



ENERGY STAR Program Requirements Product Specification for Residential Water Heaters

Eligibility Criteria Version 2.0: Final Draft

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7 Following is the **Final Draft** Version 2.0 product specification for ENERGY STAR qualified water heaters.
8 A product shall meet all of the identified criteria if it is to earn the ENERGY STAR.

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

- 11 A. **Residential Water Heater:** A product that utilizes gas, electricity, or solar thermal energy to heat
12 potable water for use outside the heater upon demand, including:
- 13 a. Storage type units¹ designed to heat and store water at a thermostatically controlled
14 temperature of less than 180 °F, including: gas storage water heaters with a nominal
15 input of 75,000 British thermal units (Btu) per hour or less and has a rated storage
16 capacity of not less than 20 gallons nor more than 100 gallons; electric heat pump type
17 units, with a maximum current rating of 24 amperes for an input voltage 250 volts or less,
18 and, if the tank is supplied, has a manufacturer’s rated storage capacity of 120 gallons or
19 less.
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 - 21 b. Instantaneous (or “tankless”) type units^{1,2} which initiate heating based on sensing water
22 flow and deliver water at a controlled temperature of less than 180 °F, heat water but
23 contain no more than one gallon of water per 4,000 Btu per hour of input, including: gas
24 instantaneous water heaters with an input between 50,000 Btu/h but less than 200,000
25 Btu per hour and has a manufacturer’s specified storage capacity of less than 2 gallons.
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 - 27 c. Solar water heaters must include a collector and storage tank, and must use the sun’s
28 thermal energy to heat water. Solar type units eligible for the ENERGY STAR Water
29 Heaters Program must be tested according to OG-300 as developed by the Solar Rating
30 and Certification Corporation (SRCC). According to the SRCC, solar units employ one of
31 the four basic types of solar water heating systems: forced circulation (includes both
32 direct and indirect systems), integrated collector and storage, thermosiphon, or self-
33 pumped.
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 - 35 d. Add-on Heat Pump Unit¹: Add-on heat pump units are air to water heat pumps designed
36 for use with a storage-type water heater or a storage tank that is not specified or supplied
37 by the manufacturer.
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 - 39 e. Light Duty EPACT covered gas water heaters which heat and store water at a
40 thermostatically controlled temperature, with an input rate >75,000 Btu per hour and
41 ≤100,000 Btu per hour, and storage volume between 20 and 100 gallons.
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43 **Note:** The definition for hybrid water heaters has been removed. In response to stakeholder feedback,
44 EPA will delay adding hybrid water heaters to this specification until a test procedure is defined for them
45 and performance data to that test method are available. At that time, EPA will initiate a stakeholder
46 process to determine appropriate requirements for these units.

¹ 10 CFR 430, Subpart B, Appendix E

² 10 CFR 430, Subpart A, § 430.2 Definitions

47 **Note Contd.,**

48 Also, EPA has made a minor modification to the EPACK covered water heaters name to minimize
49 contradiction with CFR definitions.

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- 51 B. Energy Factor³: Energy Factor (“EF”), a measure of water heater overall efficiency, is the ratio of
52 useful energy output from the water heater to the total amount of energy delivered to the water
53 heater.
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- 55 C. Solar Energy Factor: Solar Energy Factor (“SEF”) refers to the energy delivered by the total
56 system divided by the electrical or gas energy put into the system.
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- 58 D. Thermal Efficiency⁴: Thermal efficiency (TE) is the ratio of the heat transferred to the water
59 flowing through the water heater to the amount of energy consumed by the water heater.
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- 61 E. Standby Loss⁴: Standby Loss (SL) means the average hourly energy required to maintain the
62 stored water temperature.
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- 64 F. First-Hour Rating¹: The First-Hour Rating (“FHR”) is an estimate of the maximum volume of hot
65 water in gallons that a storage water heater can supply within an hour that begins with the water
66 heater fully heated.
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- 68 G. Gallons per Minute¹: Gallons per Minute (“GPM”) is the amount of gallons per minute of hot water
69 that can be supplied by an instantaneous water heater while maintaining a nominal temperature
70 rise of 77°F during steady state operation.
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- 72 H. Manufacturer Limited Warranty: Manufacturer limited warranty is an assurance by the
73 manufacturer to the consumer that the water heater, including purchased system equipment and
74 components, are guaranteed to work for a defined period of time.
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- 76 I. Basic Model: All units of a given type of covered product (or class thereof) manufactured by one
77 manufacturer and which have the same primary energy source and, which have essentially
78 identical electrical, physical, or functional (or hydraulic) characteristics that affect energy
79 consumption, energy efficiency, water consumption or water efficiency¹. Further, all individual
80 models within a basic model must have the same certified rating based on the applicable
81 sampling criteria per DOE’s regulations in Part 429⁵, and this rating must be used for all
82 manufacturer literature, the qualified product list and certification of compliance to DOE
83 standards.
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- 85 J. Lower Compressor Cut-off Temperature: The temperature below which a heat pump water
86 heater’s compressor will no longer operate, such that the unit will only work as a conventional
87 electric resistance water heater.
- 88 K. Combination Space-Heating and Water Heating Appliance: Appliance that provides both space
89 conditioning (boiler) and hot water heating with one appliance or energy source. The combination
90 appliance circulates hot water from the water heater through a heat exchanger in the air handler.
91 A blower will move the heated air through a standard duct system. In the summer, an air
92 conditioner is connected to the exchanger and the system functions similarly, with cool air being
93 pushed through the ductwork.

