



ENERGY STAR® Program Requirements Product Specification for Commercial Ovens

Eligibility Criteria Draft 2: Version 2.0

Following is the **Draft 2 Version 2.0** product specification for ENERGY STAR qualified commercial ovens. 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. **Oven:** A chamber designed for heating, roasting, or baking food by conduction, convection, radiation, and/or electromagnetic energy.¹
- B. **Product Family:** Individual models offered within a product line based on the same engineering design, including; pan capacity, fuel type, and method of steam generation, as applicable. Acceptable differences within product family may include: controls, door-opening orientation, and any topical, aesthetic additions that have no impact on oven performance in any mode.

Note: The product family definition was expanded in Draft 1 to clarify the allowable differences within any one product line for purposes of family qualification. EPA continues to seek stakeholder feedback on the proposed product family definition.

Oven Types

- C. **Combination Oven:** A device that combines the function of hot air convection (oven mode), saturated and superheated steam heating (steam mode), and combination convection/steam mode for moist heating, to perform steaming, baking, roasting, rethermalizing, and proofing of various food products. In general, the term combination oven is used to describe this type of equipment, which is self-contained.² The combination oven is also referred to as a combination oven/steamer, combi or combo.
 - a. **Half-Size Combination Oven:** A combination oven capable of accommodating a single 12 x 20 x 2 ½-inch steam table pan per rack position, loaded from front-to-back or lengthwise.
 - b. **Full-Size Combination Oven:** A combination oven capable of accommodating two 12 x 20 x 2 ½-inch steam table pans per rack position, loaded side by side, from front-to-back or lengthwise.
 - c. **2/3-Size Combination Oven:** A combination oven unable to accommodate a single 12 x 20 x 2 ½-inch steam table pan in any rack position.

Note: EPA received comments on the proposed subtype definitions for combination ovens in Draft 1, which were based on the Fisher Nickel, Inc., *Commercial Cooking Appliance Technology Assessment*. During the ENERGY STAR Draft 1 Version 2.0 stakeholder meeting held in May 2012 at the National Restaurant Association (NRA) Show, EPA initiated discussions regarding product definitions and scope. The definitions provided (Section 1C. a – c, above) represent recommendations offered to EPA during this meeting, which more precisely classify the different oven sizes.

¹ NSF 170-2010, *Glossary of food equipment terminology*.

² ASTM Standard F-2861-10 *Standard Test Method for Enhanced Performance of Combination Oven in Various Modes*.

- D. Convection Oven: A general-purpose oven that cooks food by forcing hot dry air over the surface of the food product. The rapidly moving hot air strips away the layer of cooler air next to the food and enables the food to absorb the heat energy. For the purposes of this specification, convection ovens do not include ovens that have the ability to heat the cooking cavity with saturated or superheated steam. However, this oven type may have moisture injection capabilities. Ovens that include a *hold feature* are eligible under this specification as long as convection is the only method used to fully cook the food.
- a. Half-Size Convection Oven: A convection oven that is capable of accommodating half-size sheet pans measuring 18 x 13 x 1-inch.
- b. Full-Size Convection Oven: A convection oven that is capable of accommodating standard full-size sheet pans measuring 18 x 26 x 1-inch.

Note: EPA received comments that ovens with moisture assist (i.e., baking ovens) should be covered under the convection oven definition because these ovens are not capable of steam cooking and cannot be classified under the combination oven definition. In response, EPA has clarified in the convection oven definition (Section 1D, above) that convection ovens may have a feature that allows the operator to inject moisture into the cooking cavity during a cook cycle. Convection ovens with moisture assist shall be classified as convection ovens and will be subject to the convection oven test standard (Section 4, below) in order to qualify for ENERGY STAR. However, ovens that have the capability to heat the cooking cavity with saturated or superheated steam shall be classified as combination ovens and will be subject to the combination oven test standard (Section 4, below) in order to qualify for ENERGY STAR.

EPA's intention in including moisture assist convection ovens is to bridge the gap between convection ovens and combination ovens to ensure more complete coverage and choice to the end-user based on their particular needs. EPA is proposing to omit the maximum water consumption parameter (≤ 0.25 GPH) that was in the Draft 1 convection oven definition because some convection ovens with moisture assist may have the capability of injecting greater than 0.25 GPH.

EPA is interested in stakeholder comments regarding the proposed inclusion of ovens with moisture assist that are incapable of operating in steam mode under the convection oven definition. EPA is also interested in receiving alternative terms and definitions from stakeholders for "baking ovens" or "moisture convection ovens."

