



# ENERGY STAR® Program Requirements Product Specification for Room Air Conditioners

## Eligibility Criteria Draft 1 Version 3.0

1 Following is the **Version 3.0** ENERGY STAR Product Specification for Room Air Conditioners. A product shall  
2 meet all of the identified criteria to earn the ENERGY STAR.

3 **Note:** For this specification development process, EPA invites stakeholders to send comments to  
4 [appliances@energystar.gov](mailto:appliances@energystar.gov) with “ENERGY STAR Room Air Conditioners First Draft Comments” in the subject  
5 line, by January 19, 2011.

6 The text boxes below describe the rationale that EPA used to propose the new program requirements, as well as  
7 specific topics for which EPA is seeking comment. EPA welcomes comments on considerations not included in  
8 the rationale. All comments may be directed to the e-mail address above.

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

- 10 A. Room Air Conditioner (RAC): A consumer product, other than a “packaged terminal air conditioner,” which  
11 is powered by single phase electric current and which is an encased assembly designed as a unit for  
12 mounting in a window or through the wall for the purpose of delivering conditioned air to an enclosed  
13 space. A RAC includes a prime source of refrigeration and may include a means for ventilating and  
14 heating.
- 15 B. Packaged Terminal Air Conditioner (PTAC): A wall sleeve and a separate unencased combination of  
16 heating and cooling assemblies specified by the builder and intended for mounting through the wall. It  
17 includes a prime source of refrigeration, separable outdoor louvers, forced ventilation, and heating  
18 availability energy.
- 19 C. Through the Wall (TTW) Air Conditioner: A RAC without louvered sides. These units may also be referred  
20 to as “built-in” units.
- 21 D. Casement-only: A RAC designed for mounting in a casement window with an encased assembly with a  
22 width of 14.8 inches or less and a height of 11.2 inches or less.
- 23 E. Casement-slider: A RAC with an encased assembly designed for mounting in a sliding or casement  
24 window with a width of 15.5 inches or less.
- 25 F. Louvered Sides: Exterior side vents on a RAC that permit air exchange by enhancing airflow over the  
26 outdoor coil.
- 27 G. Portable Air Conditioner: A single package air conditioner typically mounted on wheels for the purpose of  
28 moving the unit from place to place within a building or structure.
- 29 H. Reverse Cycle RAC: A RAC that employs a means for reversing the function of the indoor and outdoor  
30 coils such that the indoor coil becomes the refrigerator system condenser, allowing for heating of the air  
31 in the conditioned space; similarly, the outdoor coil becomes the evaporator, utilizing outdoor air as a  
32 source of heat.

41 **Note:** Comments from previous RAC specification revisions indicate that the efficiency of reverse cycle RACs in  
42 heat mode is not currently addressed in the federal test procedure. The ability to measure and communicate the  
43 expected energy savings from the heating season as well as from the cooling season is something that EPA  
44 believes may be important to this product category.

45 EPA would like to solicit stakeholder comment regarding the importance of addressing the performance of reverse  
46 cycle RACs in heating mode within this specification, as well as any supporting data (e.g., typical annual  
47 operating hours in heating mode, range of efficiencies of models currently on the market in heating mode) and the  
48 availability of industry test procedures to measure RAC heating mode performance.

- 49 I. Basic Model: Units of a given type of covered product (or class thereof) manufactured by one  
50 manufacturer and having essentially identical functional, physical, and electrical characteristics.  
51  
52 J. Energy Efficiency Ratio (EER): The ratio of cooling output (measured in BTU per hour) to electrical  
53 energy input (measured in Watts).

54 **Note:** Wherever possible, EPA has harmonized with DOE definitions. Those definitions, which have been  
55 harmonized with DOE, are:

- 56 • Room Air Conditioner (RAC)
- 57 • Packaged Terminal Air Conditioner (PTAC)
- 58 • Casement-only
- 59 • Casement-slider
- 60 • Basic Model

61 In addition to the definitions above, minor edits were made to definitions for the following:

- 62 • Reverse Cycle RAC
- 63 • Energy Efficiency Ratio

64 The Reverse Cycle RAC definition was revised to closely match the definition of “Heat Pump Room Air  
65 Conditioner / Heat Pump PTAC” from *ASHRAE 58 – Method of Testing for Rating Room Air Conditioner and*  
66 *Package Terminal Air Conditioner Heating Capacity*. The definition of Energy Efficiency Ratio was slightly  
67 modified for greater clarity.

68 The following definitions have been added to the Draft 1 Version 3.0 specification:

- 69 • Louvered Sides
- 70 • Portable Air Conditioner

71 These definitions are included to provide further clarification of ENERGY STAR criteria and to help identify which  
72 products are eligible for inclusion in the program and which are not. The Portable Air Conditioner definition was  
73 taken from *CSA C370-09 – Cooling Performance of Portable Air Conditioners*. A generic industry definition for  
74 Louvered Sides was not found, so a new definition was drafted for stakeholder review.

