



ENERGY STAR® Product Specification for Commercial Packaged Boilers

Eligibility Criteria Final Draft Version 1.0

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7 Following is the **Final Draft** Version 1.0 product specification for Commercial Packaged Boilers. A
8 product shall meet all of the identified criteria if it is to earn the ENERGY STAR.

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

12 A. Commercial Boiler¹: A type of packaged low pressure boiler with a capacity at full load rated input
13 of 300,000 Btu per hour (Btu/hr) or more, which is distributed in commerce: (1) for heating or
14 space conditioning applications in commercial buildings; or (2) for service water heating in
15 buildings, excluding those products that meet the definition of Hot Water Supply Boiler.

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17 B. Hot Water Supply Boiler²: A packaged boiler designed for heating potable water for purposes
18 other than space heating, with an input rating from 300,000 Btu/hr to 12,500,000 Btu/hr and of at
19 least 4,000 Btu/hr per gallon of stored water.

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21 C. Packaged Boiler¹: A boiler that is shipped complete with heating equipment, mechanical draft
22 equipment and automatic controls in one or more sections but is not custom designed and/or field
23 constructed.

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25 D. Thermal Efficiency (TE)¹: The ratio of the heat energy (Btu/hr) absorbed by the water, or the
26 water and steam, to the higher heating value for the fuel burned.

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28 E. Turndown Ratio: The ratio of the boiler's maximum nameplate firing rate (Btu/hr) to the lowest
29 nameplate firing rate (Btu/hr).

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31 F. Basic Model¹: All units of a given type of covered product (or class thereof) manufactured by one
32 manufacturer, having the same primary energy source, and which have essentially identical
33 electrical, physical, and functional (or hydraulic) characteristics that affect energy efficiency.

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36 **2) Scope:**

37 A. Included Products: Only products that meet the definitions of both a commercial boiler and
38 packaged boiler, as specified herein, which are marketed for sale in the commercial market are
39 eligible for ENERGY STAR certification.

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41 **Note:** EPA has made a clarification that eligible products must meet both the Commercial Boiler and
42 Packaged Boiler definitions in Sections 1.A. and 1.C., respectively. EPA has decided to make this
43 change to align with the terminology of the U.S. Department of Energy's (DOE) 10 CFR Part 431.86.

¹ Based on definitions in 10 CFR Subpart E §431.82. When in conflict, the definitions in 10 CFR Subpart E §431.82 take precedence.

² Based on definitions in 10 CFR Subpart G §431.102. When in conflict, the definitions in 10 CFR Subpart E §431.102 take precedence.

- 44 B. Excluded Products: The following products are not eligible for certification under this
45 specification:
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47 a. Products that are covered under other ENERGY STAR product specifications. The list of
48 specifications currently in effect can be found at www.energystar.gov/specifications.
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50 b. Commercial boilers with a capacity greater than 2,500,000 Btu/hr.
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52 **Note:** Based on the stakeholder comments in response to Draft 1, EPA had removed the maximum
53 capacity limit of 2,500,000 Btu/hr and included all commercial packaged boilers under the specification in
54 the Interim Proposal document issued on March 23, 2016, explaining that the Agency understood that
55 expanding scope to include the larger class of boilers served the interest of purchasers, manufacturing
56 partners, and the environment. However, comments on the Interim Proposal document revealed that
57 industry opinion has evolved since EPA was asked to include larger boilers. In addition, concerns arose
58 about the availability of independent test labs to test them. In recognition of this, EPA will revert back to
59 limiting the scope of the specification to 2,500,000 Btu/hr. EPA continues to exclude custom-built, field-
60 constructed boilers from the specification as the performance of those products may be altered
61 depending on installation and application, which makes it difficult to establish standardized criteria.
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63 3) Certification Criteria:

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65 A. Energy Efficiency Requirements: To certify to ENERGY STAR, commercial packaged boilers
66 shall meet the following minimum requirements:
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68 a. Thermal Efficiency \geq 94.0%
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70 b. Turndown Ratio \geq 5:1
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72 **Note:** While EPA has received support in setting the Thermal Efficiency (TE) level at 94%, some
73 stakeholders requested that the TE be set at 90%, noting that there is a clear distinction between
74 condensing and non-condensing products at levels at 85% Combustion Efficiency (CE). It was
75 mentioned that the 94% threshold is unnecessarily restrictive and that EPA appears to match ENERGY
76 STAR level with the Federal Energy Management Program (FEMP) specification. Based on EPA's
77 analysis, the Agency has concluded that setting the level at 90% TE would not provide sufficient
78 distinction between ENERGY STAR and conventional boilers, given the large proportion of models with
79 TE >90%. Therefore, EPA is maintaining the previously proposed 94% TE for this specification.

80 EPA received various other comments in response to the CE level issued in the Interim Proposal
81 document for commercial packaged boilers larger than 2,500,000 Btu/hr that opposed EPA's approach
82 used to create the CE level and the stringency of the criteria. EPA's intent was to expand scope to
83 include commercial packaged boilers of 2,500,000 Btu/hr to 5,000,000 Btu/hr using the CE metric in
84 accordance with DOE. The CE level for the larger capacity commercial boilers was proposed to be
85 >95%; however, as the Agency has decided to maintain the scope limited to 2,500,000 Btu/hr, the
86 relationship between CE and TE is no longer a relevant concern since CE does not appear in the
87 program requirements. Additionally, a definition for the term "combustion efficiency" is no longer
88 necessary because the specification does not use that metric.

89 There was stakeholder concern that the proposed ambient relative humidity (RH) conditions were too
90 stringent; however, in the Final test method issued by DOE, the RH conditions are consistent with
91 ANSI/AHRI Standard 1500-2015. As such, EPA expects the ratings to remain relatively constant and
92 should not impact the validity of EPA's conclusions.

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95 **Note cont.** One stakeholder requested EPA establish a requirement that a system be properly sized and
96 equipped to handle condensing boilers at lower operating temperatures before certification. EPA is
97 unable to certify systems as installed, only products as manufactured; therefore, EPA will not be
98 establishing this additional requirement.

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100 B. Significant Digits and Rounding:

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102 a. All calculations shall be carried out with actual measured (unrounded) values. Only the
103 final result of a calculation shall be rounded.
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105 b. Unless otherwise specified below, compliance with specification limits shall be evaluated
106 using exact values without any benefit from rounding.
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108 c. Directly measured or calculated values that are submitted for reporting on the ENERGY
109 STAR website shall be rounded to the nearest significant digit as expressed in the
110 corresponding specification limit.
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112 **Note:** EPA has updated the rounding requirements above to avoid confusion and for consistency with
113 other ENERGY STAR specifications.

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115 C. Reporting Requirements

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117 a. Report whether models are certified to UL 795 *Standard for Commercial-Industrial Gas*
118 *Heating Equipment*, ANSI Z21.13-2014/CSA 4.9 *Gas-Fired Low Pressure Steam and Hot*
119 *Water Boilers*, another combustion safety certification, or none.
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121 **Note:** Stakeholders suggested that ENERGY STAR certified commercial packaged boilers should have to
122 comply with nationally recognized safety standards for commercial boilers by an independent 3rd party
123 certification agency. While EPA is not responsible for safety certification enforcement, the Agency
124 understands the value of 3rd party safety certification may bring to the customer. As such, EPA has
125 added UL 795 and/or ANSI Z21.13 certifications as a reporting requirement, which will be available to
126 purchasers using the ENERGY STAR certified products list. EPA understands that these safety
127 standards are widely used in the industry and most commercial packaged boilers already have
128 certification to these standards.

