveyor dishwasher has been modified to remove the language regarding “an auxiliary rinse section between the power rinse and final rinse sections”. A reviewer pointed out that if a conveyor includes pumped rinse sections prior to the final sanitizing rinse section then technically it is a multiple tank machine. In addition, a new definition for flight type conveyor is provided above. Stakeholders are encouraged to provide feedback on these definitions.

- D. Hot Water Sanitizing (High Temp) Machine: A warewashing machine that applies hot water to the surfaces of dishes to achieve sanitization.
- E. Chemical Sanitizing (Low Temp) Machine: A warewashing machine that applies a chemical sanitizing solution, as defined in NSF/ANSI 170, to the surfaces of wares to achieve sanitization.
- F. Product Family: Variations of one model offered within a single product line with design differences limited to: finish/color; length of pre-wash section, voltage, and orientation (e.g., corner, straight through models). Individual models represented by a product family must have the same final rinse water and idle energy consumption.

2) Scope:

- A. Included Products: Products that meet the definition of a Commercial Dishwasher as specified herein are eligible for ENERGY STAR qualification, with the exception of products listed in Section 2.B. The following product types are eligible: under counter; single tank, door type; single tank conveyor; and multiple tank conveyor. Glasswashing machines; pot, pan, and utensil machines; flight type machines; and dual sanitizing machines are also eligible. Only those under counter machines designed for wash cycles of 10 minutes or less are eligible for ENERGY STAR.
- B. Excluded Products: Dishwashers intended for use in residential or laboratory applications are not eligible for ENERGY STAR.

Note: In response to some concerns about scope, EPA has clarified that dishwashers intended for use in residential or laboratory applications are not eligible for ENERGY STAR. EPA is also interested in whether there are industry standards that should be referenced in this section that further define EPA’s intended scope.

In addition, flight type machines have been added to the list of products eligible for ENERGY STAR qualification. If an approach cannot be agreed upon during this revision cycle, EPA may decide to exclude flight type machines until a later specification version.

3) Qualification Criteria:

- A. Energy and Water Efficiency Requirements:

Machine Type	High Temp Efficiency Requirements		Low Temp Efficiency Requirements	
	Tank Heater Idle Energy Rate*	Water Consumption**	Tank Heater Idle Energy Rate*	Water Consumption**
Under Counter	≤ 0.50 kW	≤ 0.84 GPR	≤ 0.50 kW	≤ 1.19 GPR
Stationary Single Tank Door	≤ 0.64 kW	≤ 0.89 GPR	≤ 0.60 kW	≤ 1.18 GPR
Pot, Pan, and Utensil	≤ 0.70 kW	≤ 0.58 GPSF	≤ 0.60 kW	≤ 0.58 GPSF
Single Tank Conveyor	≤ 1.50 kW	≤ 0.700 GPR	≤ 1.50 kW	≤ 0.790 GPR
Multiple Tank Conveyor	≤ 2.00 kW	≤ 0.540 GPR	≤ 2.00 kW	≤ 0.540 GPR
Flight Type	TBD	XX GPH	TBD	XX GPH

* Idle results should represent tank heater idle energy rate measured with **door closed**.

** GPR = gallons per rack; GPSF = gallons per square foot of rack; GPH = gallons per hour

Note: The Version 2.0 dataset has been scrubbed to remove duplicates and models no longer available for purchase. Models that offer different pre-wash sections or other features not necessarily captured by the ENERGY STAR metrics (i.e., exact same GPR and cycle times) but important to end user purchasing decisions were retained as separate data points. This scrubbing has resulted in a smaller dataset and some adjustments to the proposed limits in Table 1, above. Changes compared to the Draft 1 proposal are highlighted in red font for ease in reviewing.

(1) **Under Counter Machines:** The idle level for high temp machines was adjusted slightly to represent the top 25% of the Draft 2 dataset. The Draft 1 proposed GPR and idle levels for low temp machines represent the top 30% of models available and follow a natural break in the data set and therefore, remain unchanged.

(2) **Door Type Machines (Standard):** The idle level for high temp machines has been adjusted slightly that when coupled with the proposed Draft 1 GPR limit represents the top 21% of models available. EPA has decided to retain the existing Version 1.2 GPR and idle levels for low temp models based on the fact that the new Draft 2 dataset only shows 8% compliance with the previously proposed Draft 1 levels. The existing ENERGY STAR levels represent the top 26% of the Draft 2 dataset and continue to provide significant savings to the end user.

