ENERGY STAR® Program Requirements
Product Specification for Commercial Dishwashers

Eligibility Criteria
Final Draft Version 3.0

Following is the Final Draft **Version 3.0** product specification for ENERGY STAR certified commercial dishwashers. A product shall meet all of the identified criteria if it is to earn the ENERGY STAR.

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

A. Dishwashing Machine: A machine designed to clean and sanitize plates, pots, pans, glasses, cups, bowls, utensils, and trays by applying sprays of detergent solution (with or without blasting media granules) and a sanitizing rinse.

Note: Footnote citations throughout the document are updated, reflecting new or revised references. As noted in the first footnote "Additional terms found throughout this document, and related to machine components and operation, are defined in NSF/ANSI 170-2019 *Glossary of Food Equipment Terminology*, unless otherwise cited." EPA references the latest ASTM test methods that are final. EPA will make amendments to the ASTM references in the ENERGY STAR specification once the ASTM standards are finalized.

Machine Types

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 term also applies to machines in which the rack revolves on an axis during the wash and rinse cycles.

a) Under Counter: A stationary rack machine with an overall height of 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 or external booster heater for the latter.[2]

i. Glasswashing: A stationary rack, under counter machine specifically designed to clean and sanitize glasses.

b) Single Tank, Door Type: A stationary rack machine designed to accept a standard 20 inch x 20 inch 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 single tank, stationary door type machines include: single rack; double rack; pot, pan and utensil washers (PPU); chemical dump and fill type; and, hooded wash compartment ("hood type")[3]. Single tank, door type models can be either chemical or hot water sanitizing, with an internal or external booster heater for the latter.[4]

i. Pot, Pan, and Utensil (PPU): A stationary rack, door type machine designed to clean and sanitize pots, pans, and kitchen utensils.

[1] Additional terms found throughout this document, and related to machine components and operation, are defined in NSF/ANSI 170-2019 *Glossary of Food Equipment Terminology*, unless otherwise cited.
[2] ASTM F1696-18 3.1.38
[3] Hood: A device intended for collecting vapors, mists, particulate matter, fumes, smoke, steam or heat before entering an exhaust system (NSF/ANSI 170-2019 3.109).
[4] ASTM F1696-18 3.1.39

ii. Dump and Fill: A machine type where after the wash cycle, the drain automatically opens to 'dump' the wash water to a holding tank or to a drain. The rinse tank fill then becomes the water for the next wash cycle.[5]

C. Conveyor Machine: A dishwashing 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 machine that includes a tank for wash water followed by a sanitizing rinse (pumped or fresh water). This type of machine does not have a pumped rinse tank. This type of machine may include a prewashing section ahead of the washing section and an auxiliary rinse section, for purposes of reusing the sanitizing rinse water, between the wash and sanitizing rinse sections. Single tank conveyor dishwashers can be either chemical or hot water sanitizing, with an internal or external booster heater for the latter.[6]

Note: Stakeholder suggests that single tank conveyor machines do not have a "power rinse" tank. EPA reviewed the definition of single tank conveyor machines in ASTM F1920-15 Section 3.1.35, and as such, has replaced "power rinse" with "wash" in Section 1.C.a., above, to align with the ASTM definition. The footnote has been updated to reference ASTM F1920-15 Section 3.1.35.

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 sanitizing rinse. This type of machine may include a pre-washing section before the washing section and an auxiliary rinse section, for purposes of reusing the sanitizing rinse water, between the power rinse and sanitizing rinse section. Multiple tank conveyor dishwashers can be either chemical or hot water sanitizing, with an internal or external booster heater for the latter.[7]

c) Flight Type Conveyor: A conveyor machine where the dishes are loaded directly on the conveyor rather than transported within a rack. This machine is also referred to as a rackless conveyor.[8]

D. Heat Recovery Machine: Warewashing equipment with heat recovery; a heat exchanger that recovers energy from other heat sources (i.e. waste water, exhaust duct) for the purpose of heating potable water.[9] This includes but is not limited to drain water-, wash compartment-, and/or exhaust heat exchangers; and supplemental heat pumps. The equipment must meet all the following requirements:

a) Use a minimum of 95% of water volume from the cold-water inlet for the wash and rinse cycle. The machine can have both cold-water and hot-water inlets, but a maximum of 5% of wash and rinse cycle water shall come from the hot water;

b) The temperature of the water at the dishwasher's inlet must be 70°F ± 3°F; and

c) The dishwasher must operate at or above 180°F rinse temperature.

