ENERGY STAR® Program Requirements
Product Specification for Room Air Conditioners

Eligibility Criteria
Draft 1 Version 4.0

Following is the Draft 1 Version 4.0 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. 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. When in conflict, the definitions in the CFR take precedence.

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.
   1. 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.
   2. 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.
   3. 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.
   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: 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. Combined Energy Efficiency Ratio (CEER): The ratio of measured annual cooling output (in BTU) to the sum of the measured average annual electrical energy input (in watt-hours) and measured annual standby/off-mode energy use (in watt-hours). CEER is expressed in BTUs per watt-hour.

D. Ethylene Propylene Diene Monomer (EPDM): A closed-cell rubber that is used for outdoor gasketing and/or heating, ventilating, and air conditioning applications.

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

F. 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.

1 10 CFR 430.2
2 Derived from ASHRAE 58 – Method of Testing for Rating Room Air Conditioner and Package Terminal Air Conditioner Heating Capacity

ENERGY STAR Program Requirements for Room Air Conditioners – Eligibility Criteria
G. 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.

**Note:** Consistent with other recent ENERGY STAR residential appliance specification revisions, EPA is incorporating a number of minor updates in this Draft 1, including: 1) clarifying the Section 1 introduction that in the case of a conflict between the definition provided in Section 1 and the definition found in the DOE CFR, the CFR definition takes precedence; 2) incorporating new footnotes with citations for definitions included in Section 1; and 3) replacing the term “qualification” with “certification” throughout the document.

EPA also removed all references to energy efficiency ratio (EER), as it will no longer be applicable to ENERGY STAR certification. Energy criteria shall be expressed using combined energy efficiency ratio (CEER).

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.

\[
CEER_{MIN} = \text{CEER}_{BASE} - \text{CEER}_{Adder\_Connected}
\]

where,

- \( \text{CEER}_{BASE} \) is the value provided in Table 1, 2 or 3 below, depending on product type
- \( \text{CEER}_{Adder\_Connected} \) is the CEER connected allowance derived using the calculation provided in Table 4, below
Table 1: Units Without Reverse Cycle

<table>
<thead>
<tr>
<th>Capacity (BTU/hour)</th>
<th>CEER&lt;sub&gt;BASE&lt;/sub&gt; (units with louvered sides)</th>
<th>CEER&lt;sub&gt;BASE&lt;/sub&gt; (units without louvered sides)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 6,000</td>
<td>12.1</td>
<td>11.0</td>
</tr>
<tr>
<td>6,000 to 7,999</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8,000 to 10,999</td>
<td>12.0</td>
<td>10.6</td>
</tr>
<tr>
<td>11,000 to 13,999</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14,000 to 19,999</td>
<td>11.8</td>
<td>10.2</td>
</tr>
<tr>
<td>20,000 to 27,999</td>
<td>10.3</td>
<td>10.3</td>
</tr>
<tr>
<td>&gt;= 28,000</td>
<td>9.9</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Units With Reverse Cycle

<table>
<thead>
<tr>
<th>Capacity (BTU/hour)</th>
<th>CEER&lt;sub&gt;BASE&lt;/sub&gt; (units with louvered sides)</th>
<th>CEER&lt;sub&gt;BASE&lt;/sub&gt; (units without louvered sides)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 14,000</td>
<td></td>
<td>10.2</td>
</tr>
<tr>
<td>&gt;= 14,000</td>
<td></td>
<td>9.6</td>
</tr>
<tr>
<td>&lt; 20,000</td>
<td>10.8</td>
<td></td>
</tr>
<tr>
<td>&gt;= 20,000</td>
<td>10.2</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Casement Units

<table>
<thead>
<tr>
<th>Casement Type</th>
<th>CEER&lt;sub&gt;BASE&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Casement-Only</td>
<td>10.5</td>
</tr>
<tr>
<td>Casement-Slider</td>
<td>11.4</td>
</tr>
</tbody>
</table>

