



ENERGY STAR® Program Requirements Product Specification for Room Air Conditioners

Eligibility Criteria Version 4.2

Following is the **Version 4.2** 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. Where noted below, definitions are identical to the definitions in the U.S Department of Energy (DOE) test procedure at 10 Code of Federal Regulations (CFR) 430, Subpart B, Appendix F or in 10 CFR 430.2. The definitions from the CFR have been reprinted for ease of use, however, the CFR definitions take precedence and may be modified by DOE during the rulemaking process.
 - A. **Room Air Conditioner (RAC)**¹: 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.
 1. **Casement-only**¹: 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.
 2. **Casement-slider**¹: A RAC with an encased assembly designed for mounting in a sliding or casement window with a width of 15.5 inches or less.
 3. **Reverse Cycle**²: 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.
 4. **Through the Wall (TTW)**: A RAC without louvered sides. These units may also be referred to as “built-in” units.
 5. **Electromechanical**: A RAC that measures room temperature with a thermostat that undergoes a physical change (dimensional, phase change, etc.) relative to temperature, and utilizes mechanical rotary, switch, or similar user controls for cooling output, fan speed, desired temperature, or other features.
 - B. **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 consumption, energy efficiency, water consumption, or water efficiency.
 - C. **Tested Basic Connected Model (TBCM)**: A basic model that has been tested to validate it meets Demand Response criteria in section 4.G.
 - D. **Alternative Demand Response Validation (ADRV)**: A set of parameters developed by the manufacturer that predict a basic model’s ability to meet the demand response portion of the connected criteria.
 - E. **Combined Energy Efficiency Ratio (CEER)**: The energy efficiency of a room air conditioner as measured in accordance with the test procedure at 10 CFR 430, Subpart B, Appendix F or, a DOE-approved test procedure waiver pursuant to 10 CFR Part 430.27 expressed in units of BTU per watt-hour (BTU/Wh).
 - F. **Ethylene Propylene Diene Monomer (EPDM)**: A closed-cell rubber that is used for outdoor gasketing and/or heating, ventilating, and air conditioning applications.
 - G. **Louvered Sides**: Exterior side vents on a RAC enclosure to facilitate airflow over the outdoor coil.

- H. Packaged Terminal Air Conditioner (PTAC)¹: 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.
- I. Portable Air Conditioner³: A portable encased assembly, other than a “packaged terminal air conditioner,” “room air conditioner,” or “dehumidifier,” that delivers cooled, conditioned air to an enclosed space, and is powered by single-phase electric current. It includes a source of refrigeration and may include additional means for air circulation and heating.
- J. Represented Value: The represented value is determined pursuant to 10 CFR Part 429, Subpart B § 429.15 and is the identical value certified to DOE, listed on the ENERGY STAR QPL, and shown on consumer facing materials.

2) Scope:

- A. Included Products: Products that meet the definition of a room air conditioner as specified herein are eligible for ENERGY STAR certification, with the exception of those products listed in Section 2.B.
- B. Excluded Products: PTACs, portable air conditioners, and room air conditioner models with electric resistance heat as the primary heat source are not eligible for ENERGY STAR certification under this specification. Products that are covered under other ENERGY STAR product specifications, e.g., dehumidifiers, are not eligible for certification under this specification.

3) Certification Criteria:

- A. Combined Energy Efficiency Ratio (CEER): CEER shall be greater than or equal to the Minimum CEER ($CEER_{MIN}$) as calculated per Equation 1.

Equation 1. Calculation of Minimum CEER

$$CEER_{MIN} = CEER_{BASE} - CEER_{Adder_Connected}$$

where,

$CEER_{BASE}$ is the value provided in Table 1, 2 or 3 below, depending on product type

$CEER_{Adder_Connected}$ is the CEER connected allowance derived using the calculation provided in Table 4, below

¹ 10 CFR 430, Subpart A, Section 430.2

² Derived from ASHRAE 58 – Method of Testing for Rating Room Air Conditioner and Package Terminal Air Conditioner Heating Capacity

³ 10 CFR 430.2

Table 1: Units Without Reverse Cycle

Capacity (BTU/Wh)	CEER _{BASE} (units with louvered sides)	CEER _{BASE} (units without louvered sides)
< 6,000	12.1	11.0
6,000 to 7,999		
8,000 to 10,999	12.0	10.6
11,000 to 13,999		10.5
14,000 to 19,999	11.8	10.2
20,000 to 27,999	10.3	10.3
≥ 28,000	9.9	