[5] ASTM F953-2019 9.3 Operation Cycle
[6] ASTM F1920-15 3.1.35
[7] ASTM F1920-15 3.1.23
[8] ASTM F1920-15 3.1.16
[9] NSF 170-2019. Section 3.103 heat recovery equipment

Note: Stakeholder comments suggest the need to revise the Draft 2 definition for 'heat recovery machines' to ensure that all dishwashers using heat recovery mechanisms are properly identified to apply the offset equation proposed in Section 3.C below. This revised definition is proposed above.

The proposed definition changes are summarized by subpart below:

Part a) the heat recovery machine definition requires that most of the water entering the dishwasher's heat exchanger is coming from the cold-water inlet and a much smaller fraction is entering the dishwasher's heat exchanger from the water heater.

Part b) accounts for the 70°F ± 3°F combined temperature of the cold-water and hot-water inlets entering the dishwasher's heat exchanger. This part of the definition explicitly refers to the ASTM F1696-18 Section 9.3 that specifies the inlet water temperature to a door type heat recovery machine and anticipates the addition of the same inlet temperature requirement in ASTM F1920-15 for rack conveyor heat recovery machines.

Part c) limits the definition of a heat recovery machine to high temperature machines only to exclude vapor condensing machines operating at lower rinse temperatures (i.e., 140°F) that do not use the heat recovered by condensing to reduce energy use for heating water. EPA's understanding is that only machines with high temperature rinse provide sufficient waste heat to justify the additional energy credit. EPA recognizes that additional characteristics of the dish washing system may contribute to supplementary system efficiencies; however, in the absence of energy performance data, the Agency continues to identify and credit technologies that meet the criteria outlined in Section 1.D. EPA will continue to monitor advancements in technological approaches to further recognize in subsequent specification revisions.

EPA recognizes the value of heat recovery and proposes the approach outlined above as a way to more accurately define heat recovery machines than was proposed for Draft 2 of the ENERGY STAR specification. EPA also appreciates the continued input of collaborators, especially members of the ASTM F26 committee, in developing this approach. In addition, EPA acknowledges the energy savings with heat recovery capability using the offset as a way to level the playing field between heat recovery and non-heat recovery machines such that consumers faced with the option to select a high temp machine would be more informed about energy consumption differences across products. At the same time, the Agency acknowledges that consumers consider multiple trade-offs including and beyond energy efficiency before selecting either a low-temp or high-temp commercial dishwasher. Based on market sales and information made available to EPA, it's clear that there is a demand and need for all different types of eligible products and as such, EPA recognizes and promotes advanced and innovative technologies for all types of energy efficient eligible commercial dishwashing machines.

Furthermore, stakeholders have recently informed EPA of other alternative approaches for energy reduction, including capturing heat loss from the booster and heat recovery applications for low-temperature machines. EPA appreciates the additional feedback and continues to identify other strategies manufacturers adopt to achieve energy reduction and greater throughput. During the next revision of this specification, the Agency will continue to investigate ways on how best to capture energy savings for additional types of heat recovery machines that do not meet the currently proposed definitions and criteria provided in this Final Draft Version 3.0 specification.

EPA agrees with stakeholders that energy savings should be pursued across all dishwashing machine types, which is why the scope includes various types of high and low temperature products, recognizing energy savings potential for all categories in scope.

Sanitation Methods

E. Hot Water Sanitizing (High Temp) Machine: A machine that applies hot water to the surfaces of dishes to achieve sanitization.

F. Chemical Sanitizing (Low Temp) Machine: A machine that applies a chemical sanitizing solution to the surfaces of dishes to achieve sanitization.

G. Chemical Dump and Fill Type Machine: A low temp, stationary rack machine with a pumped recirculated sanitizing rinse and with or without a dedicated tank heater[10].