Table 4: Connected Allowance

<table>
<thead>
<tr>
<th>Product Type</th>
<th>CEER&lt;sub&gt;Adder_Connected&lt;/sub&gt;²</th>
</tr>
</thead>
<tbody>
<tr>
<td>All RAC types covered in Tables 1, 2 and 3¹</td>
<td>0.05 x CEER&lt;sub&gt;BASE&lt;/sub&gt;</td>
</tr>
</tbody>
</table>

¹ Product must be certified using the final ENERGY STAR Test Method for Room Air Conditioners to Validate Demand Response (TBD) to use the allowance.
² Calculated allowance shall be rounded down to the nearest tenth before being applied in Equation 1.

Note: With the broad goal of reducing greenhouse gas emissions, the primary objective of the ENERGY STAR Program is to recognize highly energy-efficient products in the market. In developing a product specification, EPA considers the following Guiding Principles:

- Significant energy savings can be realized on a national basis;
- Product performance can be maintained or enhanced with increased efficiency;
- Purchasers will recover their investment in increased efficiency within a reasonable amount of time;
- Efficiency can be achieved through one or more technologies such that qualifying products are broadly available and offered by more than one manufacturer;
Since the start of the previous specification development process, which initiated in December 2010, DOE issued new federal minimum efficiency requirements for RACs effective June 1, 2014. The amended federal standard is more stringent such that, for some product classes, the current ENERGY STAR criteria do not offer significant differentiation. EPA is proposing new performance levels that offer consumers energy savings above standard product offerings. EPA also sees an opportunity to provide optional recognition of products with connected functionality, which are being introduced into the market.

### Efficiency Criteria

In May 2014, EPA finalized a Version 3.1 specification, which harmonized with the amended DOE energy conservation standard for RACs and enabled certification using CEER. In Draft 1 Version 4.0, EPA is proposing that to certify as ENERGY STAR, RACs must be at least 10% more efficient than the 2014 minimum federal efficiency standard. Given the limited number of models that are currently able to meet the proposed Draft 1 criteria, EPA sought information from manufacturers on incremental efficiency gains that could be made with new components and technologies, as well as incremental product cost. Based on the provided information, the Agency was able to estimate a weighted average payback of 4.6 years, with most product classes falling below 5 years. Further information is available in the supplemental data and analysis spreadsheet, which accompanies this draft specification. Furthermore, EPA anticipates that as manufacturers revise RAC designs in order to meet the amended federal standard, there will be opportunity to reduce the incremental cost to achieve ENERGY STAR, by leveraging existing technologies and design options for use in RAC products, such as enhanced heat exchangers, more efficient motors, and the use of alternative refrigerants. EPA’s initial findings regarding these technologies are provided below. Stakeholders are encouraged to comment on the proposed efficiency levels and provide additional details regarding these and other energy-efficient technologies.

#### Enhanced/Enlarged Heat Exchangers

EPA understands that measures that increase heat transfer also increase energy efficiency. These measures include increasing fan speed, use of microchannel heat exchangers and upsizing coils. While increased fan speed can be accomplished at minimal incremental cost, energy efficiency gains typically come at the expense of increased product noise. As noted in the 2011 DOE rule, microchannel heat exchangers offer nominal efficiency gains and enable increased performance from heat exchangers that are smaller and lighter than traditional fin and tube arrangements. These heat exchangers have proven to be reliable in under-hood (outdoor) automotive applications, but incremental cost may be a barrier for use in RACs. As discussed in the 2011 DOE TSD, enlarging the RAC chassis enables use of larger heat exchangers that increase heat transfer without impacting noise performance.


#### Efficient Motors

Through continued research and stakeholder engagement, EPA identified direct current (DC) motors as a means of improving RAC product efficiency when compared to products with conventional alternating current (AC) motors used to operate the fan/blower system. DOE analyzed DC motor technology as a part of their rulemaking effort and found that an AC motor has a typical efficiency of 50% while a DC motor has an estimated motor efficiency of 80%. EPA is aware that DC motors are typically larger than AC motors but concurs with DOE’s assessment that the change in size does not preclude them from use in RAC products. This is further substantiated by EPA’s ongoing discussions with stakeholders indicating that manufacturers are considering DC motors for certain RAC product classes as a means of improving product efficiency.

