



ENERGY STAR® Product Specification for Commercial Packaged Boilers

Eligibility Criteria Final Draft Version 1.0

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Following is the **Final Draft** Version 1.0 product specification for Commercial Packaged 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 Boiler**¹: 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 Boiler**²: 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. **Packaged Boiler**¹: A boiler that is shipped complete with heating equipment, mechanical draft equipment and automatic controls in one or more sections but is not custom designed and/or field constructed.
- D. **Thermal Efficiency (TE)**¹: The ratio of the heat energy (Btu/hr) absorbed by the water, or the water and steam, to the higher heating value for the fuel burned.
- E. **Turndown Ratio**: The ratio of the boiler's maximum nameplate firing rate (Btu/hr) to the lowest nameplate firing rate (Btu/hr).
- F. **Basic Model**¹: 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.

2) **Scope:**

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

Note: EPA has made a clarification that eligible products must meet both the Commercial Boiler and Packaged Boiler definitions in Sections 1.A. and 1.C., respectively. EPA has decided to make this 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.

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 with a capacity greater than 2,500,000 Btu/hr.

Note: Based on the stakeholder comments in response to Draft 1, EPA had removed the maximum capacity limit of 2,500,000 Btu/hr and included all commercial packaged boilers under the specification in the Interim Proposal document issued on March 23, 2016, explaining that the Agency understood that expanding scope to include the larger class of boilers served the interest of purchasers, manufacturing partners, and the environment. However, comments on the Interim Proposal document revealed that industry opinion has evolved since EPA was asked to include larger boilers. In addition, concerns arose about the availability of independent test labs to test them. In recognition of this, EPA will revert back to limiting the scope of the specification to 2,500,000 Btu/hr. EPA continues to exclude custom-built, field-constructed boilers from the specification as the performance of those products may be altered depending on installation and application, which makes it difficult to establish standardized criteria.

3) Certification Criteria:

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

- a. Thermal Efficiency $\geq 94.0\%$
- b. Turndown Ratio $\geq 5:1$

Note: While EPA has received support in setting the Thermal Efficiency (TE) level at 94%, some stakeholders requested that the TE be set at 90%, noting that there is a clear distinction between condensing and non-condensing products at levels at 85% Combustion Efficiency (CE). It was mentioned that the 94% threshold is unnecessarily restrictive and that EPA appears to match ENERGY STAR level with the Federal Energy Management Program (FEMP) specification. Based on EPA's analysis, the Agency has concluded that setting the level at 90% TE would not provide sufficient distinction between ENERGY STAR and conventional boilers, given the large proportion of models with TE >90%. Therefore, EPA is maintaining the previously proposed 94% TE for this specification.

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

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

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

B. Significant Digits and Rounding:

- a. All calculations shall be carried out with actual measured (unrounded) values. Only the final result of a calculation shall be rounded.
- b. Unless otherwise specified below, compliance with specification limits shall be evaluated using exact 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: EPA has updated the rounding requirements above to avoid confusion and for consistency with other ENERGY STAR specifications.

C. Reporting Requirements

- a. Report whether models are certified to UL 795 *Standard for Commercial-Industrial Gas Heating Equipment*, ANSI Z21.13-2014/CSA 4.9 *Gas-Fired Low Pressure Steam and Hot Water Boilers*, another combustion safety certification, or none.

Note: Stakeholders suggested that ENERGY STAR certified commercial packaged boilers should have to comply with nationally recognized safety standards for commercial boilers by an independent 3rd party certification agency. While EPA is not responsible for safety certification enforcement, the Agency understands the value of 3rd party safety certification may bring to the customer. As such, EPA has added UL 795 and/or ANSI Z21.13 certifications as a reporting requirement, which will be available to purchasers using the ENERGY STAR certified products list. EPA understands that these safety standards are widely used in the industry and most commercial packaged boilers already have certification to these standards.

4) Test Requirements:

- A. One of the following sampling plans shall be used for purposes of testing for ENERGY STAR certification:
 - 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 and/or § 429.70. 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.

Note: Under the multi-sample selection option, in addition to the DOE sampling requirement in section § 429.60, EPA added section § 429.70, which allows the use of an Alternative Efficiency Determination Method (AEDM), a computer simulation program to determine the efficiency rating of a basic model.

Stakeholders familiar with the verification test programs that certification bodies (CBs) run on ENERGY STAR products raised concerns about the burden they would impose for low-volume high cost products such as commercial boilers. EPA reached out to AHRI to better understand the requirements of their current verification testing program for these products. Given that units are generally custom-built in order to be tested for verification, EPA agrees that a modification of our typical approach (four units of the model to be tested must be available within 10 business days of the test date) is reasonable. These procedures are not part of the specification, but reside in guidance documents issued to CBs for their reference in developing their verification testing programs. In parallel with this specification development, EPA will work with stakeholders and CBs to craft a modified approach that is reasonable for products that must be built to order for testing, and which also still fulfils the program integrity needs of the ENERGY STAR program.

In addition, EPA points out that manufacturers may use the single sample option at their discretion.

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

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

*Turndown ratio may be demonstrated for ENERGY STAR certification and verification through UL795 or ANSI Z21.13-2014/CSA 4.9 safety certification documentation.

Note: One stakeholder commented that in response to DOE concerns regarding the measurement of efficiencies in part-load conditions, the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) 155 is under development. In DOE's Final Rule, issued on October 21, 2016, the Department concluded that it will not develop a test procedure for the purpose of measuring part-load efficiency at this time. As such, EPA will likewise not include part-load efficiency requirements.

The turndown ratio compliance is determined using the guidance provided within UL 795 or ANSI Z21.13-2014/CSA 4.9. Provided below Table 2 is clarification that safety certification documentation is acceptable for demonstrating compliance with the turndown ratio requirement.

5) Effective Date:

The ENERGY STAR Commercial Packaged Boilers specification shall take effect immediately upon finalization. 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 Packaged Boilers specification in December, 2016. The Version 1.0 specification will take effect immediately upon its publication.

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.