H. Dual Sanitizing Machine: A machine designed to operate as either a high temp or low temp machine.

Heaters

I. Circulating Water Heater: A water heater that is used with an external storage tank and is thermostatically controlled to circulate water through the external storage tank and back to the heater to be reheated.

J. Instantaneous Water Heater:

a) Tank Type Instantaneous Water Heater: An automatic, thermostatically controlled water heater that has an input rating of at least 4,000 Btu/hr per gal of stored water.

b) Watertube Type Instantaneous Water Heater: An automatic, self-contained water heater that requires water flow to activate the heat source and does not utilize a separate hot water storage tank.

K. Storage Water Heater: A water heater that heats and stores water within the appliance at a thermostatically controlled temperature for delivery on demand, and that has an input rating of less than 4,000 Btu/hr per gal of stored water.

L. Booster Heater: A water heater that raises the temperature of preheated water 40 to 80°F. The preheated water is supplied to the unit [booster heater] at temperatures that are typically between 100 and 140°F [11]. This booster heater can be either integral to the dishwasher, or externally connected.[12]

Modes and Metrics

M. Wash Mode: For stationary rack machines, the dishwasher is in wash mode when it is actively running a cycle and is spraying wash water (i.e., water that is neither part of the sanitizing rinse, post sanitizing rinse, nor the prewashing unit).[13]

N. Rinse Mode: For stationary rack machines, the dishwasher is in rinse mode when it is at the end of the actively running cycle and is spraying hot water or chemical sanitizing rinse water or a post-sanitizing rinse. If there is a post-sanitizing rinse, it shall be included in rinse mode.[14]

a) Pumped Rinse: Recirculated water that is pumped from a tank and sprayed onto dishes after washing and before the final sanitizing rinse is applied.

b) Auxiliary Rinse: Recirculated water pumped from a tank or sump and sprayed onto dishes after the wash or pumped rinse cycle and before the sanitizing rinse is applied.

c) Nonrecirculating Pumped Final Sanitizing Rinse: A freshwater rinse that is pumped once over wares and achieves sanitization using either chemical sanitizers or high temperature.

[10] Some dump and fill models may be equipped with a sustainer heater that re-heats stored water if operating interval is too long between cycles.
[11] NSF/ANSI 170-2019.3.237.1. Note that in warewashing, final rinse for high temp machines is 180-195 ºF.
[12] ASTM F1696-18, 10.7.6.3. If possible, sub-monitor the energy of the booster heater during the washing energy performance test.
[13] ASMT F1696-18 3.1.42
[14] ASTM F1696-18 3.1.31

d) Recirculating Final Sanitizing Rinse: Fresh water that is pumped repeatedly over wares and achieves sanitization using either chemical sanitizers or high temperature.

e) Post Sanitizing Rinse: Using sprays of fresh, potable water applied after the sanitizing step.

O. Dwell Mode: For stationary rack machines, the dishwasher is in dwell mode when it is actively running a cycle but is not in wash or rinse modes[15] (e.g., the period of time between the wash mode and the rinse mode).

P. Idle Mode: For all dishwasher types, the dishwasher is in idle mode when it is not actively running but is still powered on and ready to wash dishes at the required temperature.[16]

Q. Energy Saver Mode: An operational setting that is designed to reduce energy during idle mode through temporary shut-down of certain machine components (pumps or belt motors) or reduction of certain temperature set points.[17]

R. Idle Energy Rate: The rate of energy consumed by the dishwasher while "holding" or maintaining wash tank water at the thermostat(s) set point during the time period specified[18] and outside of an active cycle.

S. Washing Energy: The rate of energy consumed by the dishwasher while "washing" or "sanitizing" dish loads, as expressed in kWh/rack[19]. **Note:** Rinse modes detailed in *Section 1 N. Rinse Mode* are included in washing energy calculations.

T. Water Consumption:[20] Gallons per rack, per square foot, or per hour depending on the machine type monitored during testing to determine the rate of water usage. Note: measurement begins after dishwasher is stabilized, therefore excludes water for filling or replenishing tanks[21].

