



# ENERGY STAR® Program Requirements Product Specification for Furnaces

## Eligibility Criteria FINAL DRAFT: Version 3.0 and 4.0

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Following is the **FINAL DRAFT** Version 3.0 and 4.0 product specification for ENERGY STAR qualified furnaces. 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. Residential Furnace: A heating unit with a heat input rate of less than 225,000 Btu per hour whose function is the combustion of fossil fuel (natural gas, propane, or oil) for space heating with forced hot air. Unit must include burner(s), heat exchanger(s), blower(s) and connections to heating ducts. A heating unit that meets this definition and also provides hot water for domestic or other use may be considered a furnace for purposes of this agreement. Available furnace configurations<sup>1</sup> are provided below:
  - a. Upflow: A model with the airflow discharge vertically upward at or near the top of the furnace, with the blower mounted below the heating element.
  - b. Lowboy: A model generally with a shorter cabinet in which the airflow discharge is vertically upward at or near the top of the furnace with the blower mounted beside the heating element.
  - c. Downflow: A model with the airflow discharge vertically downward at or near the bottom of the furnace, with the blower mounted above the heating element.
  - d. Horizontal: A model designed for low headroom installation with airflow across the heating element in a horizontal path.
- B. Product Family: A group of models which have identical ratings for heating input, output heating capacity, electric power (PE), auxiliary electrical energy consumption (E<sub>AE</sub>), fossil fuel energy consumption (E<sub>F</sub>), and annual fuel utilization efficiency (AFUE).
- C. Annual Fuel Utilization Efficiency (AFUE): The amount of fuel converted to space heat in proportion to the amount of fuel entering the furnace. This is commonly expressed as a percentage.
- D. Furnace Fan Efficiency ("e"): The ratio of the furnace blower motor electric consumption to the total energy consumption of the furnace, in the heating mode. The "e" metric is calculated using Annual Electricity Use (E<sub>AE</sub>) and Annual Fuel Energy Use (E<sub>F</sub>) as follows:  $(E_{AE} \times 3413) / [(E_{AE} \times 3413) + (E_F \times 1,000,000)]$
- E. Air Leakage (Q<sub>leak</sub>): The percent of the rated airflow of the fan that is required to maintain the applied pressures, accounting for air that leaves or enters through cracks, joints and penetrations in the furnace cabinet rather than through supply and return ducts installed in accordance with manufacturer's instructions.

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

50 F. Heating Degree Days (HDD): HDD are calculated by subtracting the population-weighted daily  
51 average temperature from a balance temperature, and summing only positive values over an entire  
52 year.

53  
54 G. Balance Temperature: Used in a heating degree day calculation, intended to represent a  
55 temperature at which neither heating or cooling is needed.  
56

57 **Note:** EPA has modified the definitions of Furnace Fan Efficiency, Air Leakage and Heating Degree Days  
58 to provide better clarity. EPA has clarified the definition of the Furnace Fan Efficiency (“e”) to be clear that  
59 it is the blower motor energy consumption measured during the heating season. Similarly, the air leakage  
60 definition has been modified to just include the percentage based definition. The HDD definition has been  
61 clarified by defining the term “Balance Temperature”.

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63 **2) Scope:**

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65 A. Included Products: Products that meet the definition of a Residential Furnace as specified herein  
66 are eligible for ENERGY STAR qualification, with the exception of products listed in Section 2.B.  
67 Only non-weatherized furnaces approved for residential installation are eligible.  
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69 B. Excluded Products: Furnaces intended for commercial installation and/or with a rating of 225,000  
70 Btu per hour energy or higher are not eligible for ENERGY STAR. Weatherized furnaces are not  
71 eligible for ENERGY STAR.  
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73 **Note:** A statement has been added above excluding weatherized furnaces in response to a request to  
74 further clarify the scope of the specification.

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76 **3) Qualification Criteria:**

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78 A. Regions: ENERGY STAR qualification is determined by intended distribution and sales into the  
79 following three regions:

- 80  
81 a. U.S. North - States with population-weighted Heating Degree Days (HDD) equal to or greater  
82 than 5000.  
83 b. U.S. South - States with population-weighted Heating Degree Days (HDD) less than 5000.  
84 c. Canada - All provinces and territories.  
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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.

86  
87 **Note:** A recommendation was made to define regions based on states alone. EPA believes that providing  
88 both HDD and state information is important for defining regions. HDD determines the savings to the  
89 consumer and thus minimum AFUE requirement with the state listings helps retailers, utilities, and  
90 consumers to better understand the ENERGY STAR requirements.