75 EPA requests comments on any of the definitions above.

## 76 2) Scope:

- 77  
78 A. Included Products: Products that meet the definition of a room air conditioner as specified herein are  
79 eligible for ENERGY STAR qualification, with the exception of those products listed in 2.B.  
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B. Excluded Products: PTACs, portable air conditioners, and models with electric resistance heat as the primary heat source are not eligible for ENERGY STAR qualification under this specification.

**Note:** EPA has revised the list of excluded products to clarify that only those products with electric resistance heat as the primary heat source are excluded. EPA requests feedback on this modification.

**3) Qualification Criteria:**

A. Energy Efficiency Requirements:

Table 1: Units Without Reverse Cycle		
Capacity (BTU/hour)	ENERGY STAR EER (with louvered sides)	ENERGY STAR EER (without louvered sides)
< 6,000	≥ 11.2	≥ 10.4
6,000 to 7,999		
8,000 to 13,999	≥ 11.3	≥ 9.8
14,000 to 19,999	≥ 11.2	
≥ 20,000	≥ 9.8	

Table 2: Units With Reverse Cycle		
Capacity (BTU/hour)	ENERGY STAR EER (with louvered sides)	ENERGY STAR EER (without louvered sides)
< 14,000		≥ 9.8
≥ 14,000		≥ 9.2
< 20,000	≥ 10.4	
≥ 20,000	≥ 9.8	

Table 3: Casement Units	
Casement Type	ENERGY STAR EER
Casement-Only	≥ 10.0
Casement-Slider	≥ 10.9

**Note:** The primary objective of the ENERGY STAR Room Air Conditioner Program is to recognize the most energy efficient products in the marketplace. In developing a specification, EPA considers the following Guiding Principles:

- Significant energy and/or water savings can be realized on a national basis;
- Product performance is maintained or enhanced with increased efficiency;
- Purchase of high efficiency product will be cost-effective;
- Energy and/or water efficiency can be achieved through several technology options; at least one of which is non-proprietary;
- Product energy and/or water consumption and performance can be measured and verified with testing;
- Labeling would effectively differentiate products and be visible for purchasers.

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The current ENERGY STAR criteria for most RACs were last updated in 2001. However, the ENERGY STAR RAC program has been expanded twice; first in 2003, to include through-the-wall and casement RACs, and then in 2005, to include RAC models with reverse cycle heating. EPA estimates that shipment-weighted market share for ENERGY STAR qualified RACs was 36 percent in 2009.

The proposed ENERGY STAR EER requirements in this draft specification are approximately 4% to 6% more stringent than the current ENERGY STAR EER requirements. The proposed criteria levels represent an increase from 10% more efficient than the current federal standard to 15% more efficient than the current federal standard, and harmonize with current CEE Tier 1 RAC requirements.

Five out of 15 manufacturers with products on the current ENERGY STAR Qualified Product List offer at least one product model that meets the proposed ENERGY STAR Version 3.0 requirements. While at present, only a small percentage of RACs currently on the market meet the proposed EER levels, EPA anticipates that proposed updates to RAC minimum efficiency standards will promote an increase in the number of available models that meet the proposed requirements. In proposing more stringent EER requirements, EPA also recognizes the opportunity for manufacturers to better leverage existing technologies and design options, such as:

- Improved heat exchangers
- More efficient compressors
- Improved expansion devices
- Increased fan and blower efficiency

In addition, EPA anticipates that the price premium associated with products meeting these requirements will generally be offset by energy bill savings in a reasonable time. EPA bases this judgment in part on cost information collected by the U.S. Department of Energy (DOE) and published in an April 2010 Preliminary Technical Support Document for RACs.

**B. Significant Digits and Rounding:**

- a. All calculations shall be carried out with actual measured or observed values. Only the final result of a calculation shall be rounded. Calculated results shall be rounded to the nearest 0.1 BTU per watt-hour.
- b. Unless otherwise specified, compliance with specification limit shall be evaluated using exact values without any benefit from rounding.

**Note:** Model numbers used for ENERGY STAR qualified products shall follow FTC and DOE guidelines.

**4) Test Requirements:**

- A. A representative unit shall be selected for testing based on the definition for Basic Model provided in Section 1, above.
- B. When testing room air conditioners, the following test methods shall be used to determine ENERGY STAR qualification:

Table 4: Test Methods for ENERGY STAR Qualification	
ENERGY STAR Requirement	Test Method Reference
EER	10 CFR 430, Subpart B, Appendix F

142 **Note:** EPA is considering amending the test requirement expressed in Section 4.A to harmonize with DOE's  
143 sampling requirements that manufacturers use to certify that each RAC basic model meets the applicable energy  
144 conservation standard. The DOE sampling requirements are contained in 10 Code of Federal Regulations (CFR)  
145 430.63 (subpart F), which references 10 CFR 430.24. EPA requests stakeholder feedback on whether ENERGY  
146 STAR should harmonize with DOE's sampling requirement for certification by referencing the applicable sections  
147 of the CFR.