Note: A stakeholder commented that for multiple tank conveyor machines the term 'power rinse' is used interchangeably with 'pumped rinse' but that an 'auxiliary rinse' is different and in a distinct tank. As a result, EPA includes a definition for 'auxiliary rinse' per NSF 170-2019 for further clarification to distinguish the terms from one another.

Stakeholders also noted that water consumption values measured during the ASTM test methods may not align precisely with the measured values in the NSF rating. Specific variables or slight variations in the test methods may impact the results of the measured water consumption of a machine. However, water consumption is adjusted to the manufacturer's rated water consumption per NSF/ANSI Standard 3. The measured consumption shall be confirmed that it is within 5% of the listing on the nameplate (ASTM F1920-15 4.3). EPA has included a footnote stating the NSF rating and ENERGY STAR certification for water consumption may differ due to subtle differences in testing or other variables.

Certification Terms

U. Product Family: Variations within a product line must be limited to: finish/color; length of pre-wash section, voltage, and orientation (e.g. corner, straight through models). The test model shall be configured such that it reflects worst-case energy performance for the product line. Sanitizing

[15] ASMT F1696-18 3.1.11
[16] ASTM F1696-18 3.1.19
[17] ASTM F1696-18 3.1.12
[18] ASTM F1696-18 3.1.36
[19] ASTM F1920-15. 10.8.2.2 For flight type machines, kWh is measured over 5 batches of 10 dish loads, with the first (6th batch) ignored for stabilization.
[20] NSF/ANSI 3 rating and ENERGY STAR certification water consumption measures may vary slightly due to subtle differences in testing.
[21] ASTM F1696-18: 10.7.6.1 To begin stabilizing the dishwasher, load the dishwasher with an empty rack and initiate 5 consecutive wash cycles…engage the next wash cycle for a total of 10 racks…record total water consumption.

and post sanitizing rinse water consumption, idle energy rate, and washing energy shall be the same across the product family.

Note: EPA typically requires performance testing of machine configurations which are expected to have different performance results. Product family grouping is intended to address non-performance metrics differences, such as shape, finish, and mounting options without requiring additional performance testing. EPA refers manufacturers to the test procedures. In short, if the test procedure can capture the difference in performance, then the units are tested. Per stakeholder feedback, washing energy is added to the 'Product Family' definition and to clarify that the washing energy must be the same among models to be classified in the same product family. Additional modifications were made to the Product Family definition for further clarity.

2) **Scope:**

A. Included Products: Products that meet the definition of a commercial dishwasher as specified herein are eligible for ENERGY STAR certification, 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; multiple tank conveyor and high temp flight type conveyor machines. Glasswashing machines; high temp PPU machines; non-PPU, dual sanitizing; and heat recovery machines are also eligible. Only those under counter machines designed for wash cycles of 10 minutes or less are eligible for ENERGY STAR. This Version 3.0 specification only covers electric models.

B. Excluded Products: Dishwashers intended for use in residential or laboratory applications are not eligible for ENERGY STAR under this product specification. PPU and Flight Type products which are only rated for low temp operation; steam, gas, and other non-electric models are not eligible for ENERGY STAR certification under this Version 3.0.

Note: EPA acknowledges a small portion of machines in the market are dual-sanitizing PPU type machines. However, in Draft 1, EPA proposed to exclude low temperature PPUs from scope because few of these products were available in the market; no performance data on these machines were submitted to the EPA during the data assembly period; and no low-temperature PPUs were certified to ENERGY STAR under Version 2.0. As such, because there are no certification criteria requirements for low-temperature or dual-sanitizing PPU machines, they are both ineligible for certification at this time. The Agency has further clarified the scope in Section 2.A. that "non-PPU, dual-sanitizing" products are eligible. EPA encourages data submission on low temp and/or dual-sanitizing PPUs for the next commercial dishwasher product specification revision.