(3) **Single Tank Conveyors:** The qualification rates for both low and high temp machines are similar to those demonstrated in the Draft 1 analysis (i.e., 21% and 22% respectively) and continue to provide sufficient differentiation in the marketplace and savings to the end user. Therefore, EPA did not change the GPR or idle levels.

(4) **Multiple Tank Conveyors:** The new low temp data set is extremely small but demonstrates an unacceptably low qualification rate using the previous Draft 1 levels (i.e. 0% compliance). Furthermore, adjusting the line to represent a larger share of the data set would result in only one manufacturer being represented. Therefore, EPA is proposing to keep the existing Version 1.2 levels for this subcategory. The high temp dataset is more robust; however, the overall compliance rate did not significantly change compared to the Draft 1. EPA has adjusted the idle level to be the same as low temp, consistent with the methodology provided in the Draft 1 for single tank conveyors.

Stakeholders will be able to view the Draft 2 data plots and compliance rate tables on the ENERGY STAR website at www.energystar.gov/revisedspecs (click on Commercial Dishwashers).

EPA received concerns that lowering GPR limits negatively impact cleaning performance in the field after extensive use, which could require additional run cycles to reach acceptable levels of cleanability. EPA continues to support the use of the industry accepted NSF/ANSI 3 test standard which provides a fair comparison for purposes of evaluating and comparing water consumption while meeting new machine cleaning performance. EPA is interested in getting stakeholder input on ways to educate end users about proper maintenance to help ensure continued performance over time.

EPA also received comments from energy and water efficiency advocates that water consumption levels should also be lowered for conveyor machines. However, the revised dataset continues to suggest the proposed levels provide significant differentiation in the marketplace for these categories. Within both categories, data listed in the NSF Directory suggests that the proposed ENERGY STAR levels continue to provide significant water savings (50% less gallons per rack) when compared to standard machines.

Pot, Pan, and Utensil Machines

Overall, stakeholders have expressed their support for setting separate levels for pot, pan, and utensil dishwashers. During the ENERGY STAR stakeholder meeting in February, an approach for setting performance levels for this subcategory was shared evaluating machines based on water consumption per square foot of rack. Several stakeholders suggested that EPA evaluate whether chamber volume would be an appropriate metric since these machines tend to be taller than standard door type machines.

EPA analyzed the relationship between water consumption and chamber volume. While there does appear to be correlation, EPA's proposed gallons per square foot (GPSF) metric: (1) shows an equally strong correlation and provides sufficient differentiation in the marketplace; (2) aligns with metrics used for other stationary rack categories that use a standardized rack approach; and (3) provides the end user with a method to compare models based on throughput and water usage.

Using this GPSF metric, EPA is proposing a level that represents the top 25% of *dedicated*, door type pot, pan, and utensil machines. Dual purpose door type machines, also included in the larger data set, typically use less water than dedicated systems, and will be required to meet both the standard door type GPR and pot, pan, and utensil machine GPSF requirements when tested to applicable NSF test methods for these product types (Item 3C below). Roll-in type machines were removed from the data set due to: (1) the significant difference in throughput and water use compared to other dedicated door type systems and (2) discussions with manufacturers indicating that most roll-in systems are ordered with customized racks, depending on the wares, making it difficult to apply the GPSF approach. EPA is considering excluding these product types in lieu of a way to ensure fair comparison among models but encourages stakeholders to comment on this direction.

Based on discussions with several manufacturers, there appears to be no inherent differences between the heating elements used in pot, pan, and utensil machines as compared to other standard, door type machines. Therefore, EPA is proposing the same idle levels for pot, pan, and utensil dishwashers as their standard door type counterparts. Based on industry discussions, EPA assumes that the majority of pot, pan, and utensil machines are designed for high temp applications. This assumption is supported by the absence of low temp data available in the NSF Directory. To the extent that these machines exist and seek ENERGY STAR qualification, EPA is proposing that they meet the same levels as their high temp standard door type counterparts.

Flight Type Machines

Based on extensive discussions during the ENERGY STAR stakeholder meeting, EPA has evaluated several potential metrics for setting flight type performance requirements including: total conveyor belt area; rinse belt area; total conveyor chamber volume; rinse chamber volume only; and % belt passing per hour. EPA did not identify a strong relationship between any of these measurements and water consumption. This seems to indicate that a proposed gallon per hour (GPH) metric is the best proxy for water efficiency. However, EPA is not proposing levels at this time for flight type machines. Instead, EPA will hold a focused flight type discussion on Monday, May 23, 2011 during the National Restaurant Association (NRA) Show to review the data plots and discuss potential metrics.

