



FAQs: Portable Air Cleaners

As of November 13, 2020

The following FAQs was developed by the San Francisco Department of Public Health for use by local facilities, and will be posted at www.sfc-dcp.org/COVID-Ventilation. These FAQs may change as knowledge, community transmission, and availability of PPE and testing change.

AUDIENCE: Non-healthcare organizations (including businesses, companies, offices, schools, faith-based and similar organizations) and the general public. Healthcare personnel and first responders need to check with their infection control and safety & health groups for guidance as there are specific hazards or hazardous activities which ventilation systems are set to control. Additional information for healthcare organizations can be found at www.sfc-dcp.org/covid19hcp under Health Care Exposures.

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1. When should I consider using a portable air cleaner (PAC)?

Good ventilation, social distancing and source control including masking are the most important ways to control Covid-19 transmission. Portable air cleaners (PACs) should be considered when fresh air ventilation is not sufficient or cannot be improved. They should also be considered in areas where people may be unmasked such as break and lunchrooms and in spaces with high occupant density (example – call centers). PACs cannot be used as a replacement for masking and social distancing.

2. Is an air purifier the same thing as a portable air cleaner PAC? What about a HEPA filter?

Yes, air purifiers and HEPA filter devices are types of portable air cleaners. These devices are designed to filter air in a single room or area. For the purposes of this FAQ we are focusing on PACs which have filters and have undergone standardized “Clean Air Delivery Rate” (CADR) testing using the ANSI/AHAM AC-1 protocol. CADR testing is denoted by (a) an AHAM (Association of Home Appliance Manufacturers) “VERIFIDE” label on the PAC’s box (See Figure 1 for examples), (b) listing at <https://www.ahamdir.com/room-air-cleaners/>, and/or (c) the PAC manufacturer providing documentation on CADR testing from an independent laboratory.

There are PACs on the market whose manufacturer asserts alternate air cleaning technologies and performance assessments. For Health Order and/or Directive compliance, it is the responsibility of the business who is using this equipment to demonstrate equivalency and calculate air cleaning characteristics in a fashion that can be directly compared with CADR testing. This assessment must be maintained on file with a business’s COVID-19 documentation.

3. What about California Air Resources Board (CARB) approval?

CARB tests PACs for ozone generation and electrical safety, but not for actual particle capture capabilities. All PACs used in the State of California must have CARB approval, but this **does not** replace CADR Testing or its demonstrated equivalent for COVID-19.

4. How do I know what size of PAC to purchase for my business?

Choose a PAC that has a CADR that is large enough for the size of the room or area in which you will use it. A larger CADR relative to the room size will increase the effectiveness of the PAC. There are multiple methods to determine the appropriate size PAC(s) with varying degrees of difficulty. More complex methods typically result in more precise answers and possibly allow for the use of quieter, smaller capacity PACs which may cost less. Listed in order of complexity from simplest to most complex:

1. AHAM’s “2/3rd” rule

The authors of the CADR standard suggest that a unit should have a CADR at least 2/3 of the room’s floor area (in square feet), with adjustments made if the room’s ceiling is more than eight feet in height. For COVID-19 purposes the unit’s CADR for Dust (Marked with “1” on the



Figure 1 Samples of AHAM “Verifide” label) should be used. For example, a **300 square foot room would require a PAC with a CADR for dust of 200 or more.**

2. AHAM’s Suggested Closed Room Size (SCRS) with adjustments for room height

If you have ceilings higher than 8’, you’ll want an air cleaner rated for a larger room. The following formula can be used to calculate the needed SCRS. SCRSs can be found on an PACs VERIFIDE label (Marked with “2” on the Figure 1 sample of AHAM “VERIFIDE” Label), the AHAM directory of air cleaners, or the PAC manufacturer’s literature.

$$\text{Target SCRS} \geq \text{Room Floor Area (in Square Feet)} \times (\text{Actual room height in Feet}/8)$$

For example, if you have a 310 square foot room with 12-foot ceilings you would need to select a PAC with a SCRS of 465 or more (310 square feet x (12 feet/8 feet) = 465 SCRS).

