



# ENERGY STAR® Program Requirements Product Specification for Furnaces

## Eligibility Criteria Draft Version 4.1

1 Following is the Version 4.1 product specification for ENERGY STAR certified furnaces. A product shall  
2 meet all of the identified criteria if it is to earn the ENERGY STAR.  
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4 **1) Definitions:** Below are the definitions of the relevant terms in this document.  
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6 A. **Residential Furnace:** A heating unit with a heat input rate of less than 225,000 Btu per hour whose  
7 function is the combustion of fossil fuel (natural gas, propane, or oil) for space heating with forced  
8 hot air. Unit must include burner(s), heat exchanger(s), blower(s) and connections to heating  
9 ducts. A heating unit that meets this definition and also provides hot water for domestic or other  
10 use may be considered a furnace for purposes of this agreement. Available furnace  
11 configurations<sup>1</sup> are provided below:  
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13 a. **Upflow:** A model with the airflow discharge vertically upward at or near the top of the furnace,  
14 with the blower mounted below the heating element.  
15

16 b. **Lowboy:** A model generally with a shorter cabinet in which the airflow discharge is vertically  
17 upward at or near the top of the furnace with the blower mounted beside the heating element.  
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19 c. **Downflow:** A model with the airflow discharge vertically downward at or near the bottom of the  
20 furnace, with the blower mounted above the heating element.  
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22 d. **Horizontal:** A model designed for low headroom installation with airflow across the heating  
23 element in a horizontal path.  
24

25 B. **Product Family:** A group of models which have identical ratings for heating input, output heating  
26 capacity, electric power (PE), auxiliary electrical energy consumption (E<sub>AE</sub>), fossil fuel energy  
27 consumption (E<sub>F</sub>), and annual fuel utilization efficiency (AFUE).  
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29 C. **Annual Fuel Utilization Efficiency (AFUE):** For the exact definition of AFUE, refer to the federal  
30 test method 10 CFR 430, Appendix N to Subpart B. In general, the percentage of the heat in the  
31 incoming fuel which is converted to space heat instead of being lost.  
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33 D. **Electronically Commutated Motor (ECM)<sup>2</sup>:** High efficiency brushless permanent magnet motor that  
34 is electronically controlled to operate over a broad range of speeds.  
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36 E. **Air Leakage (Q<sub>leak</sub>):** The percent of the rated airflow of the fan that is required to maintain the  
37 applied pressures, accounting for air that leaves or enters through cracks, joints and penetrations  
38 in the furnace cabinet rather than through supply and return ducts installed in accordance with  
39 manufacturer's instructions.  
40

41 F. **Heating Degree Days (HDD):** HDD for each state are calculated by subtracting the population-  
42 weighted daily average temperature for that state from a balance temperature of 65°F, and  
43 summing only positive values over an entire year.

<sup>1</sup> <http://www.ahridirectory.org/ahridirectory/helpdocs/RFRDirectory.pdf>

<sup>2</sup> Adapted from *Energy Savings Potential and Opportunities for High-Efficiency Electric Motors in Residential and Commercial Equipment*. Department of Energy, Building Technologies Office, December 2013. Accessed on February 16, 2017.

44 G. Balance Temperature: Used in a heating degree day calculation, intended to represent a  
 45 temperature at which neither heating nor cooling is needed.  
 46

47 **Note:** The definition for Furnace Fan Efficiency (“e”) has been removed from the specification and the  
 48 definition for Electronically Commutated Motor (ECM) has been added, in support of altered furnace fan  
 49 requirements in Section 3. This definition of ECM encompasses both constant torque and constant airflow  
 50 brushless permanent magnet motor designs.

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 52 **2) Scope:**  
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- 54 A. Included Products: Products that meet the definition of a Residential Furnace as specified herein  
 55 are eligible for ENERGY STAR certification, with the exception of products listed in Section 2B.  
 56 Only non-weatherized furnaces approved for residential installation are eligible.  
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 58 B. Excluded Products: Furnaces intended only for commercial installation and/or with a rating of  
 59 225,000 Btu per hour energy or higher are not eligible for ENERGY STAR. Weatherized furnaces  
 60 are not eligible for ENERGY STAR.  
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62 **3) Qualification Criteria:**  
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- 64 A. Regions: ENERGY STAR requirements are divided into the following three regions:  
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 66 a. U.S. North - States with population-weighted Heating Degree Days (HDD) equal to or greater  
 67 than 5,000.  
 68 b. U.S. South - States with population-weighted Heating Degree Days (HDD) less than 5,000.  
 69 c. Canada - All provinces and territories.  
 70