3) **Certification Criteria:**

A. Energy and Water Efficiency Requirements:

Table 1: ENERGY STAR Requirements for Commercial Dishwashers			
Machine Type	**Low Temperature Efficiency Requirements**		
	Idle Energy Rate*	**Washing Energy**	**Water Consumption****
Under Counter	≤ 0.25 kW	≤ 0.15 kWh/rack	≤ 1.19 GPR
Stationary Single Tank Door	≤ 0.30 kW	≤ 0.15 kWh/rack	≤ 1.18 GPR
Single Tank Conveyor	≤ 0.85 kW	≤ 0.16 kWh/rack	≤ 0.79 GPR
Multiple Tank Conveyor	≤ 1.00 kW	≤ 0.22 kWh/rack	≤ 0.54 GPR

Table 2: ENERGY STAR Requirements for Commercial Dishwashers	
Machine Type	**High Temperature Efficiency Requirements**

	Idle Energy Rate*	Washing Energy	Water Consumption**
Under Counter	≤ 0.30 kW	≤ 0.35 kWh/rack	≤ 0.86 GPR
Stationary Single Tank Door	≤ 0.55 kW	≤ 0.35 kWh/rack	≤ 0.89 GPR
Pot, Pan, and Utensil (PPU)	≤ 0.90 kW	≤ 0.55 + 0.05 x SF_{rack} †	≤ 0.58 GPSF
Single Tank Conveyor	≤ 1.20 kW	≤ 0.36 kWh/rack	≤ 0.70 GPR
Multiple Tank Conveyor	≤ 1.85 kW	≤ 0.36 kWh/rack	≤ 0.54 GPR
Single Tank Flight Type	Reported	Reported	GPH ≤ 2.975**x** + 55.00
Multiple Tank Flight Type	Reported	Reported	GPH ≤ 4.96**x** + 17.00

***** Idle results should be measured with the **door closed** and represent the total idle energy consumed by the machine including all tank heater(s) and controls. The most energy consumptive configuration in the product family shall be selected to test the idle energy rate. Booster heater (internal or external) energy consumption shall be measured and reported separately, if possible, per ASTM F1696-18 and ASTM F1920-15 Sections 10.8 and 10.9, respectively. However, if booster energy cannot be measured separately it will be included in the idle energy rate measurements.
****** GPR = gallons per rack; GPSF = gallons per square foot of rack; GPH = gallons per hour; **x** = maximum conveyor speed (feet/min as verified through NSF 3 certification) x conveyor belt width (feet).
† PPU Washing Energy is still in format kWh/rack when evaluated; SF_{rack} is Square Feet of rack area, same as in PPU water consumption metric.

Note: Based on further discussion with members of the ASTM F26 committee, EPA expects revisions will be made to ASTM F1696-18 to align with ASTM F1920-15 which requires testing idle energy savings in the most energy consumptive scenario. In the interim, EPA has added a statement in the note above clarifying that the most energy consumptive configuration in a product family shall be selected to test the idle energy rate for ENERGY STAR certification purposes.

B. Washing Energy: The total washing energy shall include internal or external booster heater energy in addition to the tank, heat, motor, control, and any additional auxiliary energy, expressed in kWh/rack. If a product contains an applicable heat recovery feature, the hot water offset value calculated in Equation 1, below, shall be subtracted from the ASTM measured washing energy value to obtain an adjusted value which shall be used to meet the washing energy requirements in Tables 1 and 2, above.

a. Hot Water Energy Offset: Calculate and report the primary hot water energy offset by the heat recovery dishwasher fed by the cold-water inlet during the washing energy rate based on Equation 1:

Equation 1: Hot Water Energy Offset

$$E_{\text{primaryoffset}} = \left(\frac{(V_{\text{water}} \times 583.38)}{0.80}\right) \times 0.000293$$

Where:

- $E_{primaryoffset}$ *= Calculated primary hot water energy offset in kWh/rack*
- V_{water} *= measured water volume consumed by dishwasher (gallons/rack)*

Note: EPA noted in the limited topic proposal that the primary hot water energy use calculation in ASTM F1696-18 and F1920-15 (Section 11) is well-established but is not used for calculating energy performance. Based on the feedback from ASTM F26 committee chairpersons, EPA acknowledges a modification to this equation as a useful way to account for the difference in water inlet temperatures between heat recovery and standard commercial dishwashers. Conceptually, this equation represents the energy the primary water heater would have used had the heat recovery not been present. As such, the energy recovery credit described in Draft 2 will be replaced with a simplified version (Equation 1 above) of the stakeholder recommended hot water energy offset equation shown below.