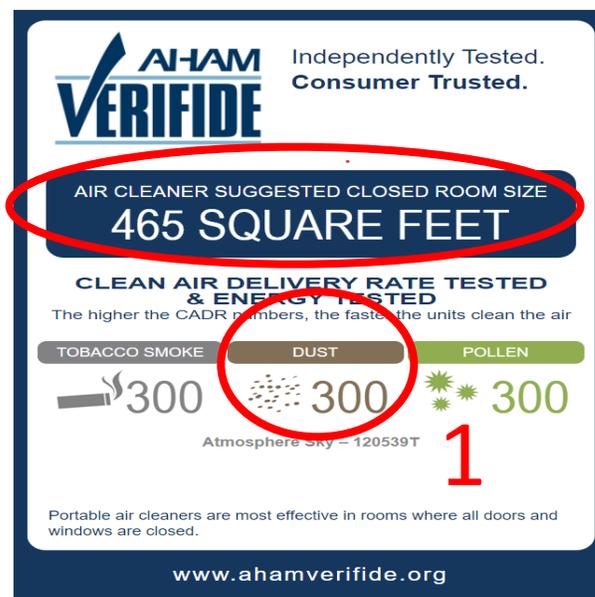


Figure 1 – Samples of AHAM “Verifide” Labels

3. CADR calculation based on desired air changes

Air change rates expressed as Air Changes per Hour (ACH) are used to describe outdoor air ventilation rates (i.e. how quickly outdoor air is delivered to indoor spaces). A combination of outdoor air ventilation and supplementary air cleaning by PACs can be used to achieve suggested ACHs.

You can calculate the required PAC CADR by entering suggested ACH and room volume using the following equation:

$$\text{PAC CADR} = (\text{ACH}/60) \times \text{room volume in cubic feet}$$

For COVID-19 the following are **suggested** minimum ACH values:

>2 for rooms and areas which already have excellent ventilation which you want to supplement,



>4 for rooms and areas which have Building Code compliant ventilation that you want to increase because of COVID-19, and

>6 for rooms and areas which have poor ventilation which need improvement for continued occupancy during COVID-19

4. Use an online PAC Calculator

Online calculators can be used to determine air cleaner size needed for a room and whether your combined PAC air cleaning and ventilation is meeting your target for air quality. The Harvard School of Public Health and the University of Colorado Boulder have jointly developed a [spreadsheet](#) which contains detailed explanations regarding PAC needs and parameters. Although intended for schools it can be used in a number of other settings. A simpler, more results-oriented spreadsheet calculator is available [here](#); it will allow you to calculate the required CADR based on your room size and desired level of air cleaning, see what a PAC is doing in a room based on its CADR, calculate the impact of multiple air cleaners, and select a PAC's based on Suggested Closed Room Size (SCRS) adjusted for room height

5. What is an Air Change per Hour (ACH) and what are they used for?

ACH is a calculated, theoretical value which allows ventilation rates and equipment to be compared, and guidelines to be set for rooms with different dimensions.

Using English units (feet) the **basic formula for ACH** is:

$$\text{ACH} = (\text{fresh ventilation rate in cubic feet per minute (CFM)} \times 60 \text{ minutes/hour}) / \text{room volume in cubic feet}$$

For **PACs the formula** becomes:

$$\text{ACH} = (\text{PAC CADR} \times 60 \text{ minutes/hour}) / \text{room volume in cubic feet}$$

For COVID-19 the following are **suggested** minimum ACH values:

>2 for rooms and areas which already have excellent ventilation which you want to supplement,

>4 for rooms and areas which have Building Code compliant ventilation that you want to increase because of COVID-19, and

>6 for rooms and areas which have poor ventilation which need improvement for continued occupancy during COVID-19

Although ACH represents the number of room volumes of air that a PAC or ventilation system filters or replaces in one hour it is considered to be purely theoretical because effective ventilation



depends on where air is introduced and removed from the room and how much mixing of fresh air is occurring within the room.

