



ENERGY STAR Program Requirements Product Specification for Commercial Boilers

Eligibility Criteria Version 1.0: Draft 1

7 Following is the **Draft 1** Version 1.0 product specification for Commercial Boilers. A product shall meet all
8 of the identified criteria if it is to earn the ENERGY STAR.

9
10 **1) Definitions:** Below are the definitions of the relevant terms in this document.

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

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

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20 C. Thermal Efficiency (TE)¹: The ratio of the heat energy (Btu/h) absorbed by the water, or the
21 water and steam, to the higher heating value for the fuel burned.

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23 D. Turndown Ratio: The ratio of the burner's maximum firing rate (Btu/hr) to the lowest firing rate
24 (Btu/hr).

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

29 **Note:** The definitions above, except for Turndown Ratio, were developed based on definitions provided
30 in the U.S. Department of Energy (DOE)'s regulatory program for commercial boilers, i.e., 10 CFR Part
31 431 Subpart E. EPA is interested to know if there is an industry accepted definition of turndown ratio and
32 a way of confirming the claimed turndown ratio of a given boiler product.

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

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37 **2) Scope:**

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

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

44 ² Based on definitions in 10 CFR Subpart G §431.102. When in conflict, the definitions in 10 CFR Subpart E
45 §431.102 take precedence.

- 46 B. Excluded Products: The following products are not eligible for certification under this
 47 specification:
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 49 a. Products that are covered under other ENERGY STAR product specifications. The list of
 50 specifications currently in effect can be found at www.energystar.gov/specifications.
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 52 b. Commercial boilers greater than 2.5MBtu/h.
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54 **Note:** In developing this Version 1.0 specification, EPA's intention is to only cover those boilers that are
 55 intended to be used in light commercial applications. Commercial boilers greater than 2.5MBtu/h are
 56 excluded, as they are typically custom built on site and product performance may be altered depending
 57 on installation and application. This makes it difficult to establish standardized criteria. EPA may decide to
 58 include boilers larger than 2.5M Btu/h under a subsequent version of this specification depending on
 59 stakeholder interest and data availability.

60 EPA's initial scoping assessment shows that product availability for oil boilers has steadily decreased
 61 over the last several years and currently, there are a limited number of high efficiency products available
 62 for purchase. The Air Conditioning, Heating and Refrigeration Institute (AHRI) certified product
 63 performance directory only lists one model of oil boiler rated at a condensing level. Given that there may
 64 be regions of the country that heavily rely on oil as a fuel source, EPA has not excluded oil boilers in the
 65 Version 1.0 scope but also has not set separate levels for them.

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 67 **3) Qualification Criteria:**
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- 69 A. Energy Efficiency Requirements: To certify for ENERGY STAR, commercial boilers shall meet the
 70 following minimum requirements:
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Table 1: Requirements for Qualified Commercial Boilers

Criteria	ENERGY STAR Requirements
Thermal Efficiency (TE)	≥ 94.0%
Turndown ratio	≥ 5:1

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 74 **Note:** When evaluating a product category for potential ENERGY STAR labeling, EPA makes use of a
 75 set of guiding principles to determine whether it is viable. Based on an initial unit and program savings
 76 analysis, EPA found that commercial boilers offer significant energy and carbon savings potential. There
 77 is sufficient product performance differentiation providing EPA with an opportunity to recognize
 78 condensing technologies and offer consumers several choices in the marketplace.

79 EPA is proposing performance criteria for commercial boilers at a minimum TE of 94.0% and a turndown
 80 ratio of 5:1.

81 Thermal Efficiency: For commercial boilers, there is a clear distinction between condensing and non-
 82 condensing products, around 92.0% TE. However, EPA found that the proposed level of 94.0% TE offers
 83 the best combination of product availability and significant savings, based on analysis of the 217
 84 packaged boiler models listed in the AHRI directory, and on information in the 2014 DOE TSD. The
 85 average annual energy savings by operating a high-efficiency commercial boiler is approximately 1,300
 86 therms per year. An installed base of 1.4 million non-condensing boilers, out of a total of 1.6 million
 87 installed boilers, offers tremendous national energy and carbon savings potential for the retrofit market.