#### Alternative Refrigerants

In comments on the November 2013 Version 4.0 framework document, manufacturers noted safety and technical feasibility concerns associated with adoption of non-ozone-depleting, low global warming potential (GWP) alternative refrigerants that are flammable.
EPA believes that there are opportunities for increasing efficiency through the use of these alternative refrigerants. Daikin indicates that switching from ozone-depleting hydrochlorofluorocarbon (HCFC)-22, or from high GWP HFC-410A, to HFC-32 refrigerant may offer an increase in overall RAC efficiency of 2-3%. Organizations have also reported energy efficiency gains in the range of 10-30% with hydrocarbon refrigerants. For example, Gree and Midea propane air conditioners may use 15% less energy than an HCFC-22 unit. The California Air Resources Board (ARB) estimates that in general, hydrocarbon refrigerants use 10-30% less energy than comparable HFC systems. Anticipating broader availability of alternative refrigerants for use in room air conditioners, EPA supports their broader use in ENERGY STAR products. EPA welcomes additional feedback and data on the potential efficiency gains associated with the use of low GWP refrigerants.

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 when installed according to provided instructions. The materials
shall minimize air leaks (seal) between the room air conditioner and the window opening, as
well as seal gaps between fixed and movable window sashes. Acceptable weather stripping
or gasket material includes vinyl clad foam, EPDM cellular rubber, silicone rubber, or
comparable alternatives. 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 FTC’s 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.

3. Insulating Cover (TTW only): RACs intended for TTW installation as defined in Section 1 shall
include an appropriately sized cover which has a minimum insulation value of R1 as
determined by the FTC’s Labeling and Advertising of Home Insulation regulations, 16 CFR
part 460. User instructions shall prompt consumers to install the insulating cover when the
RAC is not in use to provide additional insulation and reduce air leakage.

E. Sound Performance: Measured indoor sound power level shall not exceed 60 decibels - dB(A).

Note:

Installation
As signaled in the Version 4.0 Framework document, EPA believes there is an opportunity to provide
greater energy savings and performance/comfort for consumers through improved installation of
ENERGY STAR products. Minimizing air infiltration and thermal losses enables energy savings during
the cooling season for all RACs, and enables year-round energy savings for RACs that remain in-place
during the heating season. Field studies have equated certain window RAC installations to an equivalent
air exchange opening of 7.6 square inches, resulting in increased energy consumption and costs for
space conditioning in both heating and cooling seasons.¹
ENERGY STAR Program Requirements for Room Air Conditioners – Eligibility Criteria

Note (cont.): The National Renewable Energy Lab (NREL) report, Laboratory Performance Testing of Residential Window Air Conditioners, estimated that improved installation can reduce air leakage by 65-85% resulting in cooling energy savings of 5-10% in the field. Some stakeholder comments received on the Framework document indicated that additional data quantifying energy savings of installation improvements is not readily available. However, other stakeholders indicated support of EPA pursuing ways to enhance installation practices through ENERGY STAR. In the Draft 1 Version 4.0 specification, EPA is proposing criteria intended to ensure that, when effectively installed, RACs minimize energy costs from air leakage and thermal losses.

Informed by stakeholder feedback and additional research, EPA is aware that a majority of manufacturers make an effort to provide some supplemental materials (e.g., foam, weather stripping, gaskets, etc.) for consumers to use when installing the RAC. Therefore, the proposed criteria are not expected to add a significant cost burden. In considering installation, the Agency notes the need for RAC designs to be simple to install and safe when installed, while enabling flexibility in the placement and storage of the RAC. For this reason, EPA has proposed installation instructions, and noted several options for meeting the proposed installation materials criteria. EPA notes a recent RAC product introduction that utilizes fabric side curtains in lieu of traditional plastic accordion panels, which the Agency believes to be a step towards reducing air infiltration around the unit while maintaining installation flexibility. With these requirements, EPA aims to improve the quality of provided materials and instructions.