6. Do I need a PAC for each room or is one enough?

PACs will only work within the four walls of a room. You may also need more than one PAC in a room depending on how large the space is and how many air changes you need. You therefore need at least one PAC per enclosed space or room. Using multiple small PACs are more effective than a single large capacity unit as contaminant distribution is not uniform.

7. How and where should I place my PACs?

Air cleaners should be placed towards the center of where occupants sit so the clean air reaches their breathing zone without blowing air from person to person. PACs may be used in highest density occupant areas or areas where occupants may be unmasked. Avoid placing units in unused corners of rooms, beneath tables or near objects which obstruct air flow.

8. How long should I run my PAC?

You should operate your PAC for the entire time a room is occupied plus 1-2 hours afterwards if feasible. Increasing the amount of time a PAC runs at higher fan speeds increases air filtration. PACs do not instantaneously clean air so should be continuously run even during intermittent occupancy.

9. What about PACs with ultraviolet lights, ion generators, or free radical generators?

PACs with supplemental technologies such as ultraviolet lights, and ion/"free-radical" generators have not been independently or systematically assessed for effectiveness against COVID-19 and are generally not recommended. Some of these devices may produce byproducts that can cause adverse health effects.

10. What about noise levels and PACs?

Noise ratings may be reported on some PAC product packaging or literature. There is currently no standardized manner for reporting noise levels so it can be challenging to compare devices based on noise rating. Operating a PAC at high speed will increase the noise level created by the PAC. When operated at lower speeds the noise level will decrease but the PAC is no longer cleaning air at the labeled CADR or SCRS. At the very minimum, the PAC should be operated at high speed whenever a room is vacant, at the highest speed room occupants can tolerate.

11. Do PACs work with my windows open?

Yes, PACs can be used with open windows to achieve suggested ACH; it is suggested in such situations that the PACs be located away from the windows, so they aren't cleaning already clean outside air. If open windows or mechanical ventilation provide good ventilation (adequate ACH), the added benefit of the PACs may be negligible. A rule of thumb that helps ensure PACs are effective at supplemental air cleaning in ventilated spaces is to make sure that the ratio of ACH



provided by supplementary air cleaning to ACH provided by outdoor air ventilation is at least 2:1 (i.e. there should be 2 or more ACH from PACs for every 1 ACH from outdoor air ventilation). While windows and other sources of natural ventilation should be open as much as possible to achieve suggested ACH, they may be closed because of occupant comfort. When closed, additional air cleaning may be needed from PACs.

12. What are some other considerations for selecting a PAC?

Besides the ability to provide the needed air cleaning some of other considerations for PAC selection include physical dimensions, weight, and cost to maintain and replace filters.

13. Resources

San Francisco Department of Public Health (SFPDH)

- www.sfgdcp.org/covid19
- www.sfgdcp.org/COVID-Ventilation

Centers for Disease Control

- [Operating schools during COVID-19: CDC's Considerations](#)
- [Wildfire Smoke and COVID-19: Frequently Asked Questions and Resources for Air Resource Advisors and Other Environmental Health Professionals](#)

Association of Home Appliance Manufacturers

- [Directory of Certified Portable Air Cleaners](#)
- [Information Regarding Portable Air Cleaner Testing](#)

Environmental Protection Agency (EPA)

- [Ventilation and COVID-19](#)
- [Indoor Air in Homes and COVID-19](#)
- [Air Cleaners and Air Filters in the Home](#)

Harvard University School of Public Health and University Colorado, Boulder School of Engineering

- [Harvard-CU Boulder Portable Air Cleaner Calculator for Schools](#)

California Air Resources Board (CARB)

- [List of CARB-Certified Air Cleaning Devices](#)