ENERGY STAR® Program Requirements
Product Specification for Room Air Conditioners

Eligibility Criteria
Draft 2 Version 3.0

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

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

A. Room Air Conditioner (RAC): A consumer product, other than a "packaged terminal air conditioner," which is powered by a single phase electric current and which is an encased assembly designed as a unit for mounting in a window or through the wall for the purpose of providing delivery of conditioned air to an enclosed space. It includes a prime source of refrigeration and may include a means for ventilating and heating.

a. Casement-only: A RAC designed for mounting in a casement window with an encased assembly with a width of 14.8 inches or less and a height of 11.2 inches or less.

b. Casement-slider: A RAC with an encased assembly designed for mounting in a sliding or casement window with a width of 15.5 inches or less.

c. Reverse Cycle: A RAC that employs a means for reversing the function of the indoor and outdoor coils such that the indoor coil becomes the refrigerating system condenser, allowing for heating of the air in the conditioned space; similarly, the outdoor coil becomes the evaporator, utilizing outdoor air as a source of heat.

d. Through the Wall (TTW): A RAC without louvered sides. These units may also be referred to as "built-in" units.

Note: Per stakeholder feedback, the wording of the definition for Room Air Conditioner has been changed to match the DOE definition. Similarly, the wording of the definition of Reverse Cycle has been changed to exactly match the definition in ASHRAE 58 – *Method of Testing for Rating Room Air Conditioner and Package Terminal Air Conditioner Heating Capacity*.

B. Basic Model: All units of a given type of 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 consumption, energy efficiency, water consumption, or water efficiency.

Note: On March 7, 2011, DOE clarified its interpretation of the Basic Model definition (Federal Register Vol. 76, No. 44, page 12429). To harmonize, EPA has amended the above definition for Basic Model to be consistent with 10 CFR 430.2. For further explanation on the Basic Model definition, please refer to DOE's final rule.[1]

C. Energy Efficiency Ratio (EER): The ratio of cooling output (measured in BTU per hour) to electrical energy input (measured in Watts).

D. Louvered Sides: Exterior side vents on a RAC enclosure to facilitate airflow over the outdoor coil.

[1] DOE Final Rule available at:
http://www1.eere.energy.gov/buildings/appliance_standards/pdfs/cce_finalrule_notice.pdf

E. Packaged Terminal Air Conditioner (PTAC): A wall sleeve and a separate unencased combination of heating and cooling assemblies specified by the builder and intended for mounting through the wall. It includes a prime source of refrigeration, separable outdoor louvers, forced ventilation, and heating availability energy.

F. Portable Air Conditioner: A single package air conditioner typically mounted on wheels for the purpose of moving the unit from place to place within a building or structure.

G. Energy Management System (EMS): A group of interconnected devices, integrated into a system designed to schedule, control, and monitor energy usage within a single dwelling. An EMS may act as a gateway for interconnection with the Smart Grid and/or web based energy management applications and provides enhanced usability including web and mobile device remote access.

Note: In support of the new, proposed communication requirements in Section 4 of this specification, a definition for Energy Management System (EMS) has been added. This definition has been adapted from the draft ENERGY STAR Residential Climate Controls specification and has undergone several rounds of stakeholder review during that specification development process.

2) **Scope:**

A. Included Products: Products that meet the definition of a Room Air Conditioner as specified herein are eligible for ENERGY STAR qualification, with the exception of those products listed in Section 2.B.

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. Products that are covered under other ENERGY STAR product specifications are not eligible for qualification under this specification.

3) **Core Qualification Criteria:**

A. Energy Efficiency Ratio:

Table 1: Units Without Reverse Cycle

Capacity (BTU/hour)	EER (units with louvered sides)	EER (units without louvered sides)
< 6,000	≥ 11.2	≥ 10.4
6,000 to 7,999		
8,000 to 10,999	≥ 11.3	≥ 9.8
11,000 to 13,999		
14,000 to 19,999	≥ 11.2	
20,000 to 27,999	≥ 9.8	
≥ 28,000		

Table 2: Units With Reverse Cycle

Capacity (BTU/hour)	EER (units with louvered sides)	EER (units 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	EER
Casement-Only	≥ 10.0
Casement-Slider	≥ 10.9

Note: No changes have been made to the proposed Version 3.0 ENERGY STAR EER criteria reflected in Draft 1. In advance of new minimum efficiency standards, anticipated to be effective in 2014,[2] EPA intends to assess the Version 3.0 ENERGY STAR criteria to determine if a specification revision is warranted. EPA welcomes stakeholder input on the feasibility and cost-effectiveness of technology options necessary to achieve future improvements in RAC.