Further, based on field studies and research conducted by DOE in their recent rulemaking, EPA understands that TTW units are not typically removed and stored during the winter months. In an effort to minimize additional energy consumption during the heating season and improve consumer comfort, EPA is proposing that TTW products be shipped with a cover that will reduce thermal losses during the off-season. DOE Building Technologies Office’s: A Homeowner’s Guide to Window Air Condition Installation for Efficiency and Comfort(2012) estimates 7% in cooling season savings, up to 280 kWh/yr, or up to $31/yr from improved installation materials and practices very similar to those proposed in this Draft 1 specification. While limited in scope, the Urban Green Council’s: There are Holes in Our Walls estimated annual savings of $32-45 associated with improved installation practices similar to those proposed by EPA including use of air conditioner covers. EPA is seeking feedback on the proposed installation criteria and associated energy savings.


Sound Performance

Through conversations with stakeholders after the release of the Version 4.0 Framework document, EPA learned that noise might be an issue as RACs attain higher levels of efficiency. Further outreach to manufacturers affirmed a relationship between increasing RAC efficiency and increasing acoustic noise. Utilizing higher speed fans to facilitate increased heat transfer, manufacturers are able to increase the efficiency performance of the unit with minimal investment. As a result of increasing fan speeds the acoustic noise of the product also increases. Manufacturers have further noted that fan speeds for current models are on the order of 60% higher than were used 10 years ago.

Recently, the European Union (EU), through its EcoDesign regulations, instituted maximum sound power levels for RACs assessed under EN 12102: Air Conditioners, liquid chilling packages, heat pumps and dehumidifiers with electrically driven compressors for space heating and cooling – Measurement of airborne noise – Determination of sound power levels. Under the new EU regulation, RACs may not exceed indoor sound power levels of 60 dB(A) and outdoor sound power levels of 65 dB(A). For this Version 4.0 specification, EPA is proposing harmonization with the EU’s indoor sound power test requirements and threshold. EPA is aware that nearly all manufacturers of ENERGY STAR RACs sell products in the European market, and therefore a sound performance requirement for U.S. ENERGY STAR products should not require a significant new capital investment in testing rooms and equipment. While RACs are subject to the EN 12102, in their determination, the EU had limited information regarding the sound performance of RAC products as package terminal air conditioners (PTACs) and mini-split systems are more prevalent in the EU market. As such, EPA engaged several manufacturers to understand the current range of sound performance levels in the North American marketplace. EPA found that most manufacturers are utilizing internally defined sound pressure tests, in lieu of a standardized test method.
EPA understands that sound power testing, as called for by EN 12102, offers a more comprehensive assessment of a product’s acoustic noise performance compared to sound pressure testing. While humans perceive acoustic noise in terms of sound pressure, this metric is influenced by the environment surrounding a RAC, and can be amplified or dampened as a result of the test chamber or field operating conditions. Sound power testing allows for a more accurate and specific assessment of the RAC as sound power accounts only for the sound energy being generated by the RAC and transferred to the air. Sound power assessment of a RAC does not change based on the environment in which it is operated and therefore will provide a more meaningful way in which to evaluate product sound performance relative to capacity and efficiency. As such, EPA proposes the use of EN 12102.

Consistent with the ENERGY STAR Guiding Principles, EPA seeks to ensure that ENERGY STAR efficiency requirements do not lead to a compromise in product performance. To this end, the Agency has included maximum sound level criteria for ENERGY STAR ventilation fans. In proposing this sound performance requirement, the Agency strives to both ensure consumer satisfaction with ENERGY STAR RACs, as well as to ensure that the ENERGY STAR label is an attractive purchasing tool for a broad array of consumers.

EPA does not intend to include RAC sound power results on the ENERGY STAR certified products list. EPA welcomes stakeholder feedback on the proposed requirement for sound performance and harmonization with the EU.

