



ENERGY STAR Program Requirements Product Specification for Commercial Water Heaters

Eligibility Criteria Version 1.0: Draft 1

7 Following is the **Draft 1** Version 1.0 product specification for ENERGY STAR qualified commercial water
8 heaters. 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. **Commercial Water Heater:** A product that utilizes gas or electricity to heat potable water for use
12 outside the heater upon demand, at a thermostatically controlled temperature, including:

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14 a. A storage type unit¹ which heats and stores water within the appliance at a
15 thermostatically controlled temperature for delivery on demand and that is industrial
16 equipment, including:

17 i. gas storage water heaters with an input rate greater than 75,000 British thermal
18 units (Btu) per hour, and

19 ii. electric heat pump water heater designed to transfer thermal energy from one
20 temperature level to a higher temperature level for the purpose of heating water,
21 including both air-source and water-source units, with an input rate greater than
22 or equal to 1.6 kW, a maximum current rating of 24 amperes at a voltage no
23 greater than 250 volts.

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25 b. A gas instantaneous type unit¹, with an input rating not less than 4,000 Btu/hr per gallon
26 of stored water, and that is industrial equipment, including products meeting this
27 description that are designed to heat water to temperatures of 180 °F or higher.

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29 B. **Thermal Efficiency (TE)**¹: The ratio of the heat energy (Btu/h) transferred to the water flowing
30 through the water heater to the amount of energy (Btu/h) consumed by the water heater.

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32 C. **Standby Loss (SL)**¹: The average hourly energy, expressed in Btu per hour, required to maintain
33 the stored water temperature.

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35 D. **Manufacturer Limited Warranty:** An assurance by the manufacturer to the consumer that the
36 water heater, including purchased system equipment and components, is guaranteed to work for
37 a defined period of time.

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39 E. **Basic Model**¹: All units of a given type of covered product (or class thereof) manufactured by one
40 manufacturer, having the same primary energy source, and which have essentially identical
41 electrical, physical, and functional (or hydraulic) characteristics that affect energy consumption,
42 energy efficiency, water consumption, or water efficiency.

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¹ 10 CFR Part 431 Subpart G

48 **Note:** The definitions above were developed based on definitions provided in the U.S. Department of
49 Energy (DOE)'s regulatory program for water heaters, i.e., 10 CFR Part 431 Subpart G.

50 The DOE regulations categorize residential and commercial gas storage and instantaneous water heaters
51 based on the unit input rate. According to the regulations, gas storage water heaters with an input rate
52 greater than 75, 000 Btu/h are defined as commercial water heaters. However, there are some water
53 heaters with input rates in the 75,000 – 100,000 Btu per hour range that are marketed, in part, for the
54 residential market. These will not qualify for this specification even though they will still be tested and
55 rated according to the DOE regulatory requirements for commercial water heaters because they will be
56 covered under the Residential ENERGY STAR Water Heater specification.

57 For electric water heaters, EPA proposes an input rate limit of greater than or equal to 1.6 kW. The size
58 limit was proposed based on the minimum input rate of available heat pump products in the market. To
59 ensure that all products are included in the scope of the specification, EPA has set the limit at the
60 minimum available input rate of 1.6kW.

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

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66 **2) Scope:**

67 A. Included Products: Only products that meet the definition of a commercial water heater, as
68 specified herein, which are marketed for sale in the commercial market are eligible for ENERGY
69 STAR qualification.

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71 B. Excluded Products: The following products are not eligible for qualification under this
72 specification:

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74 a. Products that are covered under other ENERGY STAR product specifications. The list of
75 specifications currently in effect can be found at www.energystar.gov/products.

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77 b. Oil fired water heaters.

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79 c. Combined heating, cooling and hot water systems.

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81 **Note:** In developing this Version 1.0 specification, EPA's intention is to only cover those water heaters
82 that are intended to be used in commercial applications. EPA has attempted to clearly indicate the
83 intended scope through the technical definitions provided in Section 1, above. EPA does not intend this
84 specification to cover integrated heating/cooling and hot water systems. However, some water-source
85 heat pump water heaters operate using a working fluid from HVAC units. We do not consider these to be
86 HVAC integrated systems because they are not typically designed and sold as a single system.
87 Stakeholders are encouraged to provide feedback as to how the specification could clarify this distinction.

88 Oil water heaters are excluded because there is no significant differentiation in performance among
89 commercial oil fired water heaters.