B. Energy Saver Mode:

"Energy Saver Mode" shall be the default operating mode. In this mode, fan operation shall occur only in conjunction with compressor operation, with the following exceptions:

a. The fan may continue to run for a period not exceeding 5 minutes, after the compressor is switched off.

b. The fan may be cycled on for up to 60 seconds at a period of 5 minutes or greater to facilitate accurate control of room temperature.

C. Filter Reminder:

The product shall provide visual notification recommending the filter be checked, cleaned or replaced, as applicable. The filter reminder may be based on operating hours, sensing technology, or other means.

Note: In order to increase consumer benefits from the ENERGY STAR RAC program, EPA is proposing to add requirements for turning the "Energy Saver Mode" into the default setting and including a filter reminder in all ENERGY STAR models. Compliance with requirements 3.B and 3.C will be verified by observation or examination of product documentation.

[2] See DOE Direct Final Rule, published April 21, 2011 (Federal Register Vol. 76, No. 77, page 22454). Available at: http://edocket.access.gpo.gov/2011/pdf/2011-9040.pdf

EPA believes that a large percentage of RACs on the current ENERGY STAR qualified product list offer an "Energy Saver Mode," though this mode is typically not the product's default operating mode. By requiring this mode to be enabled by default, EPA expects that consumers will be able to save between 3 and 17 dollars per year on their utility bills, depending on the size of the RAC. These savings are in addition to the savings generated from EER improvements. Given the prevalence of an energy saver mode in the market today, EPA anticipates minimal incremental costs to implement the new requirements.

Research on manufacturer websites indicates that a large number of RACs do not currently include an air filter reminder. Sources indicate that the efficiency loss from a clogged filter is likely between 1 and 5 percent.[3] EPA estimates that the inclusion of an air filter reminder will increase the number of consumers that check and/or clean their filter regularly, for a minimal cost. Stakeholder feedback indicates that the inclusion of a simple air filter reminder would add as little as 15 cents to the total price of a RAC unit. The estimated savings per unit per year from including this function is roughly $3 or less, depending on the size of the unit. For a consumer that utilizes this function, this would equate to a payback period of less than one year, regardless of the size of the unit. These savings would be in addition to the savings generated from EER improvements and setting the "Energy Saver Mode" as the default mode.

EPA believes that by including these two features as requirements, consumers will be able to obtain additional savings at negligible cost. Further details will be shared during the Draft 2 webinar. EPA encourages stakeholder comment on both proposals.

D. Significant Digits and Rounding:

a. All calculations shall be carried out with directly measured (unrounded) values.

b. Unless otherwise specified, 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.

E. Model Numbers: Model numbers used for ENERGY STAR qualified product submissions shall be consistent with Federal Trade Commission (FTC) and Department of Energy (DOE) submissions.

4) **Optional Criteria for Smart Grid Capable Designation:**

The following criteria shall be met for a RAC to be categorized as Smart Grid Capable on the Qualified Products List (QPL):

[3] According to the Consumer Energy Center, clean air conditioner filters can help save 1-2 percent of energy costs. (http://appliancehelp.com/resources/Air-Conditioning-Filters-Guide.aspx). Cleaning a dirty air conditioner filter can save 5% of energy used according to Power Scorecard (http://www.powerscorecard.org/reduce_energy.cfm).

Note: Consistent with the principle of enhanced consumer value and in response to the Smart Appliance petition EPA received from a joint coalition of industry and efficiency advocate stakeholders,[4] EPA is evaluating how to best address and encourage smart grid functionality in ENERGY STAR specifications. In the near term, EPA is proposing to offer recognition of ENERGY STAR products that are Smart Grid Capable, through the information provided on our Qualified Product List (QPL). In order to take advantage of this opportunity, ENERGY STAR RAC models would need to meet certain criteria contained in Section 4. EPA envisions that when such products are brought to market, RACs and other appliances recognized as Smart Grid Capable may qualify for rebates or other means to incentivize consumer adoption. By defining and highlighting these capabilities, EPA intends to create a level playing field, raise awareness, and serve as a tool for utilities and consumers. EPA seeks feedback from stakeholders on this approach. Specifically, will EPA's proposed approach of establishing criteria for products that offer smart grid functionality help ensure consumers that purchase such devices are receiving a base level of value? Will doing so help stimulate market introduction and consumer adoption of RACs with communications and demand response functionality, through consumer incentives?

