



ENERGY STAR® Product Specification for Room Air Cleaners

Eligibility Criteria Draft 1 Version 2.0

Following is the Draft 1 Version 2.0 ENERGY STAR product specification for room air cleaners. A product must meet all of the identified criteria if it is to earn the ENERGY STAR.

1 DEFINITIONS

Below are the definitions of the relevant terms in this document.

- A. Room Air Cleaner: An electric appliance with the function of removing particulate matter from the air and which can be moved from room to room.
 - 1. Fan with Filter¹: Air cleaner that operates with an electrical source of power and which contains a motor and fan for drawing air through a filter media.
 - 2. Fan with Electrostatic Plates¹: Air cleaner which operates with a fan and incorporates electrically charged plates or wires to electrostatically collect particulate matter. Such devices may include filter(s).
 - 3. Fan Filter with Ion Generator¹: Air cleaner that incorporates an ion generator in addition to a fan and filter.
 - 4. Ion Generator¹: Air cleaner that incorporates an ion generator only.
 - 5. Hybrid¹: An air cleaner employing a combination of the above definitions of fan with filter, electrostatic plate/wire, and ion generator.
 - 6. Combination Product: An air cleaner that provides an additional primary function, other than actively removing particulate matter from the air, within the same housing, such as a humidifier or dehumidifier.
 - 7. Ozone Generator: A device intended to reduce or eliminate microorganisms within a room solely by means of introducing ozone into the room environment.
- B. Clean Air Delivery Rate (CADR)¹: The measure of the delivery of contaminant free air, within a defined particle size range, by an air cleaner, expressed in cubic feet per minute (cfm). CADRs are the rates of contaminant reduction in the test chamber when the air cleaner is turned on, minus the rate of natural decay when the air cleaner is not running, multiplied by the volume of the test chamber as measured in cubic feet. **Note**: CADR values are always the measurement of an air cleaner performance as a complete system, and has no linear relationship to the air movement per se or to the characteristics of any particular particle removal methodology.
- C. Room Air Cleaner Functions:
 - 1. Primary Function: Actively removing particulate matter from the air.
 - 2. Secondary Function: Function that enables, supplements or enhances a primary function. For Room Air Cleaners, Secondary Functions may include network connection, clocks, remote controls, or other programmable functions that may continue to be enabled when the primary function is inactive.
- D. Operational Modes:
 - 1. Partial On Mode²: The condition during which the equipment provides at least one secondary function but no primary function. This term encompasses the Standby Mode and Network Mode

¹ ANSI/AHAM AC-1-2015

² IEC 62542, Environmental standardization for electrical and electronic products and systems - Glossary of terms

terms from IEC 62301.

2. **On Mode:** The condition during which the equipment provides the primary function. Secondary functions may also be enabled.
- E. **Product Family:** A group of product models that are (1) made by the same manufacturer, (2) subject to the same ENERGY STAR certification criteria, and (3) of a common basic design. Product models within a family may differ from each other according to one or more characteristics or features that (1) have no impact on product performance with regard to ENERGY STAR certification criteria, and (2) are specified herein as acceptable variations within a product family. For room air cleaners, acceptable variations within a product family include:
 1. Color
 2. Housing

Note: EPA has updated several definitions to align with those in the ANSI/AHAM AC-1-2015 standard. Also, EPA added in definitions to describe room air cleaner functions and modes to align with the IEC 62542 Glossary of Terms and the IEC 62301 test procedure. EPA believes this will add clarity when describing Partial On Mode – which now encompasses the previously used terms of Standby Mode and Network Mode.

Lastly, EPA updated the definition of Product Family to add more clarity on acceptable variations within a product family. EPA requests feedback on any other variations that would not impact energy consumption but may be acceptable within a product family.

2 SCOPE

2.1 Included Products

- 2.1.1 Products that meet the definition of a Room Air Cleaner as specified herein are eligible for ENERGY STAR qualification, with the exception of products listed in Section 2.2. Certified air cleaner models shall produce a minimum 30 CADR for Smoke to be considered under this specification.

Note: EPA has updated the criteria to be based on Smoke CADR/W and has changed the product inclusions to reflect this. All products that produce a minimum of 30 CADR for Smoke are eligible to be considered for certification under this specification. To ensure that models do not fall off the certified product list solely due to the change in evaluation metric from Dust CADR to Smoke CADR, EPA has set the minimum Smoke CADR at 30 CADR.

2.2 Excluded Products

- 2.2.1 Products that are covered under other ENERGY STAR product specifications are not eligible for certification under this specification. The list of specifications currently in effect can be found at www.energystar.gov/specifications.
- 2.2.2 The following products are not eligible for certification under this specification, as defined in Section 1:
 - a. Combination products and
 - b. Ozone generators.