148 **5) Effective Date:** The ENERGY STAR Room Air Conditioner specification shall take effect on [TBD]. To qualify  
149 for ENERGY STAR, a product model shall meet the ENERGY STAR specification in effect on the model's  
150 date of manufacture. The date of manufacture is specific to each unit and is the date (e.g., month and year)  
151 on which a unit is considered to be completely assembled.

152 **Note:** Under EPA's anticipated schedule for the RAC specification revision, a final version of the specification  
153 would be published in May 2011 to be effective 9 months later (in approximately February 2012), in time for the  
154 2012 cooling season.

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

160 **Note:** In 2014, new federal minimum efficiency standards for RACs are scheduled to take effect in the United  
161 States. With this in mind, EPA would like to solicit feedback on whether there are additional opportunities for  
162 energy savings and emission reductions through RACs that should be investigated and, if so, what steps would  
163 need to be taken to realize these opportunities.

164 Some items that have come under discussion include:

165 **Fan-Only Mode:** The DOE's active mode test procedure addresses only full-load performance; it does not  
166 address RAC operation in fan-only mode. EPA is therefore soliciting comment on how fan-only mode is used and  
167 whether there is any energy savings opportunity associated with addressing fan-only mode in the next ENERGY  
168 STAR RAC specification.

170 **Thermal Bridging and Air Infiltration:** EPA is interested in feedback on potential savings opportunities related to  
171 reduction of RAC thermal bridging and air infiltration. Thermal bridging occurs when insulating material is  
172 "bridged" by a conductive material; for example by a RAC with a metallic chassis that extends from the exterior to  
173 the interior of the home. The RAC forms a thermal bridge that conducts heat from the home in the wintertime and  
174 into the home in the summertime. Energy losses can also occur as a result of air infiltration through or around the  
175 RAC.

177 **"Smart Appliances":** EPA has noted there may be "Smart Appliance" opportunities for RACs, such as:

- 179 - Participation in utility demand response (DR) programs;
- 180 - Communication with Energy Management Systems (EMS), including monitoring and self-reporting of room  
181 temperature, energy consumption, run times, and other parameters;
- 182 - Time of Use (TOU) pricing awareness, including optional automatic response to minimums operation in periods  
183 of high pricing

185 EPA is considering a requirement that RACs be user-upgradable to support Smart Grid / EMS communications  
186 capability, and is interested in understanding the associated energy savings and carbon emissions reduction  
187 potential. EPA seeks stakeholder feedback on the incremental cost associated with this upgradeability as well as  
188 the associated energy penalty from the communications transceiver and other added electronics.

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**Micro-channel Heat Exchangers:** EPA has noted that micro-channel heat exchangers may enable RAC EER improvements without the need to increase chassis size. However, initial data from the DOE TSD indicates that the savings from this technology may not currently outweigh the added cost.

**Refrigerant Environmental Impact:** EPA is aware that many refrigerants, including those used in RACs, are powerful greenhouse gases. Refrigerant R-410A has a global warming potential of 2,088.<sup>1</sup> R-410A became the dominate refrigerant used in U.S. after the 2010 HCFC ban on import and manufacture of products containing HCFC-22 and HCFC-142b, ozone-depleting refrigerants that also have high global warming potential, With an average refrigerant charge of 0.5-0.7 kg per unit, the refrigerant used in average window air conditioners is equal to 1-1.5 metric tons of CO<sub>2</sub> per unit. EPA is aware that developments are rapidly taking place in this field, with low global warming potential alternative refrigerants being developed and tested. Additionally, EPA is aware that technologies and best practices exist to reduce necessary refrigerant charge size, minimize refrigerant leakage/emissions, and recover refrigerant at end of life. EPA seeks comment on technologies, best practices, and alternatives that might be incorporated into ENERGY STAR specifications to reduce the refrigerant-related climate impacts of room air conditioners

EPA is interested in stakeholder comment on the viability of any of these technologies or other emerging technologies that may offer future efficiency gains and emissions reductions.

<sup>1</sup> Source: U.S. Environmental Protection Agency. (October 2010) *Transitioning to Low-GWP Alternatives in Unitary Air Conditioning. Fact sheet. Document Number EPA-430-F-10-044. U.S. Environmental Protection Agency: Washington, DC.*