



ENERGY STAR Program Requirements Product Specification for Residential Water Heaters

Eligibility Criteria Version 2.0: Draft 1

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7 Following is the **Draft 1** Version 2.0 product specification for ENERGY STAR qualified water heaters. A
8 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 oil, gas, or electricity to heat potable water for
12 use outside the heater upon demand, including:

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14 a. Whole-home Unit: For the purposes of this specification, a whole-home unit refers to a
15 water heater that is designed to provide potable hot water for the entire home.
16 Technologies include:

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18 i. Storage type units which heat and store water at a thermostatically controlled
19 temperature, including: gas storage water heaters with an input of 75,000 British
20 thermal units (Btu) per hour or less; electric heat pump type units, with a
21 maximum current rating of 24 amperes at a voltage no greater than 250 volts and
22 designed to transfer thermal energy from one temperature level to a higher
23 temperature level for the purpose of heating water. Add-on heat pump units are
24 air to water heat pumps designed for use with a storage-type water heater or a
25 storage tank that is not specified or supplied by the manufacturer.

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27 ii. Tankless (or “instantaneous”) type units which heat water but contain no more
28 than one gallon of water per 4,000 Btu per hour of input, including: gas
29 instantaneous water heaters with an input of 200,000 Btu per hour or less; oil
30 instantaneous water heaters with an input of 210,000 Btu per hour or less; and
31 electric instantaneous water heaters with an input of 12 kilowatts or less.

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33 iii. Solar water heaters must include a collector and storage tank, and must use the
34 sun’s thermal energy to heat water. Solar type units eligible for the ENERGY
35 STAR Water Heaters Program must have received an OG-300 rating from the
36 Solar Rating and Certification Corporation (SRCC). According to the SRCC,
37 solar units employ one of the four basic types of solar water heating systems:
38 forced circulation (includes both direct and indirect systems), integrated collector
39 and storage, thermosiphon, or self-pumped.¹

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41 b. Point-of-Use (POU) Unit: For the purposes of this specification, a Point-of-Use unit refers
42 to a water heater that is designed for use near the fixture. The unit must have an input of
43 less than or equal to 12kW with dimensions less than 36x25x24 inches (LxWxH).

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45 B. Energy Factor: Energy Factor (“EF”) is the ratio of useful energy output from the water heater to
46 the total amount of energy delivered to the water heater.

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48 C. Solar Fraction: Solar Fraction (“SF”) is the portion of the total conventional hot water heating load
49 (delivered energy and standby losses) provided by solar energy.

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¹ SRCC, Part 6: Types of Solar Thermal Systems. http://www.solar-rating.org/facts/system_ratings.html

- 51 D. First-Hour Rating: The First-Hour Rating (“FHR”) is the amount of hot water in gallons a storage
52 water heater can supply per hour (starting with a tank full of hot water).
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- 54 E. Gallons per Minute: Gallons per Minute (“GPM”) is the amount of hot water in gallons a tankless
55 water heater can supply per minute over a 77°F rise.
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- 57 F. Manufacturer Limited Warranty: Manufacturer limited warranty is an assurance by the
58 manufacturer to the consumer that the water heater, including purchased system equipment and
59 components, are guaranteed to work for a defined period of time.
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- 61 G. Basic Model Group: All units of a given type of covered product (or class thereof) manufactured
62 by one manufacturer and which have the same primary energy source and which, with the
63 exception of immersed heating elements, do not have any differing electrical, physical, or
64 functional characteristics that affect energy consumption.
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66 **Note:** Definitions for Whole home units and Point-of-Use units have been added. The previous definition
67 for Heat pump type units had specified drop-in and integrated units for eligibility. This specification has
68 been removed in efforts to promote technology neutrality, and to allow for the addition of add-on heat
69 pump units to the product category.

70 EPA recognizes that point-of-use is not primarily a product designation, but rather a system design
71 description. Nevertheless, the small instantaneous electric units designated in this specification are sold
72 as “point-of-use” in retail stores. As this is EPA’s intention in adding them, we propose use of the term.

73 Stakeholder feedback indicates that POU units can be defined by input and physical dimensions. As
74 specified in paragraph 1.16 of Appendix E, 10 CFR 430 Subpart B, the definition of a table top water
75 heater is one having dimensions of 36x25x24 inches or less. This ensures that the unit will be sized
76 appropriately to be at close proximity to the fixture, or “under the counter”.