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B. Energy Efficiency Requirements:

**Table 1, Version 3.0: ENERGY STAR Gas and Oil Furnace Requirements**

Product Type	Regions	AFUE	Furnace Fan Efficiency (e)
Gas Furnace	U.S. North/Canada	≥ 95%	≤ 2%
	U.S. South	≥ 90%	
Oil Furnace	U.S. (all)/Canada	≥ 85%	

**Table 1, Version 4.0: ENERGY STAR Gas and Oil Furnace Requirements**

Product Type	Regions	AFUE	Furnace Fan Efficiency (e)	Air Leakage (Q <sub>leak</sub> )
Gas Furnace	U.S. North/Canada	≥ 95%	≤ 2%	≤ 2%
	U.S. South	≥ 90%		
Oil Furnace	U.S. (all)/Canada	≥ 85%		

**Note:** EPA received several stakeholder comments on the performance criteria and labeling approach proposed in the previous Draft 2:

Air Leakage (Q<sub>leak</sub>)

EPA received comments suggesting that the ANSI/ASHARE 193-2010 test standard for Q<sub>leak</sub> is new and needs to be vetted before adopting and setting levels based on it. There was also some concern that Q<sub>leak</sub> may not make sense in Canada as most of the furnaces in Canada are installed in conditioned space and any heat leaked into the space would actually be beneficial to the homeowner. EPA is proposing to delay the effective date of the Q<sub>leak</sub> requirement until February 1, 2013. This will be version 4.0, which as indicated in the table above, has the same requirements otherwise.

Regional AFUE

Based on the information received regarding installation costs, EPA has revisited its cost effectiveness analysis. EPA acquired installation costs from discussions with DOE, industry leaders, trade associations and contractors. In this revised analysis, EPA took into account different installation scenarios, including (1) replacing non-condensing with condensing furnaces (2) replacing condensing with condensing furnaces, (3) addressing common vent issues and (4) new construction.

The proposed 95% AFUE level for the US North and Canada continues to provide a reasonable payback for the additional equipment retail price. As installation costs vary widely, depending on the characteristics of the dwelling, consumers will need to individually evaluate the value of a highly efficient ENERGY STAR furnace for their application with the help of their contractor. For many consumers payback time including installation cost is acceptable. For some retrofit situations, rebates offered by utilities, states, and local governments will continue to be important in offsetting the additional installation cost of an ENERGY STAR qualified unit.

For US South, however, 92% AFUE units do not offer favorable payback considering this new information about installation costs. Hence, EPA is proposing to keep the AFUE requirement at the current level of 90% in the US South.

Some stakeholders also questioned the product selection at the proposed 95% AFUE and e ≤ 2% levels. Through industry discussions, EPA established that although the percent of models meeting the combined requirement is currently less than the typical 25%, current availability patterns suggest that consumers will have sufficient product available by the time the specification takes effect.

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**Note Contd.**

Scope of ENERGY STAR Regions

Stakeholders raised concerns regarding regional ENERGY STAR labeling implementation and compliance. EPA reiterates that it intends to align with DOE in regards to the determination of regions, which will reduce the burden on manufacturers, distributors and contractors. As ENERGY STAR is a consumer information program, enforcement means ensuring that accurate information reaches consumers. Thus, we must make sure that 90 AFUE furnaces are labeled as ENERGY STAR qualified only in the South. This is very similar to our current task of ensuring the logo is used appropriately, and we intend to use our current enforcement methods.

This also answers stakeholder concerns regarding labeling the products and literature at the factory, when the regional destination of the product is not yet known. Products and literature of furnaces that meet requirements for the US South but not the US North must be labeled with the US South ENERGY STAR logo which clearly shows the unit only meets requirements for Southern states. Thus, furnaces with the US South label may be sold in the North, and there is no need to label the units differently based on where they are sold.

Furnace Fan Efficiency (e%)

EPA received comments on the use of “e” for fan efficiency, including that it does not account for efficiency in circulation mode. EPA recognizes that “e” is not representative of fan efficiency in all modes of operation; however, in anticipation of alignment with DOE’s furnace fan test method, due to be finalized in December 2012, EPA believes that this simple metric is an acceptable tool for recognizing top performers in the meantime. Many 95 AFUE furnaces already include high efficiency fans which are therefore accounted for in EPA’s payback analysis. When considered as an independent feature, EPA estimates the payback to be excellent based solely on electrical savings.

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

**Note:** EPA received comments suggesting that ENERGY STAR qualification should be based on the performance of the furnace and not on the installation configuration. Based on EPA’s analysis of the AHRI Product Directory, there is a difference in the product performance depending on configuration. The requirement above ensures the consumer that regardless of installation the ENERGY STAR qualified furnace will meet the ENERGY STAR performance requirements. This section has been added by EPA to avoid confusion in the marketplace regarding the compliance of only specific configurations and installations.