F. 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).

G. 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) Connected Product Criteria:

The following optional connected criteria are applicable to Included Products, Section 2A,

Note: Consistent with criteria proposed for other ENERGY STAR residential appliance categories, EPA is proposing optional connected criteria for RACs that are designed to provide enhanced functionality to consumers and offer potential benefits to the U.S. electricity grid.

A. Connected Room Air Conditioner 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 base appliance plus all elements (hardware, software) required to enable communication 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 4B2.

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 4D, 4F and 4G. The capabilities shall be supported through one or more means, as identified in section 4B2. A product that enables economical and direct, on-premises, open-standards based interconnection is the preferred option for meeting this requirement, but alternative approaches, where open-standards connectivity is enabled only outside of the consumer premises, 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. The appliance must meet manufacturer’s internal minimum performance guidelines, e.g., cooling performance.
Note 1: EPA’s ENERGY STAR program is seeking to help advance the market for products with intelligent features in ways that deliver immediate consumer benefits as well as support a low-carbon electricity grid over the long term. In promoting connected functionality, EPA also seeks to ensure the consumer is being considered such that product satisfaction is maintained or enhanced with the addition of new energy savings and convenience features.

These connected criteria build upon the work done in other specification (e.g., refrigerators/freezers, clothes washers, clothes dryers) where similar criteria were developed. The connected criteria mandate open access and the use of open standards to enable consumer benefits while enabling innovation and flexibility in implementation. This approach provides the Agency a basis to recognize products with connected functionality as they begin to enter the market and to consider more prescriptive changes, based on real-world market experience, if warranted.

EPA plans to also play a role in consumer education to help further the understanding of additional savings opportunities associated with ENERGY STAR products that have connected functionality, as well as how to best capture these savings (e.g., use of energy saving modes / opportunities for smart grid connection) and in what scenarios these savings will be realized.

EPA encourages stakeholder feedback on the connected criteria proposed in this draft.

B. Communications

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

   - Included in the Smart Grid Interoperability Panel (SGIP) Catalog of Standards, and/or
   - Included in the NIST Smart Grid framework 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).

   4 http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/PMO#Catalog_of_Standards_Processes
2. Communications Hardware Architecture – Communication with entities outside the Connected
   RAC System that enables connected functionality (sections 4D through 4G) 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 be 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 4B1 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 4D (must include accuracy, units and
     measurement interval);
   • Operational Status, User Settings & Messages specified in section 4F (if transmitted via a
     communication link);
   • Demand Response specified in section 4G.

D. Energy Consumption Reporting
   In order to enable simple, actionable energy use feedback to consumers and consumer
   authorized energy use reporting to 3rd 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 4C.

   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 status (e.g., 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 a performance issue, such as a clogged filter, 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 for all cycle and setting combinations:

1. **Delay Appliance Load 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 Delay Appliance Load response without limitation.
   c. The product shall be able to provide at least one Delay Appliance Load response in a rolling 24-hour period.

2. **Temporary Appliance Load Reduction 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 ≥ 85°F.
   b. **Consumer override** – The consumer shall be able to override the product’s Temporary Appliance Load Reduction response without limitation.
   c. The product shall be able to provide at least three Temporary Appliance Load Reduction responses in a rolling 24-hour period. The product is not required to provide more than one Temporary Appliance Load Reduction response per 60-minute period.

**Note**: During the Version 3.0 specification development process, EPA began considering optional connected functionality criteria for RACs. EPA did not propose specific Demand Response (DR) criteria in the Draft 3 Version 3.0 specification, but did discuss the possibility of including criteria designed to provide more predictable impacts to consumers, more consistent load shed as well as to reduce associated product testing burden. As this approach was supported by stakeholders in their written comments, EPA elected to propose DR criteria based on this approach in this Draft 1 Version 4.0 specification. Such an approach, focusing on set temperatures and compressor operation, is also informed by the experiences of utility programs like Con Edison’s coolNYC program.