3 CERTIFICATION CRITERIA

3.1 Significant Digits and Rounding

- 3.1.1 All calculations shall be carried out with actual reported (unrounded) or observed values. Calculated results shall be rounded using the following principles:
 - i. CADR and Power (W): According to guidance provided in ANSI/AHAM AC-1-2015.

- ii. CADR/W: The final value shall be rounded to one decimal place.
- iii. Partial On Mode Power: According to guidance provided in IEC 62301 Ed. 2.0.
- iv. Ozone Generation: Only the final result of a calculation shall be rounded. Calculated results shall be rounded to the nearest significant digit as expressed in the corresponding specification limit.

3.1.2 Unless otherwise specified, compliance with specification limits shall be evaluated using exact values without any benefit from rounding.

3.2 General Requirements

3.2.1 UL Safety Requirements for Ozone Emitting Models: To certify for ENERGY STAR, measured ozone shall not exceed 50 parts per billion (ppb).

3.3 On Mode Requirements

3.3.1 CADR/Watt Requirement: To certify for ENERGY STAR, the Measured Smoke CADR divided by the operating power consumption measured during the smoke particle removal test (equal to Smoke CADR / Watt) shall be greater than or equal to the Minimum Smoke CADR/Watt Requirement shown in Table 1.

Table 1: Minimum Smoke CADR/W Requirement

Smoke CADR Bins	Minimum Smoke CADR/W
$30 \leq \text{CADR} < 100$	2.1
$100 \leq \text{CADR} < 150$	2.4
$150 \leq \text{CADR} < 200$	2.9
$\text{CADR} \geq 200$	2.9

Note: EPA understands that smoke pollutants can have the greatest health risk for the general population (all ages, all degrees of allergenicity). Also, the Association of Home Appliance Manufacturers (AHAM) Verification Program for room air cleaners calculates the appropriate room size for a given room air cleaner based on Smoke CADR: Room Size (in square feet) = Smoke CADR * 1.55 (this CADR calculation is based on the assumption that the air cleaner will reduce the concentration of smoke particles in a room by 80%). Retailers appear to use this calculation to direct consumers to a specific room air cleaner. Lastly, smoke has the smallest particle size of the three pollutants tested to the ANSI/AHAM AC-1-2015 standard and is typically the most energy intensive to remove as it takes longer to remove the smallest particle. Due to these considerations and stakeholder feedback, EPA believes that smoke is an appropriate pollutant to use as the basis for an efficiency evaluation of room air cleaners. EPA will continue to report the CADR for all three pollutant types to inform consumer purchases.

In order to develop the proposed levels, EPA first built a dataset that reflects unique models on the market. EPA combined all non-ENERGY STAR models on the AHAM Verified website, all non-ENERGY STAR models found through web scraping, and the ENERGY STAR certified models (duplicates were removed) to determine the number of models on the market. Based on this, EPA found that 45% of base models on the market are ENERGY STAR certified and 55% of base models on the market are not ENERGY STAR certified. Next, EPA examined how to determine Smoke CADR/W values for each model. AHAM has indicated the power consumption during the Dust CADR/Watt test will mirror the Smoke CADR/Watt test. As such, EPA calculated the Smoke CADR/Watt for each model on the ENERGY STAR qualified products list. All of EPA's analysis is reflected in the ENERGY STAR Room Air Cleaner V2.0 Draft 1 Data Package.

After analyzing the relationship between Smoke CADR and Smoke CADR/Watt, EPA believes it would be appropriate to set efficiency criteria based on CADR size bins. EPA heard from stakeholders that smaller-CADR products, that offer a lower cost option for small rooms, have more difficulty achieving ENERGY STAR than larger-CADR products. EPA believes the proposal to set criteria based on CADR will ensure consumers have a wide range of choices in each size bin of room air cleaners and will not inadvertently choose a product that is under or oversized for their space. The CADR bins, shown in Table 1, were determined in consideration of clusters of CADR values seen on the market and after evaluating the efficiencies of models at different CADR sizes. In setting the efficiency criteria, EPA targeted the top 25% of models available on the market in each CADR bin.

3.4 Partial On Mode Requirements

3.4.1 Measured Partial On Mode Power ($P_{Partial_On}$) shall be less than or equal to the Maximum Partial On Mode Requirement ($P_{Maximum_Partial_On}$) as calculated per Equation 1, subject to the following requirements:

- i. For a model that has Wi-Fi network connection enabled by default when shipped, the model shall have Wi-Fi network connection enabled during testing and a Partial On Mode Network Connected power allowance ($P_{Network_Connected}$) defined in Table 2 shall be applied in Equation 1. These models shall be tested with a properly configured wireless network available and connected to the product when testing.