³ Based on definition in 10 CFR 430, Subpart B, Appendix E

⁴ 10 CFR 431, Subpart G

⁵ 10 CFR 429, Subpart B

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2) Scope:

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- A. Included Products: Only products that meet the definition of a Residential Water Heater, as specified herein, are eligible for ENERGY STAR qualification with exception of those products listed in Section 2B.
- B. Excluded Products: Electric resistance water heaters, Add-on Heat Pump units, and products intended only for commercial use are not eligible for this ENERGY STAR Residential Water Heater Specification. Combination space-heating and water heating appliances, as defined in Section 1, above, are not eligible under this ENERGY STAR Water Heaters specification.

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3) Qualification Criteria:

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- A. Product Performance Requirements for Electric Water Heaters:

Table 1: Criteria for Qualified Electric Water Heaters

Criteria	ENERGY STAR Requirements
Energy Factor	EF ≥ 2.0
First Hour Rating	FHR ≥ 50 gallons per hour
Warranty	6 years on sealed system
Safety	UL 174 and UL1995

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Additional qualification requirements: Manufacturers shall report the ambient temperature below which the compressor cuts off and electric resistance only operation begins.

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Note: The previous Draft 3 specification required an audible or visual alert when the compressor shuts off due to a blockage in the condensate drain. Upon further investigation and discussions with several utilities, EPA has learned that the condensate drain blockage is not a common occurrence experienced by consumers who own recent models of electric water heaters. Discussions with manufacturers revealed that this requirement would add significant manufacturing cost which would ultimately increase the retail price without also offering significant savings to the consumer. Furthermore, EPA learned that there are several aftermarket devices currently available in the marketplace for this very purpose. Taking into consideration this new information, including the existence of alternate low cost solutions available, EPA has decided to remove this requirement from the Version 2.0 specification.

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B. Product Performance Requirements for Gas Water Heaters:

a. Gas Storage Units

Table 2: Criteria for Qualified Gas Storage Water Heaters

Criteria	ENERGY STAR Requirements
Energy Factor	EF \geq 0.67
First Hour Rating	FHR \geq 67 gallons per hour
Warranty	Warranty \geq 6 years on system
Safety	ANSI Z21.10.1/CSA 4.1

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b. Gas Instantaneous Units

Table 3: Criteria for Qualified Gas Instantaneous Water Heaters

Criteria	ENERGY STAR Requirements
Energy Factor	EF \geq 0.82
Gallons-Per-Minute	GPM \geq 2.5 over a 77° rise
Warranty	Warranty \geq 10 years on heat exchanger and 5 years on parts
Safety	ANSI Z21.10.3/CSA 4.3

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c. Light Duty EPACT Covered Gas Water Heaters

Table 4: Criteria for Qualified Light Duty EPACT Covered Gas Water Heaters

Criteria	ENERGY STAR Requirements
Thermal Efficiency	TE \geq 0.90
Standby Loss	Standby loss \leq 2374 btu/hr * (TE – 0.74)
Warranty	Warranty \geq 6 years on system
Safety	ANSI Z21.10.3/CSA 4.3

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Note: Stakeholders raised concerns in their Draft 3 comments that it is premature to include hybrid water heaters in the Version 2.0 specification without a finalized test method. EPA recognizes that ENERGY STAR efficiency requirements set in Version 2.0 would potentially need to be revisited shortly after finalization once the test method is finalized and the federal minimum standards are set by the U.S. Department of Energy (DOE). For these reasons, EPA has decided to exclude hybrid water heaters within the Version 2.0 specification. EPA will revisit this product category once the NAECA test method is published and data become available based on this new test method.