88 **Note Contd.,**

89 In terms of product availability, based on analysis of the AHRI certified product performance directory and
90 on discussions with the stakeholders, about 23% of the current market would meet the proposed TE level
91 of 94.0%, representing several manufacturers and brands. The 94.0% TE level also harmonizes with
92 other energy efficiency initiatives such as Federal Energy Management Program (FEMP) requirements.

93 Turndown ratio: Boiler turndown is the ratio between maximum and minimum firing rate. The turndown
94 ratio is an important feature of boilers as most boilers operate at part load. Higher turndown ratios prevent
95 excessive cycling and the losses and wear and tear that accompany it.

96 Energy efficiency initiatives like FEMP and Consortium for Energy Efficiency (CEE), also recommend that
97 boilers have a minimum turndown ratio.

98 Approximately half of all condensing boilers in the AHRI directory have a turndown ratio of 5:1, with some
99 models capable of reaching 25:1. 18% of products listed on the AHRI directory would meet the proposed
100 minimum 94.0% TE and minimum 5:1 turndown ratio criteria.

101 Stakeholders are encouraged to provide feedback and/or any supporting data that quantifies real world
102 savings from turndown ratio.

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104 **B. Significant Digits and Rounding:**

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106 a. All calculations shall be carried out with directly measured (unrounded) values.
- 107 b. Unless otherwise specified below, compliance with specification limits shall be evaluated
108 using directly measured or calculated values without any benefit from rounding.
- 109 c. Directly measured or calculated values that are submitted for reporting on the ENERGY
110 STAR website shall be rounded to the nearest significant digit as expressed in the
111 corresponding specification limit.
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113 **Note:** In the absence of DOE rounding guidance, EPA is proposing the rounding requirements based on
114 the general industry accepted approach. Stakeholders are encouraged to provide feedback on these
115 proposed rounding requirements.

116 **4) Test Requirements:**

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118 A. One of the following sampling plans shall be used for purposes of testing for ENERGY STAR
119 qualification:
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121 1) A single unit is selected, obtained, and tested. The measured performance of this unit and of
122 each subsequent unit manufactured must be equal to or better than the ENERGY STAR
123 specification requirements. Results of the tested unit may be used to qualify additional
124 individual model variations within a basic model as long as the definition for basic model
125 provided in Section 1, above, is met; or
- 126
127 2) Units are selected for testing and results calculated according to the sampling requirements
128 defined in 10 CFR Part 429, Subpart B § 429.60. The certified rating must be equal to or
129 better than the ENERGY STAR specification requirements. Results of the tested unit may be
130 used to qualify additional model variations within a basic model as long as the definition for
131 basic model provided in Section 1, above, is met. Further, all individual models within a
132 basic model must have the same certified rating based on the applicable sampling criteria
133 this rating must be used for all manufacturer literature, the qualified product list, and
134 certification of compliance to DOE standards.

135 B. When testing commercial boilers, the following test methods shall be used to determine ENERGY
136 STAR qualification:
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138 **Table 2: Test Methods for ENERGY STAR Qualification**

ENERGY STAR Requirement	Test Method Reference
Thermal Efficiency	10 CFR Part 431.86

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141 **5) Effective Date:**

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143 The ENERGY STAR Commercial Boiler specification shall take effect on **TBD**. To certify for ENERGY
144 STAR, a product model shall meet the ENERGY STAR specification in effect on the model's date of
145 manufacture. The date of manufacture is specific to each unit and is the date on which a unit is
146 considered to be completely assembled.
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148 **Note:** EPA aims to finalize the Version 1.0 Commercial Boilers specification in December, 2015. The
149 specification will be effective immediately upon completion.

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151 **6) Future Criteria Revisions:**

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