



# EPA ENERGY STAR ENERGY STAR<sup>®</sup> Program Requirements Product Specification for Commercial Ovens

## Eligibility Criteria Draft 4: Version 2.0

Following is the **Draft 4 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.<sup>1</sup>

### **Oven Types**

- B. **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.<sup>2</sup> 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. **Quarter-Size Combination Oven:** A combination oven capable of accommodating a single 12 x 10 x 2 ½-inch steam table pan per rack position, loaded from front-to-back or lengthwise.

**Note:** In an effort to more consistently differentiate combination oven subtypes, EPA has replaced the “Less than ½-Size Combination Oven” subtype title with “Quarter-Size Combination Oven” (Section 1B.c, above). This replacement has been incorporated throughout the document, where applicable. EPA encourages stakeholders to provide feedback on this proposed change.

- C. **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.

<sup>1</sup> NSF 170-2010, *Glossary of food equipment terminology*.

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

- 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.
- D. 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.
- E. Conveyor Oven: An oven designed to carry food product on a moving belt into and through a heated chamber.
- F. 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.
- G. 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.
- H. 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.
- I. 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.
- J. 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.
- K. 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.
- L. 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***

- M. Cooking-Energy Efficiency: The ratio of energy absorbed by the food product to the total energy supplied to the oven during cooking.
- N. 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**

- O. 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.
- P. 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.
- Q. 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.

### **Qualification Terms**

- R. 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.
- S. Pan Capacity: The number of steam table pans the combination oven is able to accommodate as per the ASTM F-1495-05 standard specification.

**Note:** EPA reorganized the above subsection entitled Qualification Terms to group definitions used to determine ENERGY STAR qualification.

## **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:
  - a. Full-size gas and half- and full-size electric convection ovens.
  - b. Half- and full-size gas combination ovens with a pan capacity  $\geq 6$ .
  - c. Half- and full-size electric combination ovens with a pan capacity  $\geq 5$  and  $\leq 20$ .

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 under this specification. The following oven types and sub-types are ineligible for ENERGY STAR:
  - a. Quarter-size combination ovens.
  - b. Hybrid ovens not listed in Section 2.A, above, such as those incorporating microwave settings in addition to convection.
  - c. Conventional or standard ovens; conveyor; slow cook-and-hold; deck; mini-rack; rack; range; rapid cook; and rotisserie.
  - d. Gas combination ovens with a pan capacity of  $< 6$ .

- e. Electric combination ovens with a pan capacity < 5 and > 20.

**Note:** EPA received a stakeholder request to expand the specification scope allowing electric combination ovens with a capacity of > 20 pans to qualify. However, absent data on which to base proposed criteria levels for > 20-pan electric combination ovens, EPA is unable to fully consider the appropriateness of this product type for the ENERGY STAR Commercial Oven Specification. As such, these products remain excluded in this Version 2.0 specification. EPA may consider expanding the scope to include larger electric combination ovens in future versions if a robust dataset is made available suggesting that product differentiation is possible and significant savings could be realized by their inclusion.

**3) Qualification Criteria:**

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

<b>Table 1: Energy Efficiency Requirements for Convection Ovens</b>		
<b>Gas</b>		
<b>Oven capacity</b>	<b>Idle Rate, Btu/h</b>	<b>Cooking-Energy Efficiency, %</b>
Full-Size	≤ 12,000	≥ 46
<b>Electric</b>		
<b>Oven capacity</b>	<b>Idle Rate, kW</b>	<b>Cooking-Energy Efficiency, %</b>
Half-Size	≤ 1.00	≥ 71
Full-Size	≤ 1.60	

**Note:** EPA is proposing some minor changes to the cooking-energy efficiency and idle energy levels for convection ovens. As compared to the convection oven performance criteria proposed in the previous Draft 3, the following changes have been made to Table 1, above:

- In December, EPA received a revised set of gas convection oven idle and cooking-energy efficiency data from FSTC based on the new test method. Using this updated dataset; EPA is proposing to reduce the gas idle energy requirement from 13,000 Btu/h to 12,000 Btu/h, to better differentiate top performers in terms of energy efficiency. Approximately 30% of the models in EPA’s convection oven dataset meet this level.
- Based on changes to the ASTM F-1496 test method and the impact of these changes on EPA’s analysis of its dataset, EPA proposed cooking-energy efficiency for electric ovens at 72% in Draft 3. However, further analysis of the data showed that reducing the cooking efficiency to 71% would better enable an ample selection of products to earn the ENERGY STAR.
- No changes have been made to either the full-size gas cooking-energy efficiency level or the full-size and half-size electric idle rate levels.

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

<b>Table 2: Energy Efficiency Requirements for Combination Ovens</b>		
<b>Gas</b>		
<b>Operation</b>	<b>Idle Rate, Btu/h</b>	<b>Cooking-Energy Efficiency, %</b>
Steam Mode	≤ 200P+6,511	≥ 41
Convection Mode	≤ 150P+5,425	≥ 56
<b>Electric</b>		
<b>Operation</b>	<b>Idle Rate, kW</b>	<b>Cooking-Energy Efficiency, %</b>
Steam Mode	≤ 0.133P+0.64	≥ 55
Convection Mode	≤ 0.08P+0.4989	≥ 76

Note: P = Pan capacity as defined in Section 1.S, above.