Table 2: Units With Reverse Cycle

Capacity (BTU/Wh)	CEER _{BASE} (units with louvered sides)	CEER _{BASE} (units without louvered sides)
< 14,000		10.2
≥ 14,000		9.6
< 20,000	10.8	
≥ 20,000	10.2	

Table 3: Casement Units

Casement Type	CEER _{BASE}
Casement-Only	10.5
Casement-Slider	11.4

Table 4: Connected Allowance

Product Type	CEER _{Adder_Connected} **
All RAC types covered in Tables 1, 2 and 3*	0.05 x CEER _{BASE}

* Product must be certified using the ENERGY STAR Test Method for Room Air Conditioners to Validate Demand Response (June 2017) to use the allowance.

** Calculated allowance shall be rounded down to the nearest tenth before being applied in Equation 1.

B. Energy Saver Mode:

1. Product shall have an “Energy Saver Mode,” which may be consumer override-able. 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. After the above period, when the compressor is off, the fan may be cycled on for up to 17% of the total compressor off cycle time to facilitate accurate control of room temperature. For example, the fan may run for 1 minute then cycle off for at least 5 minutes or the fan may run for 2 minutes then cycle off for at least 10 minutes. Manufacturers may use other fan run durations, but fan run time shall not exceed 17% of total cycle time

- c. Through the Wall RACs, as defined in Section 1 may include an installer accessible setting that disables Energy Saver Mode functionality. The setting may be accessible from the product's controls or may use a physical switch, jumper or the like. Appropriate measures shall be taken to ensure that the setting is implemented as an installer setting not intended to be consumer accessible. For example, physical switches or jumpers shall require the use of tool(s), removal of a panel, or the like; settings accessible in the product's controls shall require a unique sequence of button presses, shall be in a hidden menu, shall require an installer password, or the like.
2. Products, excepting electromechanical RACs as defined in Section 1, shall ship with Energy Saver Mode enabled as the default setting.
 3. Products, excepting electromechanical RACs as defined in Section 1, shall default to Energy Saver Mode each time the unit is switched on. However, products are not required to default to Energy Saver Mode upon restoration of power after an electrical power outage that results in a loss of power to the unit.
- C. Filter Reminder:
1. Products, excepting electromechanical RACs as defined in Section 1, shall have a filter reminder that provides 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.
 2. TTW RACs, as defined in Section 1, may include an installer accessible setting that disables Filter Reminder functionality. The setting may be accessible from the product's controls or may use a physical switch, jumper or the like. Appropriate measures shall be taken to ensure that the setting is implemented as an installer setting not intended to be consumer accessible. For example, physical switches or jumpers shall require the use of tool(s), removal of a panel, or the like; settings accessible in the product's controls shall require a unique sequence of button presses, shall be in a hidden menu, shall require an installer password, or the like.
- D. Installation Requirements:
1. *Installation Materials (window units only):* Room air conditioners intended for window installations shall be shipped with weather stripping and/or gasket materials appropriate for all intended applications, including the window size(s) the unit is typically used for, when installed according to provided instructions. The materials shall minimize air leaks (seal) between the room air conditioner and the window opening, including the area between the room air conditioner and the window sash, and the area between the room air conditioner and the windowsill (if bottom-mounted) or the window head (if top-mounted). The materials shall also seal gaps between fixed and movable window sashes. Acceptable weather stripping or gasket material includes, but is not limited to, vinyl clad foam, EPDM cellular rubber, silicone rubber, or comparable alternatives that resist air and water infiltration as well as degradation due to ultraviolet (UV) radiation exposure. Room air conditioner side curtains must be tight fitting to minimize air leaks and contain insulation in the panel with a minimum insulation value of R1 as determined by the Federal Trade Commission's (FTC) Labeling and Advertising of Home Insulation regulations, 16 CFR part 460.
 2. *Installation Instructions:* Products shall ship with detailed installation documentation that includes text and, where applicable, diagrams intended to facilitate installation that minimizes air leakage and thermal losses. Instructions shall include recommendations on the proper locations to install weather stripping or gaskets and, optionally, the use of temporary tape or removable caulk to seal the unit in place. If the product is a TTW unit, instructions shall also include a recommendation that the consumer install an appropriately sized cover, to include recommended specifications that facilitate satisfactory fit, when the RAC is not in use to provide additional insulation and air sealing.

- E. Model Numbers: Model numbers used for ENERGY STAR certified product submissions shall be consistent with FTC (as specified in 16 CFR 305) and DOE (as specified in 10 CFR 429.15(b)) submissions.