- 190 D. Significant Digits and Rounding:  
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 192 a. All calculations shall be carried out with directly measured (unrounded) values.  
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 194 b. Unless otherwise specified, compliance with specification limits shall be evaluated using  
 195 directly measured or calculated values without any benefit from rounding.  
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 197 c. Directly measured or calculated values that are submitted for reporting on the ENERGY  
 198 STAR website shall be rounded to the nearest significant digit as expressed in the  
 199 corresponding specification limit.  
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201 **Note:** The above rounding section has been updated to provide additional clarity based on questions  
 202 received from EPA-recognized certification bodies. The basic rounding requirement (i.e., to the nearest  
 203 significant digit as expressed in Table 1) has not been changed.

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 205 **4) Warranty Requirements:**  
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207 Manufacturer shall offer a limited warranty on all ENERGY STAR qualified furnaces. For purposes of this  
 208 specification, a limited warranty is an assurance by the Partner that purchased system equipment and  
 209 components are warranted by the manufacturer for a period of time. The period of time is typically  
 210 expressed in numbers of years. The exact terms of the limited warranty shall be determined by the  
 211 manufacturer.  
 212

213 **Note:** One of EPA's Guiding Principles is that product performance is maintained or enhanced with greater  
 214 efficiencies. As new, more efficient technologies are introduced, consumers need to be assured that  
 215 ENERGY STAR qualified furnaces will be able to perform at the same level as their standard counterparts.  
 216 The warranty requirement above helps to provide this assurance while allowing manufacturers the  
 217 flexibility to determine the appropriate length of that warranty based on their individual business principles.  
 218 There are several ENERGY STAR product specifications that include warranty requirements. Therefore,  
 219 EPA has decided to retain this requirement.

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 221 **5) Test Requirements:**  
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- 223 A. One of the following sampling plans shall be used to test for qualification to ENERGY STAR:  
 224 1) A representative unit shall be selected for testing based on the definition for Basic Model  
 225 provided in Section 1. above; or  
 226 2) Units shall be selected for testing per the sampling requirements defined in 10 CFR 429,  
 227 Subpart B.

228 **Note:** For purposes of harmonizing with the U.S. Department of Energy (DOE) minimum standards, the  
 229 option has been added of sampling as per DOE sampling requirements defined in 10 CFR 429 Subpart  
 230 B.

- 231 B. When testing residential furnaces, the following test methods shall be used to determine ENERGY  
 232 STAR qualification:  
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Table 2: Test Methods for ENERGY STAR Qualification	
ENERGY STAR Requirement	Test Method Reference
AFUE, e ( $E_{AE}$ , $E_F$ )	10 CFR Part 430, Appendix N
$Q_{leak}$	ANSI/ASHRAE 193-2010 (Version 4.0 only)

235 **Note:** The reference to  $Q_{leak}$  test standard, ANSI/ASHRAE Standard 193-2010 “Method of Test for  
236 Determining the Airtightness of HVAC Equipment” will now only appear in Version 4.0 of this specification.

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238 **6) Effective Date:**  
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240 The ENERGY STAR Version 3.0 Furnace specification shall take effect on **February 1, 2012**. The  
241 ENERGY STAR Version 4.0 Furnace specification shall take effect on **February 1, 2013**. To qualify for  
242 ENERGY STAR, a product model shall meet the ENERGY STAR specification in effect on its date of  
243 manufacture. The date of manufacture is specific to each unit and is the date (e.g., month and year) on  
244 which a unit is considered to be completely assembled.  
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246 **Note:** EPA proposes a new February 1, 2012 effective date based on a slight delay in completing the  
247 Version 3.0 specification.

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249 **7) Future Specification Revisions:**  
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251 EPA reserves the right to change this specification should technological and/or market changes affect its  
252 usefulness to consumers, industry, or the environment. In keeping with current policy, revisions to the  
253 specification are arrived at through stakeholder discussions. In the event of a specification revision, please  
254 note that the ENERGY STAR qualification is not automatically granted for the life of a product model.  
255

256 **Review of Energy Efficiency Requirements:** Over the next several years, EPA will monitor U.S. and  
257 Canadian markets and review AFUE,  $e$  and  $Q_{leak}$  data to determine whether the limits provided in Table 1  
258 continue to provide sufficient differentiation for the consumer. If it is determined that revisions are needed,  
259 EPA will work closely with industry stakeholders to develop appropriate new levels. EPA may consider  
260 addressing digital communications and diagnostics features within HVAC systems as these technologies  
261 are more widely introduced into the marketplace.