77 Stakeholders have also indicated that providing hot water for a cluster of appliances in a point-of-use
78 application could require input power of at least 25kW. However, for units between 12 kW and 25 kW the
79 efficiency would not be measured with EF as they are not currently covered under NAECA. To avoid
80 multiple requirements, EPA proposes expanding eligibility only to units of 12 kW or less at this time. This
81 decision also stems from feedback received by EPA in regards to the inclusion of hybrid water heaters in
82 the current water heaters program. Hybrid units also would not be measured with EF, and stakeholders
83 have indicated that the preferred approach for these products would be to either wait until the next
84 version of the ENERGY STAR Water Heaters Specification, by which time the test methods will have
85 changed, or until the addition of a commercial water heaters program to the ENERGY STAR portfolio is
86 considered.

87 Stakeholders are encouraged to review all the definitions presented above and provide suggestions on
88 how they might be improved or clarified. EPA is also interested in whether there are additional terms that
89 should be defined to clarify this specification.

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91 **2) Scope:**

92 A. Included Products: Only products that meet the definition of a residential water heater, as
93 specified herein, which are intended only for sale in the residential market are eligible for
94 ENERGY STAR qualification.
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96 B. Excluded Products: Whole-home electric resistance only water heaters, products intended only
97 for commercial use, and combination appliances that supply both space and water heating are
98 not eligible for the ENERGY STAR Water Heater Program.

100 **Note:** Under included products, the scope has been updated to clarify that only products intended for sale
 101 in the residential market are eligible for ENERGY STAR qualification. Thus EPA has removed any
 102 reference to specific technologies.

103 Similarly, under excluded products, scope has been updated to clarify that products intended for
 104 commercial use are not eligible for ENERGY STAR qualification.

105 Stakeholders have questioned whether the current input rate and/or power limits and tank sizes that
 106 define a residential water heater (including the new point-of-use category) correspond well to how actual
 107 water heaters are (or should be) designed for residential use. Without addressing the appropriateness of
 108 current definitions, EPA notes that the implications of broadening the definition in this specification would
 109 include allowing products without EF ratings to qualify. Stakeholder feedback indicated that with wide
 110 scale change due presently in the metrics and test methods for water heater efficiency, the next revision
 111 cycle would be a more fruitful time to consider this question. Accordingly, EPA proposes retaining the
 112 current input rate/power limits and tank sizes for the present time. The inclusion of point of use units at
 113 and under 12 kW and add-on heat pumps presents no such difficulty.

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116 **3) Qualification Criteria:**

117 A. Product Performance Requirements for Electric Water Heaters:

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119 a. Whole Home Electric Units

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Criteria	ENERGY STAR Requirements
Energy Factor	EF ≥ 2.0
First Hour Rating	FHR ≥ 50 gallons per hour
Warranty	6 years on sealed system. In the case of add-on heat pumps, the manufacturer must assume the remaining warranty of the tank it is being installed on, up to a maximum of 6 years. In addition, add-on heat pump manufacturers must include a warning statement on their warranty sheet indicating that the original tank warranty may be voided upon installation of the add-on heat pump.
Safety	UL 174 and UL1995

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b. Point-Of-Use Electric Units

Criteria	ENERGY STAR Requirements
Energy Factor	EF ≥ 0.97
Low Flow Rate Requirement	Activation must occur at a flow rate of .3 GPM or less.
Warranty	Warranty ≥ 10 years on heat exchanger and 5 years on parts
Safety	ANSI/UL499
Flicker	Units shall perform within acceptable region defined by IEC 61000-2-2
Temperature Adjustment	Unit must have a feature that allows the user to adjust temperature. Manufacturer must submit a copy of the operation manual, which verifies this capability
Booster Capability	Product must be capable of acting as a booster to complement or augment other water heating sources. Manufacturer must submit a copy of the operation manual, which verifies this capability.