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131 **4) Test Requirements:**

- 132 A. One of the following sampling plans shall be used for purposes of testing for ENERGY STAR
133 certification:
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135 1) A single unit is selected, obtained, and tested. The measured performance of this unit and of
136 each subsequent unit manufactured must be equal to or better than the ENERGY STAR
137 specification requirements. Results of the tested unit may be used to qualify additional
138 individual model variations within a basic model as long as the definition for basic model
139 provided in Section 1, above, is met; or
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141 2) Units are selected for testing and results calculated according to the sampling requirements
142 defined in 10 CFR Part 429, Subpart B § 429.60 and/or § 429.70. The certified rating must
143 be equal to or better than the ENERGY STAR specification requirements. Results of the
144 tested unit may be used to qualify additional model variations within a basic model as long
145 as the definition for basic model provided in Section 1, above, is met. Further, all individual
146 models within a basic model must have the same certified rating based on the applicable
147 sampling criteria. This rating must be used for all manufacturer literature, the qualified
148 product list, and certification of compliance to DOE standards.

149 **Note:** Under the multi-sample selection option, in addition to the DOE sampling requirement in section §
150 429.60, EPA added section § 429.70, which allows the use of an Alternative Efficiency Determination
151 Method (AEDM), a computer simulation program to determine the efficiency rating of a basic model.
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153 Stakeholders familiar with the verification test programs that certification bodies (CBs) run on ENERGY
154 STAR products raised concerns about the burden they would impose for low-volume high cost products
155 such as commercial boilers. EPA reached out to AHRI to better understand the requirements of their
156 current verification testing program for these products. Given that units are generally custom-built in
157 order to be tested for verification, EPA agrees that a modification of our typical approach (four units of the
158 model to be tested must be available within 10 business days of the test date) is reasonable. These
159 procedures are not part of the specification, but reside in guidance documents issued to CBs for their
160 reference in developing their verification testing programs. In parallel with this specification development,
161 EPA will work with stakeholders and CBs to craft a modified approach that is reasonable for products that
162 must be built to order for testing, and which also still fulfills the program integrity needs of the ENERGY
163 STAR program.
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165 In addition, EPA points out that manufacturers may use the single sample option at their discretion.
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167 B. When testing commercial packaged boilers, the following test methods shall be used to determine
168 ENERGY STAR certification:
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Table 1: Test Methods for ENERGY STAR Certification

ENERGY STAR Requirement	Test Method Reference
Thermal Efficiency	10 CFR Part 431.86
Turndown Ratio*	UL 795 or ANSI Z21.13-2014/CSA 4.9

171 *Turndown ratio may be demonstrated for ENERGY STAR certification and verification through UL795 or
172 ANSI Z21.13-2014/CSA 4.9 safety certification documentation.
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174 **Note:** One stakeholder commented that in response to DOE concerns regarding the measurement of
175 efficiencies in part-load conditions, the American Society of Heating, Refrigerating, and Air-Conditioning
176 Engineers (ASHRAE) 155 is under development. In DOE's Final Rule, issued on October 21, 2016, the
177 Department concluded that it will not develop a test procedure for the purpose of measuring part-load
178 efficiency at this time. As such, EPA will likewise not include part-load efficiency requirements.
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180 The turndown ratio compliance is determined using the guidance provided within UL 795 or ANSI Z21.13-
181 2014/CSA 4.9. Provided below Table 2 is clarification that safety certification documentation is
182 acceptable for demonstrating compliance with the turndown ratio requirement.
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5) Effective Date:

186 The ENERGY STAR Commercial Packaged Boilers specification shall take effect immediately upon
187 finalization. To certify for ENERGY STAR, a product model shall meet the ENERGY STAR specification
188 in effect on the model's date of manufacture. The date of manufacture is specific to each unit and is the
189 date on which a unit is considered to be completely assembled.
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191 **Note:** EPA aims to finalize the Version 1.0 Commercial Packaged Boilers specification in December,
192 2016. The Version 1.0 specification will take effect immediately upon its publication.
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199 **6) Future Specification Revisions:**

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