4) Connected Product Criteria:

The following optional connected criteria are applicable to Included Products, Section 2.A., that meet the definition of a room air conditioner.

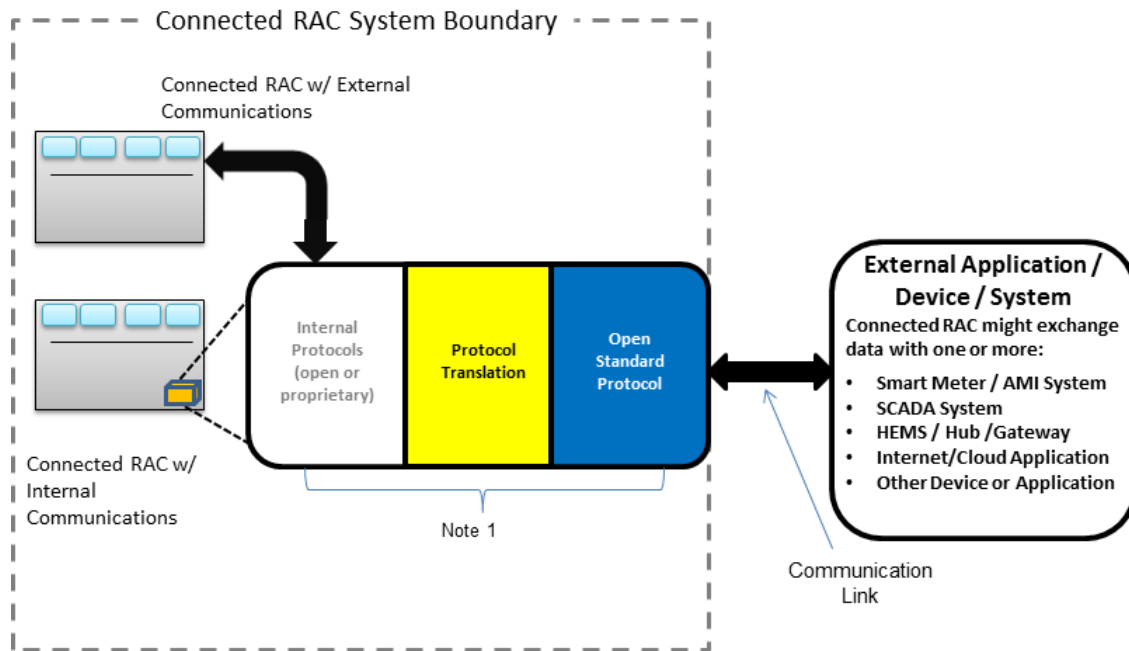
A. Connected RAC System

To be recognized as connected and to be eligible for the connected allowance, a Connected RAC System, as shown in Figure 1) shall include the appliance plus all elements (hardware, software) required to enable communications in response to consumer-authorized energy related commands (*not including third-party remote management which may be made available solely at the discretion of the manufacturer*). These elements may be resident inside or outside of the base appliance. This capability shall be supported through one or more means, as identified in Section 4.B.2.

The specific design and implementation of the Connected RAC System is at the manufacturer's discretion provided it is interoperable with other devices via open communications protocol and enables economical consumer-authorized third-party access to the functionalities provided for in Sections 4.D, 4.F and 4.G., and the capabilities shall be supported through one or more means, as identified in Section 4.B.2. A product that enables economical and direct, on-premises, open-standards based interconnection is the preferred option for meeting this requirement, but alternative approaches are also acceptable.

The product must continue to comply with the applicable product safety standards – the addition of the functionality described below shall not override existing safety protections and functions.

Figure 1. Connected RAC System Boundary – Illustrative Example



Note 1: Communication device(s), link(s) and/or processing that enables open standards-based communication between the Connected RAC System and Energy Management Device/Application(s). These elements could be within the base appliance, and/or an external communication module, a hub/gateway, or in the Internet/cloud.

B. Communications

1. Open Standards – Communication with entities outside the Connected RAC System that enables connected functionality (Sections 4.D, 4.F and 4.G) must use, for all communication

layers, standards:

- Included in the Electric Power Alliance Catalog of Standards,⁴ and/or
- Included in the NIST Smart Grid framework⁵ Tables 4.1 and 4.2, and/or
- Adopted by the American National Standards Institute (ANSI) or another well-established international standards organization such as the International Organization for Standardization (ISO), International Electrotechnical Commission (IEC), International Telecommunication Union (ITU), Institute of Electrical and Electronics Engineers (IEEE) or Internet Engineering Task Force (IETF).