**Note:** EPA received overall stakeholder support for the performance criteria proposed in the Draft 3 specification so no changes have been made to the levels presented in Table 2, above.

- C. Additional Idle Calculation Guidance: Compliance with the Convection Oven and Combination Oven idle rate requirements shall be based on gas energy only for purposes of qualifying gas models. When calculating the gas oven idle rates, electric energy consumed by auxiliary components shall not be taken into consideration. However, the total electric energy consumption measured during idle tests shall be reported separately.

**Note:** Per discussions at the ASTM F-26 standards technical committee meeting in October, EPA has clarified that the performance data used to determine gas oven idle rate levels do not include supplemental electrical energy consumption associated with auxiliary functionality (e.g., circulating fan(s) and controls). Absent additional performance data needed in order to account for idle electric energy in setting levels, only gas energy will be included when determining idle rate results for purposes of ENERGY STAR qualification.

Several stakeholders suggested that EPA require the reporting of electric energy consumption for gas ovens to provide end users with a more accurate accounting of total energy consumed by the appliance and associated operating costs. EPA is proposing a total electric energy reporting requirement for gas convection and combination ovens for idle rate tests (Section 4H.c, below). This information will be displayed on the ENERGY STAR Qualified Product List (QPL).

Based on additional data, EPA may adjust the gas convection and combination oven idle rate criteria levels in future versions of this specification to reflect total energy consumption (gas and electric).

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 exact values without any benefit from rounding.
- c. Cooking-Energy Efficiency: 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 number. The calculated energy consumption values for electric convection and combination ovens shall be rounded to 0.01 for idle rates.

**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: Test Methods for ENERGY STAR Qualification		
Oven Category	ENERGY STAR Requirement	Test Method Reference
Convection Ovens	Cooking-Energy Efficiency, Idle Energy Rate, and Production Capacity	ASTM F-1496-12, <i>Standard Test Method for Performance of Convection Ovens</i>
Combination Ovens	Cooking-Energy Efficiency, Idle Energy Rate, Production Capacity, and Water Consumption	ASTM F-2861-10, <i>Standard Test Method for Enhanced Performance of Combination Oven in Various Modes</i>

**Note:** The F-1496, *Standard Test Method for Performance of Convection Ovens* has been revised to F-1496-12 in Table 3, above, based on recent approval by the ASTM F-26 standards committee.

- 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.
- E. If the representative combination oven model under test is designed to hold 18 x 26-inch sheet pans, manufacturer-supplied wire racks shall be positioned in the oven to accommodate 12 x 20 x 2<sup>1</sup>/<sub>2</sub>-inch steam table pans.
- F. Combination ovens with roll-in, removable racks shall have the racks positioned in place during steam mode and convection mode idle tests.

**Note:** The ASTM F-2861-10 standard test method does not specifically address roll-in, removable rack positioning during idle tests; however, during the October ASTM F-26 committee meeting, attendees discussed the issue and came to a consensus that the most appropriate, consistent approach would be to position the racks inside the oven during steam mode and convection mode idle tests. EPA agrees with the committee's decision, but encourages stakeholders to provide additional feedback in regards to roll-in, removable rack positioning.

- G. The combination oven average operating temperature for the ENERGY STAR steam mode idle test shall be 212 ± 5°F.

**Note:** The ASTM F-2861-10 standard test method tolerance for operating a combination oven in steam mode (maximum humidity, maximum fan speed) is 212 ± 2°F. Several manufacturers indicated that it is difficult to achieve an average steam mode idle temperature within a ± 2°F tolerance; therefore, EPA proposes expanding the tolerance to 212 ± 5°F. Stakeholders are encouraged to comment on the proposed tolerance expansion.

- H. Additional Reporting Requirements:
  - a. The average water consumption rates, the average condensate drain temperatures, and the maximum condensate drain temperatures shall be reported for all combination ovens. If the oven does not require condensate cooling water during convection mode operation, then it shall be reported as non-applicable
  - b. The production capacity for all convection oven and combination oven cooking-energy efficiency tests shall be reported.
  - c. The electric energy idle rate for gas convection and combination oven idle rate tests shall be reported.

**Note:** EPA received stakeholder support for the addition of production capacity reporting requirements for both convection and combination ovens. The inclusion of production capacity on the ENERGY STAR Qualified Product List will allow end users the ability to compare qualified ovens based on their individual production needs.

As noted above, EPA is proposing to require the reporting of the additional electric energy consumption for gas ovens' idle rate tests to provide end users with a more accurate accounting of total energy consumed by the appliance and associated operating costs.

- 5) Effective Date:** The ENERGY STAR Commercial Oven Specification shall take effect on **January 6, 2014**. 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 the Version 2.0 specification by April 1, 2013. Once finalized, 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 January 6, 2014**, all ovens qualified under Version 1.1 must be certified to the Version 2.0 specification 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 use of the ENERGY STAR mark to promote non-complying models. Manufacturers with questions about the third-party certification program can visit [www.energystar.gov/3rdpartycert](http://www.energystar.gov/3rdpartycert) or email [verification@energystar.gov](mailto: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.