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97 **3) Qualification Criteria:**

98 A. Product Performance Requirements for Gas Water Heaters:

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100 **Table 1: Requirements for Qualified Gas Water Heaters**

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Criteria		ENERGY STAR Requirements
Thermal Efficiency		≥ 0.94
Maximum Standby Loss	storage	≤ 0.84 * [(Input Rate / 800) + 110(Volume) ^{1/2}] (Btu/h)
	instantaneous	N/A
Minimum Manufacturer Limited Warranty		3 years on tank and/or heat exchanger and 1 year on parts

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107 B. Product Performance Requirements for Electric Water Heaters:

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Table 2: Criteria for Qualified Electric Water Heaters

Criteria	ENERGY STAR Requirements
Efficiency Metric TBD	TBD
Minimum Manufacturer Limited Warranty	TBD

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111 **Note:** When evaluating a product category for potential ENERGY STAR labeling, EPA considers several
 112 guiding principles including the return on consumer investment in greater energy efficiency. In an initial
 113 savings and cost-effectiveness analysis, EPA estimates that commercial water heaters, on average, offer
 114 a payback of less than 1 year across several commercial applications including multi-family housing,
 115 nursing homes, and restaurants. This, coupled with sufficient product performance differentiation ranging
 116 from non-condensing to condensing technologies in the case of gas-fired water heaters, strong
 117 stakeholder support for ENERGY STAR labeling of commercial water heater products, and significant
 118 energy and carbon savings potential indicate that commercial water heaters are a good fit for the
 119 ENERGY STAR program.

120 Research and discussions with stakeholders indicate that gas storage and instantaneous water heaters
 121 constitute the majority of the market. Gas storage and instantaneous water heaters have a DOE test
 122 method and metric, which allow for immediate inclusion of these products in this version of the
 123 specification.

124 Considering the savings opportunity on the electric side provided by heat pump water heaters, EPA also
 125 proposes to include electric water heaters once a test method and metric for heat pump water heater
 126 efficiency is developed by the Department of Energy (DOE). Details regarding EPA's Draft 1 proposal
 127 and plans for these product types are provided below.

128 Gas Water Heaters:

129 EPA proposed qualification criteria for commercial gas water heaters of a minimum Thermal Efficiency.
 130 For gas storage water heaters, EPA also proposes a maximum standby loss.

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133 **Note Contd.,**

134 In terms of the energy savings, the Thermal Efficiency level is responsible for the majority of the savings
135 of commercial gas water heaters. The average annual energy savings by operating a high-efficiency gas
136 commercial water heater is estimated at approximately 1,000 therms per year. The proposed Thermal
137 Efficiency level for gas water heaters is 0.94. The 0.94 Thermal Efficiency level harmonizes with other
138 energy efficiency initiatives such as the Federal Energy Management Program (FEMP) and Consortium
139 for Energy Efficiency (CEE) Tier 2. Also, based on analysis of the AHRI directory and discussions with the
140 stakeholders, it is estimated that about 25% of the current market would meet the proposed Thermal
141 Efficiency level of 0.94 and products that could meet these requirements reflect good consumer selection.
142 The majority of the market share is at the 0.80 Thermal Efficiency level.

143 The overall savings from standby loss is proportionally less in commercial water heaters due to the much
144 higher hot water demand when compared to residential water heaters. Therefore, EPA does not seek to
145 differentiate products based on the standby loss requirement but to set a level for reasonable savings and
146 to ensure that as new technologies enter the marketplace, standby loss continues to be considered with
147 regard to product efficiency. The formula of the proposed standby loss is based on the federal minimum
148 standard formula and includes input rate and volume of the storage unit as variables. The proposed level
149 of 16% more stringent than the federal requirement allows inclusion of most water heaters in the market
150 that meet the 0.94 Thermal Efficiency requirement.

151 EPA proposes a minimum 3 year warranty for the tank and/or heat exchanger, and 1 year for parts.
152 These warranty requirements are included to ensure that the performance of the product is maintained
153 over time. EPA includes warranty requirements in a range of ENERGY STAR specifications to help
154 ensure product performance is not traded off against efficiency.

155 Electric Water Heaters:

156 EPA has included electric water heaters in the specification, recognizing the significant energy savings
157 potential of heat pump water heating technology. Furthermore, EPA analysis shows they provide
158 purchasers with a reasonable payback period. However, in the absence of a test method, EPA is not
159 able to set requirements at this time. As the lead Agency for ENERGY STAR test methods, DOE will
160 review, verify, or develop, as needed, an ENERGY STAR test method for inclusion in this specification.
161 When that process is complete, EPA and DOE intend to work through a stakeholder process to add the
162 test method and efficiency criteria to the specification. DOE is aware of several existing test methods,
163 such as the ASHRAE 118.1, *Method of Testing for Rating Commercial Gas, Electric, and Oil Service*
164 *Water Heating Equipment*, which is currently under revision. Once the test method is sufficiently defined
165 by DOE, EPA will initiate a stakeholder process to set required levels for electric water heaters based on
166 the metric the test method measures.