Note: EPA recognizes that standardized messages to enable requisite connected functionality may not be available. In such cases, manufacturer-specific messaging is unavoidable, and is permitted by certain open standards. In cases where proprietary messaging is necessary, the Application Programming Interface (API) or similar documents must ensure open access to the connected functionalities outlined in Section 4.C.

2. Communications Hardware Architecture – Communication with entities outside the Connected RAC System that enables connected functionality (Sections 4.D through 4.G) shall be enabled by any of the following means, according to the manufacturer's preference:
 - a. Built-in communication technology
 - b. Manufacturer-specific external communication module(s) and/or device(s)
 - c. Open standards-based communication port on the appliance combined with open standards-based communications module
 - d. Open standards-based communication port(s) on the appliance in addition to a, b or c, above

If option b or c is used, the communication module/device(s) must be easy for a consumer to install and shipped with the appliance, provided to the consumer at the time of sale, or provided to the consumer in a reasonable amount of time after the sale.

C. Open Access

To enable interconnection with the product, in addition to Section 4.B.1 that requires open-standards, an interface specification, API or similar documentation shall be made available to interested parties that at a minimum, allows transmission, reception and interpretation of the following information:

- Energy Consumption Reporting specified in Section 4.D (must include accuracy, units and measurement interval);
- Operational Status, User Settings & Messages specified in Section 4.F (if transmitted via a communication link);
- Demand Response specified in Section 4.G.

⁴ http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/PMO#Catalog_of_Standards_Processes

⁵ <http://www.nist.gov/smartgrid/upload/NIST-SP-1108r3.pdf>

D. Energy Consumption Reporting

In order to enable simple, actionable energy use feedback to consumers and consumer authorized energy use reporting to third parties, the product shall be capable of transmitting energy consumption data via a communication link to energy management systems and other consumer authorized devices, services, or applications. This data shall be representative of the product's interval energy consumption. It is recommended that data be reported in watt-hours for intervals of 15 minutes or less, however, representative data may also be reported in alternate units and intervals as specified in the product manufacturer's interface specification or API detailed in Section 4.C.

The product may also provide energy use feedback to the consumer on the product itself. On-product feedback, if provided, may be in units and format chosen by the manufacturer (e.g., \$/month).

E. Remote Management

The product shall be capable of receiving and responding to consumer authorized remote requests (*not including third-party remote management which may be made available solely at the discretion of the manufacturer*), via a communication link, similar to consumer controllable functions on the product. The product is not required to respond to remote requests that would compromise performance and/or product safety as determined by the product manufacturer.

F. Operational Status, User Settings & Messages

1. The product shall be capable of providing the following information to energy management systems and other consumer authorized devices, services or applications via a communication link:
 - Operational / Demand Response (DR) status (for example: off/standby, energy saver mode, low cool, max cool, delay appliance load, temporary appliance load reduction).
2. The product shall be capable of providing the following information on the product and/or to energy management systems and other consumer authorized devices, services or applications via communication link:
 - At least two types of messages relevant to the energy consumption of the product. For example, messages for room air conditioners might address performance issues or reporting energy consumption that is outside the product's normal range.

G. Demand Response

The product shall have the capability to receive, interpret and act upon consumer-authorized signals by automatically adjusting its operation depending on both the signal's contents and settings from consumers. At a minimum, the product shall be capable of providing the following capabilities for all cycle and setting combinations, except where otherwise noted:

1. *Delay Appliance Load (DAL) Capability*: The capability of the product to respond to a signal in accordance with consumer settings, except as permitted below; by increasing the set temperature by at least 4°F for at least 4 hours.
 - a. Maximum Set Temperature – The increased set temperature shall not exceed 85°F.
 - b. Consumer override – The consumer shall be able to override the product's DAL response without limitation.
 - c. The product shall be able to provide at least one DAL response in a rolling 24-hour period.
2. *Temporary Appliance Load Reduction (TALR) Capability*: The capability of the product to respond to a signal in accordance with consumer settings, except as permitted below; by disabling compressor operation for at least 10 minutes.
 - a. Maximum Set Temperature – The product shall not respond if the set temperature is $\geq 85^{\circ}\text{F}$.

- b. Consumer override – The consumer shall be able to override the product’s TALR response without limitation.
- c. The product shall be able to provide at least three TALR responses in a rolling 24-hour period. The product is not required to provide more than one TALR response per 60-minute period.

