



ENERGY STAR® Program Requirements Product Specification for Commercial Ovens

Eligibility Criteria Draft 3: Version 2.0

Following is the **Draft 3 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 a product family for purposes of qualification include: controls, door-opening orientation, and any aesthetic additions that have no impact on oven energy consumption in any operating mode.

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. **Less than ½-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 a comment on the proposed subtype definition title “2/3-Size Combination Oven” in Draft 2. Specifically, the “2/3-Size” subtype title could cause confusion in the marketplace because it implies that the “2/3-Size” ovens are larger than the “Half-Size” ovens. Therefore, EPA has replaced the “2/3-Size” subtype title with “Less than ½-Size Combination Oven” (Section 1C.c, above). This replacement has been incorporated throughout the document, where applicable. EPA encourages stakeholders to provide feedback on this proposed change.

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 (e.g., baking ovens and moisture-assist ovens). 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.
- 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.

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. Less-than 1/2-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: EPA received a stakeholder request to include gas combination ovens with a capacity of 6 pans within the scope of this specification. Prior to the release of Draft 2, EPA had limited data on which to base proposed criteria for 6-pan gas combination ovens. Since the release of Draft 2, EPA has received data on 6-pan ovens which suggest that they are within the range of energy performance of 7 pan and larger models. As a result, EPA has expanded the proposed scope of the Version 2 specification to include 6-pan gas combination ovens.

EPA encourages stakeholders to submit additional 6-pan performance data for further consideration.

3) Qualification Criteria:

A. Convection Oven 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	$\leq 13,000$	≥ 46
Electric		
Oven capacity	Idle Rate, kW	Cooking-Energy Efficiency, %
Half-Size	≤ 1.0	≥ 72
Full-Size	≤ 1.6	

Note: In recognition of the fact that ASTM F-1496-99 (2012) standard test method, is under revision, the Pacific Gas and Electric's Food Service Technology Center (FSTC), Southern California Edison, and Southern California Gas utilities provided EPA with a dataset that included test results based on both the 1999 and 2012 versions of the ASTM F-1496 convection oven test standard. EPA conducted a comparative analysis of the combined datasets and found that on average, cooking-energy efficiency results increased by nearly 2% using the 2012 version. In the interest of establishing new ENERGY STAR requirements or these products in the near term, EPA is proposing new minimum cooking-energy efficiency levels based on this analysis. These new levels continue to represent the most efficient convection ovens available in the marketplace.

A supplemental document to the proposed ENERGY STAR convection oven cooking-energy efficiency levels in Table 1, above, detailing the comparative analysis can be found at www.energystar.gov/revisedspecs.

EPA encourages stakeholders to review the supplemental document and provide comments on the analysis and the newly proposed convection oven levels.

B. Combination Oven Cooking-Energy Efficiency and Idle Energy Rate Requirements:

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: No changes to combination oven idle energy or cooking-energy efficiency requirements are being proposed in this draft. EPA received support for the efficiency requirements proposed in Draft 2.

The Draft 3 gas combination oven dataset increased to include three, 6-pan models. Re-analysis of the complete dataset indicates that approximately 25% of the ENERGY STAR gas combination models meet the proposed requirements.

- a. The Combination Oven Idle Energy Rate requirement calculations are based on the pan capacity of the oven. The variable "P" represents the capacity of the combination oven as determined by the number of steam table pans the oven is able to accommodate as per the ASTM F-1495-05 standard specification.

Note: EPA received two comments from stakeholders in response to Draft 2 recommending: (1) the variable “P” in the combination oven idle energy rate calculation should be defined; and (2) oven capacity should be considered as written in the ASTM F-1495-05 specification for combination ovens (e.g., determining the number of steam table pans the oven can accommodate).

In response to these comments, Section 3B.a, above, states the representation of the variable “P” and uses language consistent with ASTM F-1495-05. Stakeholders are encouraged to comment on the content and language proposed in Section 3B.a.

C. Significant Digits and Rounding:

- a. Unless otherwise specified, compliance with specification limits shall be evaluated using exact values without any benefit from rounding.
- b. 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.
- c. 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 convection and 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, any model within that product family can be tested and serve as the representative model.
- B. When testing commercial ovens, the following test methods shall be used to determine ENERGY STAR qualification.

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, Idle Energy Rate, and Water Consumption	ASTM F-2861-10, <i>Standard Test Method for Enhanced Performance of Combination Oven in Various Modes</i>

Note: Once final, the revised ASTM F-1496 test method will be referenced.

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

Note: EPA is proposing that in the event that an electric oven has sliding voltage versatility or is offered in different voltage configurations, the oven shall be tested at its expected worst-performing voltage to ensure that regardless of field setting, the product will meet ENERGY STAR criteria. Certification bodies will only report the tested voltage to EPA for purposes of qualification and listing.

- E. 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. For all idle tests, because the oven shall be idling in a “ready-to-cook” state, the removable wire racks used to accommodate the steam table pans shall remain in place. Energy absorbed by the wire racks during idle and cooking-energy efficiency testing shall not be considered when calculating the idle rates and cooking-energy efficiencies.
- F. 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 standard test method. If the oven does not require condensate cooling water during convection mode operation, then it shall be reported as non-applicable.

The production capacity for the cooking-energy efficiency steam mode and convection mode tests shall be reported for all combination ovens based on the results of the ASTM F-2861-10 standard test method.

Note: EPA received a comment stating that if an oven is operating in convection mode, then there may not be the presence of condensate cooling water introduced to the drain line. EPA understands that a combination oven operating in convection mode may not use condensate cooling water and proposes that in such instances, the drain temperatures be reported as non-applicable opposed to reporting the air temperature. The ASTM F-2861-10 standard test method for combination ovens provides guidance for measuring drain temperature during the cooking-energy efficiency tests in steam and convection modes. EPA encourages feedback on the inclusion of this language.

EPA is proposing a requirement that production capacities be reported for combination ovens to provide the customer with the maximum throughput potential of the ovens operating in both steam and convection modes. This will allow the consumer the ability to choose the oven that best matches their production needs while also comparing energy efficiency performance. EPA encourages stakeholders to provide feedback on the production capacity reporting requirement

- 5) **Effective Date:** The ENERGY STAR Commercial Oven Specification shall take effect on **September 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 December 2012. Immediately, upon its finalization, all equipment covered by this specification that has been certified as meeting the Version 2.0 requirements by an EPA recognized Certification Body (CB) may qualify. **Effective September 1, 2013**, all currently qualified units must be third party certified to the Version 2.0 requirements 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.