EPA's proposed criteria embraces the stakeholders' definition of a smart RAC as one that has, at a minimum, the capability to receive, interpret and act upon demand response signals, and enhances it with criteria that EPA sees as offering near term consumer benefit. In particular, EPA believes that RACs with bi-directional communications capability between the RAC and the home EMS, or other external devices, systems or applications, could provide additional value to consumers through remote management and energy consumption reporting. This connectivity can enable new tools and services that help consumers better understand and manage their RAC energy use and/or services that help remotely manage the RAC in order to deliver customer savings automatically. EPA is interested in stakeholder feedback on other features and functionality that could be enabled through enhanced RAC communications capabilities.

EPA notes that stakeholders have asked the Agency to consider a 5% credit to the ENERGY STAR energy performance level for smart grid enabled appliances that can provide demand response. The proposed credit is designed to drive production and market adoption of such appliances. EPA notes there is precedence in the ENERGY STAR program for incorporating energy allowances (aka "adders") to accommodate certain features or functionality of interest to consumers, as well as targeted incentives to encourage the adoption of energy saving features that provide benefit to consumers. To support EPA's consideration of an incentive, EPA encourages stakeholders to provide further input on the functionalities of interest, the consumer benefit associated with each, how such benefits should be measured and verified, and any price differential for a product with such functionalities.

A. Communication Requirements:

a. To enable integration with the Smart Grid, with Energy Management Systems (EMS), and/or with other external devices, systems or applications; the product shall either:

i. Include secure bi-directional communications capability, or

ii. Be end-user field upgradeable to add secure bi-directional communications capability by installation of a communication module. Note that it is not required for compatible communication modules to be available at product launch. Manufacturers are free to offer communications modules at a later date, for example when warranted by market conditions.

b. An Interface Specification or Interface Control Document (ICD), as appropriate, shall be available to 3rd party developers to enable open access to the product's full range of communication and remote control capabilities.

[4] Agreement on Minimum Federal Efficiency Standards, Smart Appliances, Federal Incentives and Related Matters for Specified Appliances. Accessible at: http://www.aham.org/ht/a/GetDocumentAction/i/49956.

c. If additional modules, devices and/or infrastructure are needed to activate the product's communications capabilities, prominent labels and instructions shall be displayed at the point of purchase on a product tag that ships with the product and in the product literature. These labels shall provide specific information on what consumers or utilities must do to activate these capabilities (e.g. "*This product requires installation of a network module compatible with the utility smart meter, energy management gateway or other communication device for interconnection with the Smart Grid, Energy Management System, and/or with other external devices, systems or applications."*)

d. Communications shall include:

   i. Basic authentication and authorization so that only authorized devices or software applications can access the product, and

   ii. Security measures to protect against unauthorized access.

e. The product shall be capable of recording the following data at least once every 60 seconds and transmitting it at least once every 5 minutes, upon request from a connected device:
   - Unique ID
   - Room temperature in °F or °C (0.1 °F or °C resolution)
   - Active cool, Active heat (Reverse-Cycle units only) setpoints in °F or °C
   - Energy Saver mode setting: (Off, On)
   - HVAC mode setting (Off, Heat (Reverse-Cycle units only), Cool, Auto (if applicable))
   - Active HVAC mode (Off, Heat (Reverse-Cycle units only), Cool)
   - Fan mode setting (Off, Low, High)
   - Active fan mode (Off, Low, High)
   - Energy consumption data in 15 min intervals in kWh (minimum accuracy ±10%)

f. The product shall be capable of accepting remote control commands from authorized devices or software applications to enable near-real time (within 0.5 seconds after receiving the command) settings changes to the following, at any point in time:
   - Time synchronization
   - Active cool, Active heat (Reverse-Cycle units only), setpoints in °F or °C
   - Energy Saver mode setting (Off, On)
   - HVAC mode setting (Off, Heat (Reverse-Cycle units only), Cool, Auto (if applicable))
   - Fan mode setting (Off, Low, High)

   The product is not required to respond to remote control commands that are potentially damaging to the product, for example frequent cycling of the compressor.

Note: EPA has encouraged the implementation of "intelligent" energy-saving features and functions for qualified products since its inception. In order to continue this effort in RACs and ensure that consumers receive the most value from the ENERGY STAR brand, EPA is proposing a limited set of bi-directional communications criteria in Section 4A for RACs to meet in order to be categorized as an ENERGY STAR qualified product that is Smart Grid Capable. RACs meeting these optional criteria will enable enhanced energy awareness and other tools to help consumers better understand and manage their RAC energy use. The above requirements are intended to both facilitate enhanced energy management through responsive remote control and secure transmission of data relevant to residential energy management and enable smart grid demand response capabilities.