U.S. Regions	U.S. States per Region
U.S. North	Alaska, Colorado, Connecticut, Idaho, Illinois, Indiana, Iowa, Kansas, Maine, Massachusetts, Michigan, Minnesota, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New York, North Dakota, Ohio, Oregon, Pennsylvania, Rhode Island, South Dakota, Utah, Vermont, Washington, West Virginia, Wisconsin and Wyoming.
U.S. South	Alabama, American Samoa, Arizona, Arkansas, California, Delaware, District of Columbia, Florida, Georgia, Guam, Hawaii, Kentucky, Louisiana, Maryland, Mississippi, Nevada, New Mexico, North Carolina, Oklahoma, Puerto Rico, South Carolina, Tennessee, Texas and Virginia.

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 72 B. Energy Efficiency Requirements:  
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74 **Table 1: ENERGY STAR Gas and Oil Furnace Requirements**

Product Type	Regions	AFUE	Air Leakage (Q <sub>leak</sub> )
Gas Furnace	U.S. North/Canada	≥ 95.0%	≤ 2.0%
	U.S. South	≥ 90.0%	
Oil Furnace	U.S. (all)/Canada	≥ 85.0%	

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 76 C. Furnace Fan Requirement: To earn the ENERGY STAR, models must be equipped with an  
 77 electronically commutated fan motor (ECM).  
 78

79 **Note:** EPA has removed the Furnace Fan Efficiency (e ≤ 2.0%) requirement previously listed in Table 1  
 80 above. This requirement has been replaced by Section 3C Furnace Fan Requirement. To earn the  
 81 ENERGY STAR, models must be equipped with an electronically commutated fan motor.  
 82

83 The compliance date for the Federal test method for furnace fan efficiency in terms of the fan energy  
84 rating (FER) metric was July 3, 2014. EPA has not displayed furnace fan efficiency (e) on its Product  
85 Finder since 2014 for consistency with this rule. Compliance with the furnace fan efficiency standard  
86 (expressed in terms of FER) is required beginning July 3, 2019, which is also the date manufacturers will  
87 be required to show compliance with the standards by testing using the FER test procedure.  
88

89 EPA considered adopting the FER metric and setting requirements according to it, but concluded that it  
90 was better to wait until additional FER data is available. FER accounts for electrical use by furnace fans in  
91 a fundamentally different way than “e”, such that there is little correlation between the two metrics. To use  
92 FER, EPA would have to set a level without reference to “e” data of currently available ENERGY STAR  
93 products. Also, based on currently available products, furnaces with FER substantially better than the  
94 Federal standard will not be a cost effective choice for consumers. Therefore, to simplify the transition  
95 away from the “e” metric while maintaining the requirement of a high-efficiency furnace fan to protect the  
96 consumer, EPA proposes requiring ECMs. ECMs deliver greater efficiency by operating over a range of  
97 speeds to meet the needs of the situation, and consumers may expect significant savings from these fans.  
98 EPA expects that all currently certified furnaces meet this requirement. EPA will consider including an  
99 FER requirement in future revisions.

100  
101 Based on market penetration from Partners’ unit shipment data, and based on analysis of the AHRI  
102 directory, EPA concludes that the current AFUE levels in combination with ECM fan requirements provide  
103 an appropriate balance of differentiation and consumer choice. Based on this available data, 26% of  
104 furnace sales in the U.S. are ENERGY STAR certified, and around 30% of models in the AHRI directory  
105 meet the AFUE requirements in Table 1 and are equipped with an ECM.

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107 D. Multiple Configurations: To earn the ENERGY STAR, models offered in multiple configurations  
108 (i.e., upflow, downflow, horizontal, and lowboy) shall meet the regional ENERGY STAR levels  
109 presented in Table 1 for all configurations they are offered in. For example, if a model is intended  
110 to be sold in the U.S. North region and is offered in upflow, downflow, and horizontal  
111 configurations, then the model shall meet the U.S. North region ENERGY STAR levels as tested  
112 in all three configurations. Manufacturers cannot claim that a model meets ENERGY STAR U.S.  
113 North when installed in the downflow configuration only. Similarly, a model cannot be qualified  
114 across two different regions depending on configuration. For example, if sold in Canada all  
115 configurations shall meet the Canadian requirements in Table 1 to bear the ENERGY STAR.  
116 Models may qualify for labeling in every region for which all offered configurations meet the  
117 requirements of that region. For instance, models qualified for labeling in Canada may also be  
118 labeled everywhere in the U.S. and bear the standard ENERGY STAR logo, while models  
119 qualified only for labeling in the U.S. South may only use the U.S. South regional label.  
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121 E. Significant Digits and Rounding:

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123 a. All calculations shall be carried out with directly measured (unrounded) values.  
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125 b. Unless otherwise specified, compliance with specification limits shall be evaluated using  
126 directly measured or calculated values without any benefit from rounding.  
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128 c. Directly measured or calculated values that are submitted for reporting on the ENERGY  
129 STAR website shall be rounded to the nearest significant digit as expressed in the  
130 corresponding specification limit.  
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#### 132 **4) Warranty Requirements:**

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134 Manufacturer shall offer a limited warranty on all ENERGY STAR certified furnaces. For purposes of this  
135 specification, a limited warranty is an assurance by the Partner that purchased system equipment and  
136 components are warranted by the manufacturer for a period of time. The period of time is typically  
137 expressed in numbers of years. The exact terms of the limited warranty shall be determined by the  
138 manufacturer.

139 **5) Test Requirements:**

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- 141 A. A representative model shall be selected for testing per the following requirements:
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- 143 1) For qualification of an individual product model, the representative model is that model;
- 144
- 145 2) For qualification of a product family, any model within that product family may be considered
- 146 the representative model.
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- 148 B. One of the following sampling plans shall be used for purposes of testing for ENERGY STAR
- 149 qualification:
- 150
- 151 1) A single unit is selected, obtained, and tested. The measured performance of this unit and of
- 152 each subsequent unit manufactured must be equal to or better than the ENERGY STAR
- 153 specification requirements. Results of the tested unit may be used to qualify additional model
- 154 variations within a product family as long as the definition for product family provided in
- 155 Section 1, above, is met; or
- 156
- 157 2) Units are selected for testing and results calculated according to the sampling requirements
- 158 defined in 10 CFR Part 429, Subpart B § 429.18. The rated values must be equal to or better
- 159 than the ENERGY STAR specification requirements. Results of the tested unit may be used
- 160 to qualify additional model variations within a product family as long as the definition for
- 161 product family provided in Section 1, above, is met.
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- 163 C. When testing residential furnaces, the following test methods shall be used to determine
- 164 ENERGY STAR certification:
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**Table 2: Test Methods for ENERGY STAR Certification**

ENERGY STAR Requirement	Test Method Reference
AFUE	10 CFR Part 430, Appendix N
$Q_{leak}$	ANSI/ASHRAE 193-2010

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168 **Note:** The reference to “e” and its test method, “Interim Approach for Determining Furnace Fan Energy

169 Use”, have been removed from Table 2 above.

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171 **6) Effective Date:**

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173 The ENERGY STAR Furnace specification shall take effect on **February 1, 2013**. To qualify for ENERGY

174 STAR, a product model shall meet the ENERGY STAR specification in effect on its date of manufacture.

175 The date of manufacture is specific to each unit and is the date on which a unit is considered to be

176 completely assembled.

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178 **7) Future Specification Revisions:**

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180 EPA reserves the right to change this specification should technological and/or market changes affect its

181 usefulness to consumers, industry, or the environment. In keeping with current policy, revisions to the

182 specification are arrived at through stakeholder discussions. In the event of a specification revision, please

183 note that the ENERGY STAR certification is not automatically granted for the life of a product model. EPA

184 is planning to consider the following for future specification revisions:

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- 186 A. EPA will continue to monitor U.S. and Canadian markets and review AFUE data to determine
- 187 whether the limits in Table 1 continue to provide sufficient differentiation for the consumer. At this
- 188 point in time, EPA sees little potential to raise AFUE requirements.
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- B. As the market responds to the new Federal furnace fan efficiency standards, EPA will monitor the development of highly-efficient technologies that allow for differentiation.
  - C. System status and consumer messaging can aid in energy savings as well as overall system performance. These features can assist in ensuring proper installation and maintenance as well as address the issue of emergency replacement of a failed piece of HVAC equipment. EPA will continue to monitor whether the kinds of requirements in place for ENERGY STAR Most Efficient furnaces make sense to bring into this specification.
  - D. EPA believes that stepped and variable capacity equipment has the potential to save energy, and save consumers money, considered as a technological solution to the common practice of oversizing furnaces. It will also be more comfortable for homeowners, thus providing better performance. EPA will consider requiring stepped or variable capacity in the next specification revision.
  - E. Overall system efficiency plays a key role in energy savings. EPA will work closely with stakeholders to find a way to recognize and increase system efficiency.