Equation 1: Calculation of Maximum Partial On Mode Power Requirement

$$P_{Maximum_Partial_On} = P_{Base_Allowance} + P_{Network_Connected}$$

Where:

- $P_{Maximum_Partial_On}$ is the Maximum Partial On Mode Power Requirement, in watts;
- $P_{Base_Allowance}$ is the Partial On Mode Base power allowance for all products; and
- $P_{Network_Connected}$ is the Partial On Mode Network Connected power allowance.

Table 2: Partial On Mode Power Allowances

	Partial On Mode Power Allowance for models with Wi-Fi network connection enabled during testing	Partial On Mode Power Allowance for models without Wi-Fi network connection enabled during testing
$P_{Base_Allowance}$	1.00	1.00
$P_{Network_Connected}$	1.00	0

Note: EPA updated this section to reference Partial On Mode (it was previously Standby Mode). This is because the IEC 62542 Glossary of Terms updated their definitions of Standby Mode and Network Mode to both be encompassed under the term Partial On Mode. Partial On Mode now refers to a lower power mode in which a product can be providing a number of secondary functions, including network connectivity (if available and enabled by default).

The current Version 1.2 maximum standby power is 2 Watts. EPA has lowered this maximum to 1.00 Watt for non-connected products based on certification data showing that 1.00 Watt is very feasible to achieve. Recognizing that network capabilities might consume extra power, EPA included an allowance of 1 Watt for products tested with Wi-Fi network connection enabled (maintaining the same limit for network-connected products as Version 1.2), due to the increasing prevalence of network capability among room air cleaners and the benefits it may offer to consumers. EPA heard from recognized-laboratories that testing is currently being conducted with all features enabled that are enabled by default, including network connectivity. As a result, EPA believes lowering the Maximum Partial On Mode Power Requirements while offering a network connected allowance, will encourage efficiency in Partial On Mode while not penalizing products that offer a networking feature.

4 TEST REQUIREMENTS

4.1 Test Methods

4.1.1 Test methods identified in Table 2 shall be used to determine certification for ENERGY STAR.

ENERGY STAR Requirement	Test Method Reference
Cigarette Smoke CADR	ANSI/AHAM AC-1-2015: <i>Method of Measuring the Performance of Portable Household Electric Room Air Cleaners</i>
Measurement of Operating Power	
Ozone Generation	UL 867 Ed. 5.0 <i>Electrostatic Air Cleaners</i>
Measured Partial On Mode Power ($P_{\text{Partial_On}}$)	IEC 62301 Ed. 2.0 <i>Household electrical appliances – Measurement of standby power</i>

Note: EPA has updated the test method references in Table 2 to the most recent version of those standards.

4.2 Number of Units Required for Testing

4.2.1 Representative Models shall be selected for testing per the following requirements:

- i. For certification of an individual product model, the Representative Model shall be equivalent to that which is intended to be marketed and labeled as ENERGY STAR. Because of the inherent statistical variance in counting low density dust particles, manufacturers have the option of testing the unit three times, each time with a new filter. The measured performance (or mean of measured performance) of this unit and of all units sold must be equal to or better than the ENERGY STAR specification requirements:

$$\text{CADR}_{\text{Test}} (\text{CADR}_{\text{Test_Mean}}) \geq \text{ENERGY STAR CADR Criteria}$$

$$\text{Measured Ozone}_{\text{Test}} (\text{Measured Ozone}_{\text{Test_Mean}}) \leq \text{ENERGY STAR Ozone Criteria}$$

$$\text{Measured Partial On Mode Power}_{\text{Test}} (\text{Measured Partial On Mode Power}_{\text{Test_Mean}}) \leq \text{ENERGY STAR Maximum Partial On Mode Power Criteria}$$

- ii. For certification of a Product Family, any model within that Product Family can be tested and serve as the Representative Model. Any subsequent testing failures (e.g., as part of verification testing) of any model in the family will have implications for all models in the family.

4.2.2 A single unit of each Representative Model shall be selected for testing.

5 EFFECTIVE DATE

5.1.1 Effective Date: The Version 2.0 ENERGY STAR Room Air Cleaner specification shall take effect

on **TBD**. 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 on which a unit is considered to be completely assembled.

- 5.1.2 Future Specification Revisions: EPA reserves the right to change the specification 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.