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B. Product Performance Requirements for Gas Water Heaters:

a. Whole-Home Gas Storage Units

Criteria	ENERGY STAR Requirements
Energy Factor	EF ≥ 0.67
First Hour Rating	FHR ≥ 67 gallons per hour
Warranty	Warranty ≥ 8 years on sealed system
Safety	ANSI Z21.10.1/CSA 4.1

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b. Whole-Home Gas Tankless Units

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Criteria Item	ENERGY STAR Requirements
Energy Factor	EF ≥ 0.82
Gallons-Per-Minute	GPM ≥ 2.5 over a 77° rise
Warranty	Warranty ≥ 10 years on heat exchanger and 5 years on parts
Safety	ANSI Z21.10.1/CSA 4.1 or ANSI Z21.10.3/CSA 4.3, depending on burner size

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C. Product Performance Requirements for Solar Water Heaters:

a. Whole-Home Solar Units

Criteria	ENERGY STAR Requirements
Solar Fraction	SF ≥ 0.5
Warranty	10 years on collector, 6 years sealed system, 2 years on controls, 1 year on parts

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Note: The focus of this specification revision is to re-evaluate the water heater category in terms of a technology neutral approach, and to expand and re-organize the criteria so that additional energy saving products may be highlighted for the consumer. EPA is aware that new minimum federal standards will go into effect in 2015, and will re-evaluate the criteria in the coming years to account for resulting changes in performance levels.

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In order to maintain technology neutrality, products have been reclassified based on the fuel type – Electric, Gas and Solar water heaters. Under each fuel type, products are further classified based on whole home and point-of-use criteria. In addition, EPA proposes to retain the distinction between storage and instantaneous water heaters for this revision cycle, pending changes to the water heater test method. Changes to the product categories are as follows:

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Whole-home Electric:

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This proposal includes add on heat pumps in the same category as integrated heat pumps, and with the same performance requirements. EPA felt there were clearly scenarios in which add-on heat pumps would be competing with integrated units, so a level playing field requires the same levels for both. In addition, we received many comments on the response document questioning the advisability of a separate after market device category.

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With the proposed inclusion of add-on heat pump units in this category, EPA had requested feedback from stakeholders with regards to the appropriate warranty requirements that would assure consumers a reliable product. Stakeholders unanimously agreed that in some cases, the addition of an add-on heat pump would void the manufacturer’s warranty of the original tank. Unfortunately, there was little consensus among manufacturers on whether all add on designs would void the original warranty. Therefore, EPA proposes that all add-on heat pump manufacturers assume the remainder of the original tank warranty up to 6 years.

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It is in the consumer’s best interest to avoid establishing requirements that would place them in the middle of a dispute between the original tank manufacturer and the add-on heat pump manufacturer on warranty fulfillment. EPA considered limiting the warranty requirement to designs that require “alteration to the tank”, or defining particular types of failures add-on heat pump manufacturers would be responsible for. Ultimately EPA felt either course would be likely to leave consumers in the middle of warranty disputes.

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However, EPA does not consider the proposed requirement an ideal solution, and welcomes stakeholder suggestions to improve it. EPA intends to discuss this potential solution in more detail and gather stakeholder feedback during the Draft 1 Webinar.

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185 **Note Contd.**

186 Point-of-Use Electric:

187 Requirements for Point-of-Use (POU) units have been added to this draft. They include Energy Factor,
188 low flow rate, booster capability, temperature adjustment, warranty, safety and flicker requirements.

189 Under-the-counter units of 12 kW or less generally will only be able to provide hot water to a single sink,
190 and not, for instance a shower. This will be cost effective for consumers who purchase a POU electric unit
191 instead of a new, increased capacity, whole-home unit, assuming the whole home water heater does not
192 need replacement. An example of this would be if a consumer builds a small addition to their house, and
193 needs to supply hot water to a new fixture.

194 Whole-home Gas:

195 As proposed in the specification framework, the whole-home gas storage category will include high
196 efficiency gas storage water heaters and gas condensing water heaters. EPA proposes that the EF level
197 be set at the current high efficiency gas storage level of .67, where it has been since 9/1/2010. 19% of
198 active models in the AHRI directory meet this requirement, and preliminary 2010 shipments indicate 11%
199 market penetration, so raising the level is not needed.

200 For warranty requirements, since the previous specification had different requirements for high efficiency
201 gas storage and gas condensing, at 6 and 8 years respectively, it was necessary to choose a period that
202 would represent the entire whole-home gas storage category. A period of 8 years was chosen to ensure
203 adequate time for payback on units.

204 Whole-home Solar:

205 EPA has decided not to combine solar water heaters with the whole home gas and electric categories,
206 based on stakeholder feedback on the framework document and on consumer purchasing decisions.
207 EPA remains concerned about the consumer cost effectiveness of these systems, even taking 30% tax
208 credits into account and comparing them to conventional systems.