- E. Conventional or Standard Oven: An oven that cooks food primarily using the naturally occurring hot air currents to transfer heat over the surface of the food product without the use of a fan or blower. The burner or elements heat the air within the oven cavity as well as the cavity walls, causing currents of hot air that transfer heat to the surface of the food. The hot air's buoyancy carries it upward through cooler air, which then slowly sinks to the bottom of the oven as it cools off.
- F. Conveyor Oven: An oven designed to carry food product on a moving belt into and through a heated chamber.
- G. Slow Cook-and-Hold Oven: An oven designed specifically for low-temperature (e.g., less than 300°F) cooking, followed by a holding period at a specified temperature.
- H. Deck Oven: An oven that cooks food product directly on the floor of a heated chamber. The bottom of each compartment is called a deck and heat is typically supplied by burners or elements located beneath the deck. The oven ceiling, floor, and walls are designed to absorb heat quickly and radiate that heat back slowly and evenly.
- I. Mini-Rack Oven: A rack oven that has the ability to produce steam internally and includes an internal rotating rack where pans are manually pushed into the racks. Mini-rack ovens typically hold 5 – 8 full-size sheet pans.

- J. Rack (Roll-In) Oven: A high-capacity oven, with the ability to produce steam internally and fitted with a motor-driven mechanism for rotating multiple pans fitted into one or more pan racks within the cavity.
 - a. Single Rack Oven: A rack oven that is able to hold one full rack of sheet pans of product at a time, based on nominal 4-inch spacing between pans.
 - b. Double Rack Oven: A rack oven that is able to hold two single racks or one double-width rack, based on nominal 4-inch spacing between pans.
- K. Range Oven: An oven base for a commercial range top (i.e., burners, electric elements or hobs). Range ovens may use either standard or convection technologies to cook food.
- L. Rapid Cook Oven: An oven that utilizes one or more non-traditional heat transfer technologies to cook food product significantly faster than would be possible using conventional (e.g., convection, conduction, radiant) heat transfer technologies. Heat transfer technologies that may be employed include microwave, quartz halogen, and high-velocity or impingement convection.
- M. Rotisserie Oven: An oven fitted with a mechanism to move or turn food past a fixed heat source while the food is slowly being cooked on all sides.

Energy Efficiency Metrics

- N. Cooking-Energy Efficiency: The ratio of energy absorbed by the food product to the total energy supplied to the oven during cooking.
- O. Idle Energy Rate: The rate of oven energy consumption while it is maintaining or holding at a stabilized operating condition or temperature. Also called standby energy rate.

Water Consumption

- P. Average Water Rates: The ratio of the average potable water used to the maximum number of steam table pans the oven can accept during heavy-load cooking in steam and convection modes; expressed as gallons per hour (GPH) per pan.
- Q. Average Condensate Temperature: The average temperature of the condensed steam and cooling water mixture exiting the combination oven and directed to the drain during heavy-load cooking in steam and convection modes.
- R. Maximum Condensate Temperature: The maximum temperature of the condensed steam and cooling water mixture exiting the combination oven and directed to the drain during heavy-load cooking in steam and convection modes.

Note: As per the additional test reporting requirements (Section 4G, below) EPA included *average condensate temperature* and *maximum condensate temperature* definitions. Stakeholders are encouraged to provide feedback on the proposed definitions.

2) Scope:

- A. Included Products: Products that meet the definitions of a Commercial Oven and Convection Oven or Combination Oven as specified herein are eligible for ENERGY STAR qualification, with the exception of products listed in Section 2.B. The following subtypes are eligible: (1) full-size gas and half- and full-size electric convection ovens; and (2) half- and full-size gas combination ovens with a pan capacity > 6 and half- and full-size electric combination ovens with a pan capacity ≥ 5 and ≤ 20 .

To ensure only commercial ovens qualify under this specification, products shall be third-party certified to NSF/ANSI Standard 4, *Commercial Cooking, Rethermalization and Powered Hot Food Holding and Transport Equipment*.

- B. **Excluded Products:** This specification is intended for commercial food-grade ovens. Ovens designed for residential or laboratory applications cannot qualify for ENERGY STAR. 2/3-size combination ovens, as defined in Section 1 above, as well as hybrid ovens not listed in Section 2.A, such as those incorporating microwave settings in addition to convection, are excluded from this specification. Other oven types excluded, as defined in Section 1, include: conventional or standard; conveyor; slow cook-and-hold; deck; mini-rack; rack; range; rapid cook; and rotisserie. Gas combination ovens with a pan capacity of ≤ 6 and electric combination ovens with a pan capacity < 5 and > 20 are not eligible for ENERGY STAR.

