



ENERGY STAR Program Requirements Product Specification for Commercial Boilers

Eligibility Criteria Version 1.0: Draft 1

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

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

- A. Commercial Boiler¹: A type of packaged low pressure boiler with a capacity at full load rated input of 300,000 Btu per hour (Btu/hr) or more, which is distributed in commerce: (1) for heating or space conditioning applications in commercial buildings; or (2) for service water heating in buildings, excluding those products that meet the definition of Hot Water Supply Boiler.
- B. Hot Water Supply Boiler²: A packaged boiler designed for heating potable water for purposes other than space heating, with an input rating from 300,000 Btu/hr to 12,500,000 Btu/hr and of at least 4,000 Btu/hr per gallon of stored water.
- C. Thermal Efficiency (TE)¹: The ratio of the heat energy (Btu/h) absorbed by the water, or the water and steam, to the higher heating value for the fuel burned.
- D. Turndown Ratio: The ratio of the burner's maximum firing rate (Btu/hr) to the lowest firing rate (Btu/hr).
- E. Basic Model¹: All units of a given type of covered product (or class thereof) manufactured by one manufacturer, having the same primary energy source, and which have essentially identical electrical, physical, and functional (or hydraulic) characteristics that affect energy efficiency.

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

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

2) **Scope:**

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

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.

B. Excluded Products: The following products are not eligible for certification under this specification:

- a. Products that are covered under other ENERGY STAR product specifications. The list of specifications currently in effect can be found at www.energystar.gov/specifications.
- b. Commercial boilers greater than 2.5MBtu/h.

Note: In developing this Version 1.0 specification, EPA's intention is to only cover those boilers that are intended to be used in light commercial applications. Commercial boilers greater than 2.5MBtu/h are excluded, as they are typically custom built on site and product performance may be altered depending on installation and application. This makes it difficult to establish standardized criteria. EPA may decide to include boilers larger than 2.5M Btu/h under a subsequent version of this specification depending on stakeholder interest and data availability.

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

3) Qualification Criteria:

A. Energy Efficiency Requirements: To certify for ENERGY STAR, commercial boilers shall meet the following minimum requirements:

Table 1: Requirements for Qualified Commercial Boilers

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

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

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

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

Note Contd.,

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

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

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

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

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

B. Significant Digits and Rounding:

- a. All calculations shall be carried out with directly measured (unrounded) values.
- b. Unless otherwise specified below, compliance with specification limits shall be evaluated using directly measured or calculated values without any benefit from rounding.
- c. 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.

Note: In the absence of DOE rounding guidance, EPA is proposing the rounding requirements based on the general industry accepted approach. Stakeholders are encouraged to provide feedback on these proposed rounding requirements.

4) Test Requirements:

- A. 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 individual model variations within a basic model as long as the definition for basic model provided in Section 1, above, is met; or
 - 2) Units are selected for testing and results calculated according to the sampling requirements defined in 10 CFR Part 429, Subpart B § 429.60. The certified rating must be equal to or better than the ENERGY STAR specification requirements. Results of the tested unit may be used to qualify additional model variations within a basic model as long as the definition for basic model provided in Section 1, above, is met. Further, all individual models within a basic model must have the same certified rating based on the applicable sampling criteria this rating must be used for all manufacturer literature, the qualified product list, and certification of compliance to DOE standards.

B. When testing commercial boilers, the following test methods shall be used to determine ENERGY STAR qualification:

Table 2: Test Methods for ENERGY STAR Qualification

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

5) Effective Date:

The ENERGY STAR Commercial Boiler specification shall take effect on **TBD**. To certify for ENERGY STAR, a product model shall meet the ENERGY STAR specification in effect on the model's date of manufacture. The date of manufacture is specific to each unit and is the date on which a unit is considered to be completely assembled.

Note: EPA aims to finalize the Version 1.0 Commercial Boilers specification in December, 2015. The specification will be effective immediately upon completion.

6) Future Criteria Revisions:

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