$$E_{\text{primaryoffset}} = \frac{\left(V_{\text{water}} \times c_{\text{p}} \times \rho \times (T_{\text{instd}} - T_{\text{inhr}})\right)}{\eta}$$

The proposed Equation 1 factors out the following assumed constants for simplification purposes and adds a conversion factor to convert from Btu to kWh (1 Btu = 0.000293 kWh):

V_{water} = measured water volume consumed by dishwasher in gallons/rack
c_p = specific heat of water in Btu/lb*°F = 1.0
ρ = density of water in lb/gallon = 8.334
T_{instd} = inlet water temperature to a standard (non-heat recovery) machine (per ASTM F1696-18/F1920-15 Section 9.3) = 140
T_{inhr} = inlet water temperature to a heat recovery machine (per ASTM F1696-18/F1920-15 Section 9.3) = 70
η = assumed commercial primary water heating system efficiency feeding dishwashers including standby and recirculation losses = 80% or 0.80.

As with the credit proposed in Draft 2, this offset for eligible models would be applied once to a commercial dishwasher and subtracted from the ASTM measured washing energy value to obtain an adjusted value. Washing energy requirements would apply to the adjusted value (i.e., measured washing energy - $E_{primaryoffset}$ in kWh/rack).

In addition to the stakeholder suggested hot water energy offset equation noted above, and in response to the limited topic proposal, some stakeholders introduced an alternative approach-that the primary hot water energy consumption value be added to the measured washing energy value for standard (non-heat recovery) type machines instead of subtracting it from the measured washing energy value for heat recovery machines. The justification for this alternative proposal is such that adding the offset to standard machines would eliminate the incentive to test them at the maximum allowable inlet water temperature (140°F). Additionally, a stakeholder noted that the inlet temperature recordings for heat recovery machines shall be taken at two points (cold and hot water inlets), whereas the inlet temperature for standard machines is recorded at a single hot water supply line. Per ASTM F1696-18 Section 10.7.7.2 and F1920-15 Section 10.8.15, these recordings are averaged during the test.

EPA recognizes the justification for this proposed alternative, however, EPA believes the application of the offset, as outlined in section 3B, allows a fair washing energy performance comparison among high temperature heat recovery and non-heat recovery machines. Furthermore, the concerns regarding creating an incentive for non-heat recovery machines to test at the max allowable inlet temperature are unwarranted for the following reasons. Testing standard machines at 140°F yields a lower measured washing energy value than when the machines are tested at lower inlet temperatures, which may be preferred by the product brand owner. As stakeholders note and per the ASTM test method, inlet temperatures for standard machines can vary (at or below 140°F± 2); however, the value is set at a constant maximum temperature in the offset equation to yield a maximum credit for a heat recovery machine, for which inlet water temperature is fixed at 70°F. Thus, the incentive to test at 140°F would still apply whether the offset is added to measured washing energy for a standard machine or subtracted from measured washing energy for a heat recovery machine,

Note cont. Lastly, adding the offset to the measured value of conventional machines in lieu of subtracting it from heat recovery machines would change the profiles of the datasets used to inform this specification. Therefore, the Agency maintains the position of allowing the offset as applicable to heat recovery machines. Interim conversations with some stakeholders who are proponents of this alternative approach indicate that they remain supportive of the offset application proposed in this specification as well.

If warranted, EPA will consider the alternative equation and approach again during the next specification revision.

B. User-Adjustable Conveyor Machines: Conveyor machines that offer multiple speeds adjustable by the end user must meet the ENERGY STAR requirements using the maximum conveyor speed setting tested to and certified to NSF/ANSI Standard 3. Water consumption values using the maximum conveyor speed setting shall be used for certification purposes. Water consumption using the slowest conveyor speed shall also be reported to EPA.

C. Dual-Sanitizing Machines: As defined in Section 1, these machines shall meet both the high temp and low temp requirements presented in Tables 1 and 2, above, to earn ENERGY STAR certification.