209 EPA intends to examine if there is a more effective tool than ENERGY STAR for encouraging broader
210 adoption of solar water heating systems. Stakeholder feedback on this point is particularly welcome.

211 As detailed in the specification framework, industry feedback has previously indicated that the use of
212 Solar Fraction in the current specification is not in line with industry practice. EPA received positive
213 stakeholder feedback on using SEF instead, and if Solar units are retained as part of this specification,
214 will do so.

215 Stakeholders are encouraged to provide feedback and/or any supporting data on the questions above.

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217 **D. Significant Digits and Rounding:**

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219 a. All calculations shall be carried out with actual measured or observed values. Only the
220 final result of a calculation shall be rounded. Unless otherwise specified in 10 CFR part
221 430 or part 431, calculated results shall be rounded to the nearest significant digit as
222 expressed in the corresponding specification limit.

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224 b. Unless otherwise specified, compliance with specification limit shall be evaluated using
225 exact values without any benefit from rounding.

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227 **Note:** The requirement for solar water heater results to match SRCC directory listings has been removed.
228 Under EPA's third party certification requirements, any EPA-Recognized lab and/or EPA-Recognized
229 certification body can qualify and verify ENERGY STAR products to ENERGY STAR specifications.

230 **4) Test Requirements:**

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- 232 A. A representative model shall be selected for testing per the following requirements:
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- 234 1) For qualification of an individual product model, the representative model is that model;
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- 236 2) For qualification of a basic model group, any model within that basic model group may be
- 237 considered the representative model.
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- 239 B. One of the following sampling plans shall be used for purposes of testing for ENERGY STAR
- 240 qualification:
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- 242 1) A single unit is selected, obtained, and tested. The measured performance of this unit and of
- 243 each subsequent unit manufactured must be equal to or better than the ENERGY STAR
- 244 specification requirements. Results of the tested unit may be used to qualify additional
- 245 model variations within a basic model group as long as the definition for basic model group
- 246 provided in Section 1, above, is met ; or
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- 248 2) Units are selected for testing and results calculated according to the sampling requirements
- 249 defined in 10 CFR Part 429, Subpart B § 429.17. The rated values must be equal to or
- 250 better than the ENERGY STAR specification requirements. Results of the tested unit may be
- 251 used to qualify additional model variations within a basic model group as long as the
- 252 definition for basic model group provided in Section 1, above, is met.
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- 254 C. When testing residential water heaters, the following test methods shall be used to determine
- 255 ENERGY STAR qualification:
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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 tankless.
First Hour Rating (FHR)		
Gallons per minute (GPM)		
Low Flow Rate		POU electric units
Flicker		POU electric units
Solar Fraction	SRCC – OG-300: Operating Guidelines and Minimum Standards for Certifying Solar Water Heating Systems	Whole-home solar units

257 ***Note on recovery efficiency:** For thermostatically-controlled water heaters that do not completely

258 recover or do not undergo a recovery cycle prior to the start of the second draw of the simulated-use test,

259 the recovery efficiency shall be determined as specified in Section 11.2 of ASHRAE 118.2.

260 **Note:** As proposed above, manufacturers are required to follow the sampling requirements defined by

261 DOE for purposes of choosing units for ENERGY STAR testing. The sampling requirements for

262 residential water heaters are defined in 10 CFR Part 429, Subpart B § 429.17. This language replaces

263 previous direction regarding individual and product family testing.

264 Stakeholders indicated that Low Flow Rate is an important metric for POU electric units; however, EPA is

265 not aware of a test method for it, and will not be able to include it in the final revised requirements without

266 one. Stakeholder input is requested on this point.

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268 **Note Contd.**

269 In addition, the referenced standard for flicker defines the acceptable region, but does not define the
270 method for test. EPA requests stakeholder feedback on the appropriate method of test.

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272 **5) Effective Date:**

273 The ENERGY STAR Residential Water Heater specification shall take effect on September 1, 2012. To
274 qualify for ENERGY STAR, a product model shall meet the ENERGY STAR specification in effect on the
275 model's date of manufacture. The date of manufacture is specific to each unit and is the date on which a
276 unit is considered to be completely assembled.
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279 **Note:** EPA aims to finalize the Version 2.0 Residential Water Heaters specification by December 1, 2011,
280 with a proposed September 1, 2012 effective date.

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282 **6) Future Criteria Revisions:**

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