ENERGY STAR®
Room Air Conditioners (RAC)

Draft 1 Version 4.0 Specification
Stakeholder Webinar
November 24, 2014

Webinar Logistics

- All phone lines will be muted, **to unmute please press *6**
- Please do not use the GoTo Webinar 'Questions' feature to ask questions.
- Presented material can be found on the ENERGY STAR Room Air Conditioner Product Development webpage at www.energystar.gov/revisedspecs and follow the Version 4.0 link for Room Air Conditioners

Introduction – Welcome/Goals	Melissa Fiffer, EPA
Room Air Conditioners **Draft 1, Version 4.0 – Presentation & Discussion**	
- Definitions - Revisions to ENERGY STAR Criteria	Melissa Fiffer, EPA Ryan Fogle, D&R International
- Installation Requirements	Melissa Fiffer, EPA
- Sound Performance	Melissa Fiffer, EPA Jessica Lyman, ICF International
- "Connected" Functionality	Melissa Fiffer, EPA Doug Frazee, ICF International
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Webinar Goals

1. Highlight proposed changes in the Draft 1, Version 4.0 specification.

2. Solicit stakeholder feedback on outstanding issues/questions identified.

3. Address stakeholder questions about process and/or changes.

4. Discuss next steps and timeline.

Specification Development

- When developing or revising a specification, EPA balances:
  - The need to keep pace with evolution among leading products and continue to effectively differentiate the most efficient products.
  - Timing & impact of new Federal standards.
  - Production cycles and other factors important to the industry.
- Key elements of the stakeholder process:
  - Consistency
  - Transparency
  - Inclusiveness
  - Responsiveness
  - Clarity

ENERGY STAR Guiding Principles

- ENERGY STAR criteria are designed to balance a varied set of objectives, including:
  - Significant energy savings
  - Maintained or enhanced product performance
  - Purchasers can recover investment in increased efficiency within a reasonable time period
  - Efficiency can be achieved through one or more technologies; qualifying products from multiple manufacturers
  - Energy consumption can be measured and verified with testing
  - Label provides meaningful differentiation

Specification Development Cycle

RAC Specification Background & Version 4.0 Drivers

- Background:
  - October 2013: Version 3.0 ENERGY STAR RAC specification went into effect:
    - 15% more efficient than baseline model.
  - May 2014: Version 3.1 specification provided crosswalk of efficiency criteria from Energy Efficiency Ratio (EER) to Combined Energy Efficiency Ratio (CEER).
  - June 2014: New Federal standards went into effect using CEER.
- Drivers for Version 4.0 revision:
  - Deliver greater consumer savings and better differentiation relative to standard products in the marketplace.
  - Provide opportunity to recognize enhanced functionality and demand response capabilities through optional “connected” criteria.

Overview of Draft 1 Version 4.0

- Proposes revision of energy criteria using CEER for all RAC products.
- Proposes inclusion of installation criteria.
- Proposes inclusion of indoor sound performance criteria.
- Proposes optional Connected criteria for RACs, with a 5% allowance for products certified to this criteria.
- Minor revisions to definitions, significant digits/rounding.
- Effective date – 9 months after Version 4.0 is finalized.

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Definitions

- All EER references have been removed, as it is no longer applicable to ENERGY STAR certification.
  - CEER is required for demonstrating compliance to U.S. federal standards as of June 1, 2014.
- The definition for CEER has been added.
- Footnotes provide the applicable citations (e.g., CFR, ASHRAE 58, etc.)
  - In cases of conflict, the CFR definition takes precedence.

Proposed Criteria – Without Reverse Cycle

Table 1: Units Without Reverse Cycle

Capacity (BTU/hour)	$CEER_{BASE}$ (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	

Proposed Criteria – With Reverse Cycle, Casement Units

Table 2: Units With Reverse Cycle

Capacity (BTU/hour)	$CEER_{BASE}$ (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

Proposed Criteria - Connected

RACs that are certified to optional Section 4 connected criteria and tested using the final and validated ENERGY STAR Test Method for Room Air Conditioners to Validate Demand Response Functionality – (TBD) may be eligible for a 5% allowance against the minimum energy requirements:

Equation 1. Calculation of Minimum CEER

$$CEER_{MIN} = CEER_{BASE} - CEER_{Adder\_Connected}$$

Connected Allowance	
Product Type	**$CEER_{Adder\_Connected}$**
All RAC types covered in Tables 1, 2 and 3	0.05 x $CEER_{BASE}$