167 EPA also proposes to include a minimum warranty requirement of 5 years on the compressor and (in
168 consideration of the longer expected life time of heat pumps) 2 years on other parts. EPA would like to
169 understand more about the reliability of the different parts in a heat pump water heater to determine the
170 appropriateness of the proposed warranty requirement.

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

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173 C. Product Safety Requirements:

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175 **Table 3: Safety Requirements for Qualified Water Heaters**

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Product	ENERGY STAR Requirements
Gas Water Heaters	ANSI Z21.10.3/CSA 4.3
Heat Pump Water Heaters	TBD

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178 **Note:** EPA is proposing safety requirements to ensure that as new technologies come to market,
179 purchasers are assured of the same safe and quality performance over time that they have come to
180 expect with commercial water heaters offered today.

181 For gas water heaters, EPA proposes that all eligible products must comply with ANSI Z21.10.3/CSA 4.3.
182 This is the industry established safety standard for commercial storage and instantaneous water heaters
183 with an input rate above 75,000 Btu/hr.

184 For heat pump water heater requirements, a placeholder is included in this version. As part of revisions
185 to include heat pump water heaters in this specification, EPA intends to propose UL 1995, titled "*Heating
186 and Cooling Equipment*" which presents safety requirements for commercial heat pump water heaters.

187 EPA welcomes stakeholder feedback on the proposed safety requirements and any recommendations on
188 other standards or requirements to be considered.

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

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- 191 a. All calculations shall be carried out with directly measured (unrounded) values.
- 192 b. Unless otherwise specified below, compliance with specification limits shall be evaluated
193 using directly measured or calculated values without any benefit from rounding.
- 194 c. Directly measured or calculated values that are submitted for reporting on the ENERGY
195 STAR website shall be rounded to the nearest significant digit as expressed in the
196 corresponding specification limit. TE shall be rounded to the nearest 0.01 and SL shall be
197 rounded to the nearest whole number. COP shall be rounded to the nearest 0.1.
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199 **Note:** In the absence of DOE rounding guidance, EPA is proposing the rounding requirements based on
200 the general industry accepted approach. Stakeholders are encouraged to provide feedback on these
201 proposed rounding requirements.

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203 **4) Test Requirements:**

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- 205 A. One of the following sampling plans shall be used for purposes of testing for ENERGY STAR
206 qualification:
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- 208 1) A single unit is selected, obtained, and tested. The measured performance of this unit and of
209 each subsequent unit manufactured must be equal to or better than the ENERGY STAR
210 specification requirements. Results of the tested unit may be used to qualify additional
211 individual model variations within a basic model as long as the definition for basic model
212 provided in Section 1, above, is met. Further, all individual models within a basic model must
213 have the same certified rating based on the applicable sampling criteria per DOE's
214 regulations in Part 429 and this rating must be used for all manufacturer literature, the
215 qualified product list, and certification of compliance to DOE standards.; or
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- 217 2) Units are selected for testing and results calculated according to the sampling requirements
218 defined in 10 CFR Part 429, Subpart B § 429.44. The certified rating must be equal to or
219 better than the ENERGY STAR specification requirements. Results of the tested unit may be
220 used to qualify additional model variations within a basic model as long as the definition for
221 basic model provided in Section 1, above, is met. Further, all individual models within a
222 basic model must have the same certified rating based on the applicable sampling criteria
223 per DOE's regulations in Part 429 and this rating must be used for all manufacturer
224 literature, the qualified product list, and certification of compliance to DOE standards.
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226 B. When testing commercial water heaters, the following test methods shall be used to determine
227 ENERGY STAR qualification:
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229 **Table 4: Test Methods for ENERGY STAR Qualification**

ENERGY STAR Requirement	Test Method Reference	Applicable Products
Thermal Energy	10 CFR Part 431.106	Gas Water Heaters
Standby Loss		
TBD	TBD	Heat Pump Water Heaters

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232 **5) Effective Date:**
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234 The ENERGY STAR Commercial Water Heater specification shall take effect on **TBD**. To qualify for
235 ENERGY STAR, a product model shall meet the ENERGY STAR specification in effect on the model's
236 date of manufacture. The date of manufacture is specific to each unit and is the date on which a unit is
237 considered to be completely assembled.
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239 **Note:** EPA aims to finalize the Version 1.0 Commercial Water Heaters specification in December, 2012.
240 The specification will be effective for gas water heaters immediately upon completion.

241
242 **6) Future Criteria Revisions:**
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244 EPA reserves the right to change the specification should technological and/or market changes affect its
245 usefulness to consumers, industry, or the environment. In keeping with current policy, revisions to the
246 specification are arrived at through industry discussions. In the event of a specification revision, please
247 note that the ENERGY STAR qualification is not automatically granted for the life of a product model.