D. Dual-Purpose Door Type Machines: Machines designed to be used either as a standard door type machine or a PPU machine shall meet the performance requirements for both of those subcategories**.** Testing of these machines shall be performed in all conditions that qualifies the machine for the applicable subcategory.

E. Post Sanitizing Machines: Machines offering a post sanitizing rinse will be evaluated for ENERGY STAR certification with the post sanitizing rinse turned on during testing. The final rinse water consumption will include both sanitizing and post sanitizing rinses.

F. Industry Standard Certifications: All machines shall be certified to the NSF/ANSI 3-2019 Standard, *Commercial Warewashing Equipment*, OR a more recent NSF/ANSI 3 published standard.

Note: EPA notes that if a dishwasher functions as more than one product type, then the model must meet the requirements for all of those product types. One commenter suggested clarifying that testing performed on dual-purpose door type machines must be conducted in the condition for the appropriate subcategory. Similar to dual sanitizing machines in Section 3.C, above, if a machine has multi-functional capabilities (i.e., can operate as more than one category) then the machine must meet the requirements of both subcategories. EPA appreciates the comment and added this clarification to the dual-purpose door type machines criteria.

4) **Test Requirements:**

A. Representative Models: shall be selected for testing per the following requirements:

   a. For certification 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 certification of a product family, any model within that product family can be tested and serve as the representative model.

B. Test Methods: When testing commercial dishwashers, the following test methods shall be used to determine ENERGY STAR certification:

Table 3: Test Methods for ENERGY STAR Certification	
Dishwasher Category	**Test Method Reference**
Under-counter; stationary single tank door; pot-pan-utensil	ASTM F1696-18, *Standard Test Method for Energy Performance of Stationary-Rack, Door-Type Commercial Dishwashing Machines*
Single tank conveyor; multiple tank conveyor; single tank flight; multiple tank flight	ASTM F1920-15, *Standard Test Method for Energy Performance of Rack Conveyor Commercial Dishwashing Machines*

Note: EPA is monitoring ASTM's progress with revising the F1696 and F1920 test methods. EPA references the latest, effective ASTM test methods that are final. EPA will consider making adjustments to this ENERGY STAR specification in order to update the ASTM references as well as any edits to definitions or other relevant sections in a forthcoming ENERGY STAR specification revision once the ASTM standards test procedures are approved and published.

C. Multiple Voltages: For dishwashers with multiple voltage-versatility and those that are available in different voltage configurations, the representative model shall be tested at the most energy consumptive (worst case scenario) rating, according to the manufacturer.

D. 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 second decimal place.

E. Additional Reporting Requirement:

a. For dish machines with heat recovery systems applying the energy offset, report the percentage of hot water supply (maximum of 5%) per section 1.D.a., above.

Note: In order to verify the percentage of hot water supplied to the dish machine, EPA added in an additional reporting requirement for heat recovery machines in Section 4.E. of this specification. This reporting requirement is only applicable to dish machines applying the energy offset calculation.

5) **Effective Date:** The ENERGY STAR Commercial Dishwasher Specification shall take effect on **May 24, 2021**. To certify 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 anticipates completing the Version 3.0 process no later than August 10, 2020 with an effective date of May 24, 2021.

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 certification is not automatically granted for the life of a product model.

A. Considerations for Future Revisions: EPA is committed to continuing to develop performance requirements for commercial dishwashers that more accurately reflect in-the-field performance

and new technology that provides energy and water benefits to consumers.

a. New Performance Data Collected

i. Booster heater idle energy
ii. Primary hot water energy use
iii. Flight type washing energy

b. New Categorization Data Collected

i. Dump and Fill
ii. Energy Recovery
iii. Flight Type, Single vs Dual-Sanitizing
iv. Low-temp PPU and Dual-Sanitizing PPU

c. Industry Test Procedures

i. NSF 3 – Rinseability metric
ii. ASTM F1696 and ASTM F1920 updates

d. Other Considerations

i. Drain water tempering savings
ii. Cycles between recirculating tank flush (Adaptive Solids Removal)
iii. Heat pump applications