Note: Draft 1 defined countertop-size combination ovens as ovens that are unable to accommodate a minimum of one steam table pan measuring 12 x 20 x 2 ½ -inch. As defined, countertop combination ovens were proposed to be excluded from the scope because the referenced ASTM standard does not address combination ovens of this size. EPA received comments that some countertop-size ovens were capable of accommodating full-size steam pans and therefore that sub-type should be changed to 2/3-size combination ovens (Section 1C. c, above). EPA changed both the oven type and definition of countertop-size combination oven sub-type to 2/3-size combination ovens. EPA continues to propose that the 2/3-size combination ovens remain excluded from the Version 2.0 scope.

While EPA sees value in including as wide a range of product types as feasible in this specification, at present EPA does not have adequate data (i.e., multiple manufacturers and models) to evaluate and propose efficiency requirements for the following:

- (1) gas combination ovens with a pan capacity of 6 pans or less;
- (2) electric combination ovens with a pan capacity of 4 pans or less; and,
- (3) electric combination ovens with a pan capacity greater than of 20 pans.

EPA may consider including these product types once performance data is made available which demonstrates the appropriateness of their inclusion.

3) Qualification Criteria:

- A. Cooking Energy Efficiency and Idle Energy Rate Requirements:

Table 1: Energy Efficiency Requirements for Convection Ovens		
Gas		
Oven capacity	Idle Rate, Btu/h	Cooking-Energy Efficiency, %
Full-Size	TBD	TBD
Electric		
Oven capacity	Idle Rate, kW	Cooking-Energy Efficiency, %
Half-Size	TBD	TBD
Full-Size	TBD	

Note: Based on initial input from the ASTM subcommittee, EPA anticipates that the changes to the ASTM F-1496-99 (2012) test method may affect heavy-load cooking-energy efficiency values to account for the increase in product load and the energy absorbed by the pans. These changes should yield a more accurate performance comparison between convection ovens and combination ovens operating in convection mode. Initial testing data suggests that cooking-energy efficiency values will likely increase across all ovens, requiring EPA to re-evaluate the convection oven ENERGY STAR performance levels to ensure continued representation of the top performers.

EPA expects to receive some convection oven data in the upcoming weeks. Once received, EPA will be able to revisit the convection oven idle and cooking-energy efficiency levels and anticipates using this data to propose new levels prior to Draft 3 in an interim document which will be distributed sometime in late-August or early-September. To assist in this evaluation effort, stakeholders are encouraged to submit convection oven performance data based on the revised ASTM F-1496-99 (2012) test method to EPA for evaluation.

Table 2: Energy Efficiency Requirements for Combination Ovens

Gas		
Operation	Idle Rate, Btu/h	Cooking-Energy Efficiency, %
Steam Mode	$\leq 200P+6,511$	≥ 41
Convection Mode	$\leq 150P+5,425$	≥ 56
Electric		
Operation	Idle Rate, kW	Cooking-Energy Efficiency, %
Steam Mode	$\leq 0.133P+0.64$	≥ 55
Convection Mode	$\leq 0.08P+0.4989$	≥ 76

Note: EPA received additional data from PG&E's Food Service Technology Center, Southern California Edison, Southern California Gas, and oven manufacturers since the May ENERGY STAR Commercial Oven stakeholder meeting to update the existing data set. EPA continues to use the weighted approach described in Draft 1 in developing the proposed idle and cooking-energy efficiency levels.

EPA received a comment that there would be several combination oven models that would fail to meet all of the proposed performance criteria levels but may still consume less total annual energy than models that would be eligible to meet the Draft 1 proposed performance criteria. EPA has made some adjustments to the performance levels (presented in Table 2, above) that resolves this concern and now ensures that models able to meet the ENERGY STAR efficiency criteria will perform better than non-qualified models across various usage scenarios. EPA believes that these revised levels continue to differentiate the top performers in the market and provide end-users with a range of choices based on brand, size, and fuel type.

B. Significant Digits and Rounding:

- a. All calculations shall be carried out with directly measured (unrounded) values. Calculated results for gas combination oven idle rates shall be rounded to the nearest whole value. Calculated results for electric combination oven idle rates shall be rounded to the nearest tenth.

Note: Since combination oven idle rate requirements are in the form of a calculation, EPA is providing further clarification regarding rounding for purposes of ENERGY STAR reporting and listing.

- b. Unless otherwise specified, compliance with specification limits shall be evaluated using exact values without any benefit from rounding.
- c. Cooking-Energy Efficiency: 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.
- d. Idle Energy Rate: Calculated values for gas combination oven idle rates that are submitted for reporting on the ENERGY STAR website shall be rounded to the nearest whole value. Calculated values for electric combination oven idle rates shall be rounded to the nearest tenth.