Technology Discussion

- EPA is proposing that to qualify for ENERGY STAR, RACs must be 10% more efficient than the 2014 federal minimum
- EPA understands there are multiple existing design opportunities to increase the efficiency of RACs:
  - *Enhanced/Enlarged Heat Exchangers, e.g., microchannel*
  - *Efficient Motors, e.g., direct current (DC) motors*
  - *Alternative Refrigerants, in accordance with the Significant New Alternatives Policy (SNAP) program*

Average Energy Savings
Proposed Version 4.0 Criteria

- Estimated energy savings for RACs that meet the proposed levels range from 31 kWh per year to 212 kWh per year depending on product class.
  - Traditional 5000 Btu/hr RAC: 31 kWh/yr
  - Traditional 8000 Btu/hr RAC: 63 kWh/yr
  - Traditional 14000 Btu/hr RAC: 115 kWh/yr
- The weighted annual energy savings for all product classes is 56 kWh/year.

Average Cost Savings
Proposed Version 4.0 Criteria

- Estimated energy savings for RACs range from $4 per year to $26 per year depending on product class.
  - Traditional 5000 Btu/hr RAC: $3.82
  - Traditional 8000 Btu/hr RAC: $7.71
  - Traditional 14000 Btu/hr RAC: $14.13
- The weighted annual cost savings for all of the product classes is $6.85.

Consumer Payback

- Several manufacturers indicated there are multiple cost effective approaches:
  - Manufacturers provided materials and manufacturing cost data for the most common product classes.
  - EPA scaled this data to estimate payback for other product classes.
- EPA expects a range of cost effective design options to be available by the effective date.
- Average payback of 4.6 years, with most product classes under 5 years.

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Installation Requirements
Proposed Version 4.0 Criteria

As signaled in the framework, the Draft 1 proposal includes criteria intended to promote efficient, weather-tight installations and improve consumer comfort:

- *Window RACs*: Inclusion of weather stripping/gasket materials to minimize air leaks, and tight-fitting side curtains with a minimum R1 insulation value
- *All RACs*: Detailed installation instructions
- *Thru-the-wall RACs*: Insulating cover with a minimum R1 insulation value

Installation Requirements
Stakeholder Comments & Discussion

- Window RACs:
  - One commenter requests that EPA clarify the list of materials is not intended to be exhaustive
  - One commenter notes that their products ship with cut-to-size panels and insulation, but expresses concern about costs associated with potentially switching materials
  - One commenter requests guidance on an adequate seal, while another suggests EPA set a max leakage and/or heat transfer
  - One commenter expresses support for side curtain criteria
- Discussion:
  - What additional clarity can EPA provide around the proposed window RAC installation criteria, while still maintaining flexibility?
  - For window RACs, are there other installation measures that should be taken to minimize air leakage? What are the associated energy savings?
  - EPA is aware that a majority of manufacturers include materials, as indicated in the example above. Which materials are other partners already including in the box?

Installation Requirements
Stakeholder Comments & Discussion

- Thru-the-wall RACs:
  - Two commenters note that insulating covers would add additional cost for the manufacturer, and question whether they provide significant savings
- Discussion:
  - What is the cost of insulating covers?
  - In Draft 1, EPA cites an estimated 280 kWh or $31-45 in annual savings from improved installation practices and materials similar to those proposed. What portion of those savings (kWh or $) might be associated with using an insulating cover during the off-season?

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Sound Performance
Proposed Version 4.0 Criteria

- Aligning with European EcoDesign regulations, proposing:
  - Measured indoor sound power level shall not exceed 60 decibels - dB(A)
  - Sound power measured in accordance with EN12102
- Sound power assessment offers a more accurate and specific assessment of a product's sound performance
  - Unlike sound pressure testing, sound power is unaffected by the surrounding environment

Sound Performance
Stakeholder Comments & Discussion

- Conversations with stakeholders indicated a relationship between increasing RAC efficiency and increasing acoustic noise.
- In comments, two stakeholders opposed the inclusion of the proposed sound performance criteria, citing the following reasons:
  - EN12102 is not a consensus-based standard
  - Noise testing results are subject to variation
  - Limited availability of suitable U.S. test chambers would result in burden for manufacturers
- Discussion:
  - Does an alternate standard or metric offer a similarly reproducible means of assessing RAC sound performance?
  - What are the lessons learned from experience with EN12102 and the sound performance requirements in the European market?
  - Recognizing the potential that manufacturers have noted for noise issues at higher efficiency levels, are stakeholders currently aware of and/or anticipating consumer complaints?
  - Which design decisions are being made to avoid increasing noise in higher efficiency products?