Interested stakeholders should RSVP to commercialdishwashers@energystar.gov by **May 17, 2011**. Manufacturers with additional flight type proposals are encouraged to share these with EPA prior to the meeting to be included in the discussion.

- B. **High/Low Temperature Machines:** Machines designed to be interchangeable in the field from high temp to low temp, and vice versa, shall meet both the high temp and low temp requirements of Table 1 to qualify as ENERGY STAR.

- C. Dual Purpose Door Type Machines: Machines designed to be used either as a dishwasher or a pot, pan, and utensil washer shall meet the performance requirements for both of those sub categories.
- D. Determination of Gallons Per Rack: The following calculations shall be used to determine gallons per rack. These calculations are based on conversions provided in the NSF Products and Service Listing for commercial dishwashers at www.nsf.org.

Conveyor Type

$$\text{GPR} = \frac{\text{GPH} \times \text{RL}}{\text{CS} \times 60}$$

Door Type

$$\text{GPR} = \frac{\text{GPH} \times (\text{WT} + \text{RT} + \text{DT} + \text{LT})}{3600}$$

Load Time= 5 seconds for straight through door-type dishwashers.

Load Time= 7 seconds for corner door-type dishwashers.

Load Time= 30 seconds for front load/unload dishwashers

GPSF = GPR/square foot of rack (pot, pan, and utensil)

Undercounter Type

$$\text{GPR} = \frac{\text{GPH} \times (\text{WT} + \text{RT} + \text{DT} + \text{LT})}{3600}$$

Load time= 30 seconds.

WT= Wash Time in seconds.

RT= Rinse time in seconds.

DT= Dwell time in seconds.

RL= Rack length, use 20x20 in.

LT= Load time.

CS= Maximum conveyor speed in feet per minute

GPH= Water use in gallons per hour.

Note: For purposes of determining GPSF for pot, pan, and utensil machines, EPA has included a simple calculation, above which builds on the GPR calculation for standard door type machines.

- E. 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.

Note: Provided above are slightly modified rounding principles based on several questions and requests received over the last several months regarding this requirement. These changes are meant to be clarifications; the core rounding requirements have not changed.

4) Test Requirements:

- A. Representative Models shall be selected for testing per the following requirements:
- a. For qualification of an individual product model, the representative model shall be equivalent to that which is intended to be marketed and labeled as ENERGY STAR.
 - b. For qualification of a product family, any model within that product family can be tested and serve as the representative model.
- B. When testing commercial dishwashers, the following test methods shall be used to determine ENERGY STAR qualification:

ENERGY STAR Requirement	Test Method Reference
Gallons per Rack (GPR) and Gallons per Square Foot of Rack (GPSF)	NSF/ANSI 3-2010 Standard, <i>Commercial Warewashing Equipment</i> and <i>ENERGY STAR Test Method for Final Rinse Water Consumption</i>
Idle Energy Rate – Undercounter and Stationary Rack, Single Tank, Door Type	ASTM Standard F1696-07, <i>Standard Test Method for Energy Performance of Single-Rack Hot Water Sanitizing, Door-Type Commercial Dishwashing Machines*</i>
Idle Energy Rate – Single and Multiple Tank Rack Conveyor Dishwashers	ASTM Standard F1920-07, <i>Standard Test Method for Energy Performance of Rack Conveyor, Hot Water Sanitizing, Commercial Dishwashing Machines*</i>

* Although the titles of the ASTM test procedures listed above specifically call out hot water sanitizing machines, the idle energy rate portion is also applicable, and shall be used, for chemical sanitizing machines.

Note: The NSF/ANSI 3-2010 test standard has been finalized and therefore, the test method reference provided in Table 2 above has been updated. A reference to the proposed new ENERGY STAR test method for measuring final rinse water consumption is also included.

- 5) **Effective Date:** The ENERGY STAR Commercial Dishwasher Specification shall take effect on **May 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: Given the number and complexity of comments received on the Draft 1 specification, EPA expects that additional review, analysis, and discussion will push finalization of this specification beyond May 2011. EPA is now targeting August 2011 for the final release of Version 2.0 and is proposing an effective date of May 1, 2012. This effective date will also provide manufacturers time to prepare qualifying products and promotional materials for the May 2012 NRA Show.

- 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.

ASTM Test Standard Review: EPA will revisit this specification once the revision processes for ASTM F1696 and ASTM F1920 are complete. These test methods will address washing energy performance as well as idle energy rate.