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C. Product Performance Requirements for Solar Water Heaters:

Table 5: Criteria for Qualified Solar Water Heaters

Criteria	ENERGY STAR Requirements
Solar Energy Factor	SEF \geq 1.8 for electric backup SEF \geq 1.2 for gas backup
Warranty	10 years on collector, 6 years sealed system, 2 years on controls, 1 year on parts

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D. Significant Digits and Rounding:

- a. All calculations shall be carried out with directly measured (unrounded) values, except EF shall be rounded to the nearest 0.01, as specified in 10 CFR 430.23(e)(2).
- b. 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. TE shall be rounded to the nearest 0.01 and SL shall be rounded to the nearest whole number. SEF shall be rounded to the nearest 0.1.

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Note: EPA has added the significant digits and rounding requirements for Thermal Efficiency, Standby Loss and Solar Energy Factor. In the absence of DOE rounding guidance for these metrics, EPA is proposing the rounding requirements based on the general industry accepted approach.

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4) Test Requirements:

- A. A representative model shall be selected for testing per the following requirements:
 - 1) For qualification of an individual product model, the representative mode shall be equivalent to that which is intended to be marketed and labeled as ENERGY STAR;
 - 2) For qualification of a basic model group, any model within that basic model group may be considered the representative model.
- B. One of the following sampling plans shall be used for purposes of testing for ENERGY STAR qualification:
 - 1) A single unit is selected, obtained, and tested. The measured performance of this unit and of each subsequent unit manufactured must be equal to or better than the ENERGY STAR specification requirements. Results of the tested unit may be used to qualify additional

186 individual model variations within a basic model as long as the definition for basic model
187 group provided in Section 1, above, is met, or
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189 2) Units are selected for testing and results calculated according to the sampling requirements
190 defined in 10 CFR Part 429, Subpart B § 429.17. The certified rating must be equal to or
191 better than the ENERGY STAR specification requirements. Results of the tested unit may be
192 used to qualify additional model variations within a basic model as long as the definition for
193 basic model provided in Section 1, above, is met.
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195 C. When testing residential water heaters, the following test methods shall be used to determine
196 ENERGY STAR qualification:
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Table 6: Test Methods for ENERGY STAR Qualification

ENERGY STAR Requirement	Test Method Reference	Applicable Products
Energy Factor	10 CFR 430, Subpart B, Appendix E*	Gas and electric units; FHR only for storage units, GPM only for instantaneous.
First Hour Rating (FHR)		
Gallons per minute (GPM)		
Thermal Efficiency	10 CFR 431, Subpart G	Light duty EPACT covered gas water heaters
Standby Loss		
Solar Energy Factor	SRCC – OG-300: Operating Guidelines and Minimum Standards for Certifying Solar Water Heating Systems	Whole-home solar units

199 * This includes any applicable guidance that DOE has issued regarding the testing of these products (See
200 <http://www1.eere.energy.gov/guidance/default.aspx?pid=2&spid=1>). **Note on recovery efficiency:**
201 Guidance includes that for thermostatically-controlled water heaters that do not initiate and complete a
202 recovery cycle prior to the start of the second draw of the simulated-use test, the recovery efficiency shall
203 be determined as specified in Section 11.2 of ASHRAE 118.2.

204 **5) Effective Date:**

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206 The ENERGY STAR Residential Water Heater specification shall take effect on **July 1, 2013**. To qualify
207 for ENERGY STAR, a product model shall meet the ENERGY STAR specification in effect on the model's
208 date of manufacture. The date of manufacture is specific to each unit and is the date on which a unit is
209 considered to be completely assembled.
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211 **Note:** The proposed effective date has been adjusted to reflect an expectation that this specification will
212 be finalized by October 1, 2012.

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214 **6) Future Criteria Revisions:**

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216 EPA reserves the right to change the specification should technological and/or market changes affect its
217 usefulness to consumers, industry, or the environment. In keeping with current policy, revisions to the
218 specification are arrived at through industry discussions. In the event of a specification revision, please
219 note that the ENERGY STAR qualification is not automatically granted for the life of a product model.