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, the most energy consuming model within the product family shall serve as the representative model.
- B. When testing commercial ovens, the following test methods shall be used to determine ENERGY STAR qualification and water consumption rates:

Table 3: Convection Oven Test Methods for ENERGY STAR Qualification

ENERGY STAR Requirement	Test Method Reference
Convection Ovens: Cooking-Energy Efficiency and Idle Energy Rate	ASTM F-1496-99 (2012), <i>Standard Test Method for Performance of Convection Ovens</i>
Combination Ovens: Cooking Energy Efficiency and Idle Energy Rate	ASTM F-2861-10, <i>Standard Test Method for Enhanced Performance of Combination Oven in Various Modes</i>

Note: In anticipation of the finalization of the updated ASTM F-1496-99 (2012) standard, EPA will reference the revised standard and will re-evaluate the convection oven performance levels once data is available. Stakeholders are encouraged to submit convection oven test data as per the ASTM F-1496-99 (2012) test method.

- C. For ovens with variable Btu/h or kW input, each available input shall be tested individually and meet the cooking-energy efficiency and idle energy rate requirements presented in Table 1 or Table 2, above, of this specification.
- D. For ovens with multiple voltages, the oven should be tested at the most energy consumptive voltage according to the manufacturer.

Note: EPA received a comment noting that testing an oven with sliding voltage capabilities at its most energy consumptive voltage is disadvantageous because the worst performing voltage may not be the voltage the customer is operating the oven. During the Draft 1 meeting in May, most stakeholders agreed that ovens with sliding or adjustable voltage configurations will not vary greatly with regard to efficiency performance across the voltage options (i.e., 208 versus 240). Therefore, EPA is proposing that in the event that an electric oven has sliding voltage versatility, the oven shall be tested at its expected worst-performing voltage to represent a worst-case scenario amongst the product family. This ensures that the end-user will experience ENERGY STAR performance no matter what voltage the product is set. Certification bodies will only report the tested voltage to EPA for purposes of qualification and listing.

- E. If the representative model under test includes a setback mode or automatic controls, these features must be disabled or overridden during testing for purposes of ENERGY STAR qualification.
- F. If the representative combination oven model under test is designed to hold 18 x 26-inch sheet pans, manufacturer-supplied wire racks may be positioned in the oven to accommodate 12 x 20 x 2¹/₂-inch steam table pans. During idle testing in various modes; because the oven shall be idling in a “ready-to-cook” state, the removable wire racks used to accommodate steam table pans shall remain in place during all idle tests. Energy absorbed by the wire racks during idle and cooking-energy efficiency testing shall not be considered.
- G. Additional Test Reporting Requirements: The Average water consumption rates, the average condensate drain temperatures, and the maximum condensate drain temperatures shall be reported for all combination ovens based on the results of the ASTM F-2861-10 test method

Note: EPA received a comment stating that water consumption for steam-cooking and condensate cooling should be measured separately. However, some combination oven models have a single water supply connection that delivers the water used for steam generation and for condensate cooling. Currently, the ASTM F-2861-10 standard does not provide guidance on separately measuring water used for each purpose; therefore, EPA will not require separate reporting of water consumption rates for steam generation and condensate cooling. EPA will require that the average water consumption rates be reported in both steam- and convection-cooking modes.

Note cont.

Additionally, EPA received a suggestion to include mandatory reporting of average and maximum condensate drain temperatures in addition to the average water consumption rates, as measured to ASTM F-2861-10 standard. The rationale is that reporting both water consumption and condensate drain temperatures will provide the end-user with additional information to evaluate and compare water consumption rates. EPA is proposing to require reporting of the average water consumption rates and the average and maximum drain temperatures to better inform the end-users of the ENERGY STAR qualified combination ovens' operating characteristics.

- 5) Effective Date:** The ENERGY STAR Commercial Oven Specification shall take effect on **August 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 is working toward finalizing this Version 2.0 specification by November 2012.

As noted above, the test method for convection ovens is under review and will be put up for ballot soon. Once final, EPA intends to revisit the convection oven idle and cooking-energy efficiency levels once a robust data set is assembled, based on this revised test method.

Immediately, upon its finalization, all equipment covered by this specification that have been certified as meeting the Version 2.0 requirements by an EPA recognized Certification Body (CB) may qualify.

Effective August 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 models. Manufacturers with questions about the third-party certification program can visit www.energystar.gov/3rdpartycert or email verification@energystar.gov.

- 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 ENERGY STAR qualification is not automatically granted for the life of a product model.