H. Information to Consumers

If additional modules, devices, services and/or infrastructure are part of the configuration required to activate the product’s communications capabilities, prominent labels or other forms of consumer notifications with instructions shall be displayed at the point of purchase and in the product literature. These shall provide specific information on what consumers must do to activate these capabilities (e.g. *“This product has Wi-Fi capability and requires Internet connectivity and a wireless router to enable interconnection with an Energy Management System, and/or with other external devices, systems or applications.”*).

5) Test Requirements:

- A. One of the following sampling plans shall be used to test energy performance for certification to ENERGY STAR:
 - 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. Note that to determine the represented value per 10 CFR Part 429, Subpart B § 429.15, additional testing outside of ENERGY STAR is required. The represented value must also be equal to or better than the ENERGY STAR specification requirements.
 - 2. At least two units are selected, obtained and tested. The represented value is calculated from the test results according to the sampling requirements defined in 10 CFR Part 429, Subpart B § 429.15. The represented value must be equal to or better than the ENERGY STAR specification requirements.

Results of the tested unit(s) may be used to certify additional individual model variations within a Basic Model as long as the definition for Basic Model provided in Section 1, above, and in 10 CFR Part 430.2 is met.

- B. When testing room air conditioners, the following test method shall be used to determine ENERGY STAR certification:

Table 5: Test Methods for ENERGY STAR Certification

ENERGY STAR Requirement	Test Method Reference
CEER	10 CFR 430, Subpart B, Appendix F OR DOE-approved test procedure waiver pursuant to 10 CFR Part 430.27*

* DOE understands that various basic models may need a test procedure waiver to show the benefits of various operations pursuant to 10 CFR Part 430.27.

- C. Compliance with Energy Saver Mode, Filter Reminder, and Installation criteria shall be through examination of product and/or product documentation.
- D. Compliance with connected functionality requirements, as specified in Section 4, shall be demonstrated through examination of product and/or product documentation. In addition, demand response functionality shall be verified using the ENERGY STAR Test Method for Room Air Conditioners to Validate Demand Response (June 2017) in order to be eligible for the connected allowance.

- E. Compliance of a basic model with demand response functionality (section 4.G.) shall be:
1. Validated by testing using the ENERGY STAR Test Method for Room Air Conditioners to Validate Demand Response (June 2017) in order for a product to be listed as having connected functionality on the Qualified Product List, and to be eligible for any connected allowance.
- OR
2. Predicted via an Alternative Demand Response Validation (ADRV). An ADRV is developed based on the specific set of manufacturer-defined parameters from a minimum of (2) tested basic connected models (TBCMs) that have been tested according to the ENERGY STAR Test Method for Room Air Conditioners to Validate Demand Response (June 2017) and meet the demand response requirements of the connected criteria. Examples of these manufacturer-defined parameters can include, but are not limited to, hardware and software documentation, connection types and capabilities, and computer simulations. To use an ADRV for a model's certification, the manufacturer shall submit 1) test data from the relevant TBCMs, and 2) a short memo to the certifying body stating their intent to use an ADRV to meet the demand response portion of testing requirements and explaining how the TBCM test data is relevant to the model for certification.
 - i. A TBCM manufactured by an original equipment manufacturer (OEM) and sold across different brands and brand owners may be used to support an ADRV across those brands.
 - ii. Manufacturers are responsible for ensuring the accuracy and reliability of the ADRV. Models certified based on an ADRV will be subject to verification testing based on the ENERGY STAR Test Method for Room Air Conditioners to Validate Demand Response.
- F. For the purpose of ENERGY STAR certification, the performance of room air conditioners with efficient variable output shall require a test procedure waiver from DOE per 10 CFR 430.27.
- G. Significant Digits and Rounding: All calculations shall be carried out as specified in Appendix F to Subpart B of Part 430 and 10 CFR Part 430.23(f). Do not round individual test results. Rounding is specified in 10 CFR Part 429 for the represented value.
- 6) **Effective Date:** The ENERGY STAR Room Air Conditioner specification shall take effect on **October 26, 2015**. Any product model with a date of manufacture on or after this date shall meet this specification to earn the ENERGY STAR. The date of manufacture is specific to each unit and is the date on which a unit is considered completely assembled.
- 7) **Future Specification Revisions:** EPA reserves the right to change the criteria should federal requirements, 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 certification is not automatically granted for the life of a product model.