EPA believes ENERGY STAR products should be future-oriented and flexible. EPA has proposed that RACs sold with either built-in or modular communications be eligible for designation and that products with modular communications may be sold without communication modules though end users must be able to add such modules, when appropriate. This requirement is intended to provide flexibility to stakeholders and consumers. Modular communications capability will allow communications modules to be purchased and installed when suitable communication protocols are released or when related smart grid and/or EMS infrastructure is in place. Modules may be changed or upgraded in order to interoperate with future devices, while built-in communications may be provided at a lower cost.

The proposed bi-directional communication criteria are intended to ensure secure authorized 3rd party access, allow qualification of products with either built-in or upgradeable communications, encourage interoperability, and inform consumers how to activate the product's communication capabilities. EPA believes open access and interoperability are important for products that are smart grid capable, and to this end, has proposed that a manufacturer must publish an Interface Specification or ICD so RACs categorized by ENEGY STAR as Smart Grid Capable can be interoperable with 3rd party devices and applications.

EPA notes that DOE, to the extent necessary, will be developing test procedures for smart grid capable appliances for the ENERGY STAR program, including RACs. EPA and DOE representatives participated in an Association for Home Appliance Manufacturers (AHAM) led meeting to discuss AHAM's smart grid capable appliance test procedure development efforts. For purposes of an optional designation of RAC products with smart grid capabilities, EPA proposes that requirement 4A could be verified by observation or examination of product documentation.

B. Delay Load Capability:

RACs shall include a consumer-overrideable capability to respond to a signal requesting a delay of load for a time duration not exceeding either 4 hours or such other period that the consumer may select. Upon receipt of this signal, the product must automatically reduce its average wattage during this period by at least 25 percent relative to average wattage in the operating cycle under the DOE test conditions.

C. Spinning Reserve Capability:

RACs shall include a consumer-overrideable capability to respond to a signal requesting the start of a reduced load period for a time duration not exceeding 10 minutes. Upon receipt of this signal, the product must automatically reduce its average wattage during this period by at least 80 percent relative to average wattage in the operating cycle under the DOE test conditions.

Note: The proposed requirements for Delay Load Capability and Spinning Reserve Capability are based upon the Joint Petition presented by AHAM and efficiency organizations to EPA (see footnote 2). Such signals could be sent from a utility, third party energy service provider, home energy management system (EMS), or other device or application.

EPA has received comments from stakeholders indicating concern that the 25 percent average wattage reduction for the Delay Load Capability may be too aggressive with the potential for consumer dissatisfaction with the product. EPA requests further comment to determine the extent that this is a concern and what steps could be taken to mitigate this concern.

EPA proposes that for purposes of an optional designation as Smart Grid Capable, requirements 4B and 4C could be verified by observation or examination of product documentation.

D. Date and Time:

When integrated with external devices, applications or systems that provide date and time synchronization, the product shall maintain the correct date & time without user input. The minimum timekeeping accuracy shall be of ±0.5s per 24-hour period.

Note: Communication with HEMS and/or the Smart Grid requires data to be time-stamped and responses to external signals to be scheduled. Therefore, maintenance of the correct date and time is critical. The above requirement does not require display of date and time. Accuracy requirements are consistent with that of Quartz timekeeping. For purposes of an optional designation as Smart Grid Capable, requirement D could be verified by examination of product documentation.

5) **Test Requirements:**

A. One of the following sampling plans shall be used to test for qualification to ENERGY STAR:

a. A representative unit shall be selected for testing based on the definition for Basic Model provided in Section 1. above; or

b. Units shall be selected for EER testing per the sampling requirements defined in 10 CFR 429.15, which references 10 CFR 429.11.

Note: In response to stakeholder feedback and consistent with other appliance specification revision efforts, EPA has made explicit reference to the latest DOE sampling procedures (found in the March 7, 2011 Federal Register Vol. 76, No. 44, on page 12456) for purposes of qualification testing. This added language formalized the current practice, to allow manufacturers the option to demonstrate qualification based on a single test or leverage testing performed for purposes of minimum efficiency standards.

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

6) **Effective Date:** The ENERGY STAR Room Air Conditioner specification shall take effect on October 1, 2012. To qualify 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 (e.g., month and year) on which a unit is considered to be completely assembled.

Note: EPA has modified the effective date for the Version 3.0 specification to October 1, 2012 in response to stakeholder feedback and in recognition of the unique market cycle for this product.

7) **Future Specification Revisions:** EPA reserves the right to change the criteria 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 ENERGY STAR qualification is not automatically granted for the life of a product model.