In the Draft 3 Version 3.0 specification, EPA also detailed potential concerns with DR criteria that required percent energy use reductions relative to a baseline. More specifically, the RAC Delay Appliance Load (DAL) response detailed in the Joint Petition to ENERGY STAR for Smart Appliances, calls for a 25% load reduction relative to the measured product energy consumption during testing to the DOE test procedure. Since the DOE energy test runs the RAC at maximum capacity, a 25% reduction in the field would only be realized for RACs that are unable to provide the desired cooling capacity and are hence running at full capacity. RACs that are more lightly loaded would not need to provide as great a response, or if running at 75% or lower capacity, would not need to respond at all. In effect, the RACs that are struggling to keep up with cooling demands would be required to provide the greatest load shed; potentially resulting in significant comfort impacts, while RACs that are more lightly loaded might not need to respond at all. As such, EPA believes that proposing DAL criteria that mandates a minimum, defined set temperature shift will better limit consumer comfort impacts, provide more predictable load shed and significantly reduce test burden.
Note (cont.): Similarly, the joint petition to ENERGY STAR called for a RAC Temporary Appliance Load Reduction (TALR) response that provides an 80% load reduction relative to the measured product energy consumption during testing to the DOE test procedure. Stakeholders informed EPA that RACs would need to switch off the compressor in order to comply. While EPA believes this deeper percent reduction criteria does provide a reasonable assurance of similar reductions in the field, EPA has proposed a maximum temperature approach that calls for switching off the compressor in the interest of significantly reduced test burden. DOE and EPA recognize that mandating RACs disable compressor operation during TALR responses would avoid the need to establish a baseline and monitor RAC energy consumption; effectively reducing test burden for TALR in a similar manner as with DAL.

The proposed DAL and TALR criteria both include an 85°F maximum adjusted set temperature limit to protect consumers from extreme temperatures, and include consumer override criterion that ensures consumers have the ability to override a response when necessary. EPA recognizes that the set temperature may not reflect the room temperature and is seeking comment on whether a maximum set temperature of 85°F will sufficiently prevent an excessively high room temperature. While EPA sought a health-based resource to cite on a temperature, the Agency did not identify an agreed upon maximum temperature. As such, EPA proposes a reasonable temperature as a starting point and seeks stakeholder feedback regarding sources for health-based maximum temperature thresholds. EPA welcomes stakeholder comment on the proposed DR criteria for RACs.

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

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

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

<table>
<thead>
<tr>
<th>ENERGY STAR Requirement</th>
<th>Test Method Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEER</td>
<td>10 CFR 430, Subpart B, Appendix F</td>
</tr>
<tr>
<td>Sound Performance</td>
<td>EN12102</td>
</tr>
</tbody>
</table>

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, as specified in Section 4, shall be through examination of product and/or product documentation. In addition, demand response functionality will be certified using the ENERGY STAR Test Method for Room Air Conditioners to Validate Demand Response – Date TBD in order to be eligible for the connected allowance.
Note: Sound performance must be tested in accordance with the test method EN 12102: Air
Conditioners, liquid chilling packages, heat pumps and dehumidifiers with electrically driven
compressors for space heating and cooling – Measurement of airborne noise – Determination of sound
power levels, currently used in the EU. Since many ENERGY STAR brand owners ship RACs to the EU,
use of the EN 12102 method will reduce testing burden for purposes of certification.

EPA welcomes stakeholder feedback on use of the EN12102 test method for sound power, and its
accuracy in representation of sound performance in the US RAC market.

6) Effective Date: The ENERGY STAR Room Air Conditioner specification shall take effect on TBD.
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.

Note: EPA is aware that room air conditioners are a seasonal product with specific manufacturing cycles
to support an April-August retail sales cycle. EPA intends to finalize this Version 4.0 specification early in
2015 and anticipates it would be effective 9 months later. As with other ENERGY STAR specifications,
early certification will be available once the specification has been finalized.

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.