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Overview

- EPA is helping to advance products with intelligent features that deliver immediate consumer benefit and support a low-carbon electricity grid over the long term.
- Draft 1 introduces *optional* Connected Functionality (CF) criteria for RACs.
  - EPA will provide additional recognition of ENERGY STAR RACs that are certified as meeting all CF criteria.
  - Draft 1 builds on CF in the final Version 5.0 Residential Refrigerators and Freezers (R/F) Specification while leveraging connected opportunities unique to RACs.
  - Consumers will have full control as to if and how their RAC responds to Demand Response (DR) signals.
  - 5% allowance for ENERGY STAR RACs certified to optional connected criteria, including evaluation using a (TBD) ENERGY STAR Test Method for Room Air Conditioner to Validate Demand Response.

Connected RAC System

Defines the RAC system as:

- Consisting of all required hardware and software
- Communications hardware may be built-in or external
- Using open standards for external communications
- Preference for RACs that enable on-premises, open standards connectivity, but RACs that enable open standards only in the cloud may comply
- Remote Management excluded from open standards & open access criteria

Communications & Open Access

Aligns with the final connected communications criteria for other product categories:

- Open standards:
  - In the NIST SGIP Catalog of Standards, or;
  - In the NIST Smart Grid Framework Table 4.1 or 4.2, or;
  - Adopted by ANSI or by a well recognized international SDO.
- Communications hardware may be:
  - Built-in.
  - Proprietary external paired with module/device.
  - Open standards based port & module.
  - Open standards based port (no module) with one or more of the above.
- Open Access – API available to interested parties

Consumption Reporting, Remote Management

Also aligns with final connected communications criteria for other product categories:

- Energy consumption reporting:
  - Allows implementation flexibility
  - Promotes reporting accuracy
  - Remote management availability

Operational Status, User Settings & Messages

- Proposes **consumer-authorized** reporting of Demand Response and operational status (e.g., off/standby, low cool, max cool).
  - Enables load-balancing entities to better assess available dispatch-able load.

- At least two types of energy-related messages required, for example.
  - Notification of performance issues, or
  - Energy consumption that is outside the product's normal range.

Demand Response

- Delay Appliance Load (DAL) response

  The set temperature must be increased by at least 4°F for at least 4-hours

  - Upper set temperature limit of 85°F
  - Consumer override-able
  - At least one response per rolling 24-hour period

- Temporary Appliance Load Reduction (TALR) response

  Compressor operation halted for at least 10-minutes

  - No response if set temperature is ≥85°F
  - Consumer override-able
  - At least three responses per rolling 24-hour period
  - No more than one TALR response per 60-minute period

Optional Connected Criteria
Stakeholder Comments & Discussion

- One commenter supports the DAL/TALR approach, noting it will provide predictable consumer impacts and energy reduction, while minimizing test burden.
- *Discussion:*
  - EPA welcomes stakeholder feedback on all aspects of the optional connected criteria.
  - Will the proposed DR criteria deliver the kind of load shed that utility partners are seeking? What have partners learned from AC pilot programs?
  - Will a maximum set temperature of 85 degrees sufficiently prevent an excessively high room temperature? Is there a health-based maximum temperature threshold?

Certification of Connected Functionality

- Compliance with connected functionality will be through examination of the product and/or product documentation.
- Additionally, demand response functionality will be certified using an ENERGY STAR Test Method for Residential Room Air Conditioners to Validate Demand Response (TBD).
  - DOE is planning to develop a test that will validate the demand response capabilities of a RAC, to be referenced in the Version 4.0 specification.
  - DOE is initiating this effort now and will be contacting manufacturers to obtain products for testing or to witness testing in manufacturer labs.
  - Products must be certified using this new ENERGY STAR test method in order to be eligible for the 5% allowance .

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Anticipated Timeline for Version 4.0 Spec Revision

October 24, 2014	Draft 1, Version 4.0 Specification Released
November 19, 2014	Comment Period Closes on Draft 1 Specification
November 24, 2014	Stakeholder Webinar (Today)
December 2014 – January 2015	• Draft 2 Specification Distributed, Stakeholder Webinar or Meeting, and Comment Period • Final Draft Specification Distributed and Comment Period
February 2015 – tentative	Final Version 4.0 Specification Released

Questions?

Contacts

Spec Development:

- Melissa Fiffer, US EPA
  Fiffer.Melissa@epa.gov
- Ryan Fogle, D&R International
  rfogle@drintl.com
- Doug Frazee, ICF International
  dfrazee@icfi.com
- Jessica Lyman, ICF International
  jessica.lyman@icfi.com
- appliances@energystar.gov

Test Method:

- Bryan Berringer, US DOE
  Bryan.Berringer@ee.doe.gov
- Daniel Weintraub, Navigant Consulting, Inc.
- Daniel.Weintraub@navigant.com