ASHRAE

STANDARD

ANSI/ASHRAE Standard 52.2-2017
(Supersedes ANSI/ASHRAE Standard 52.2-2012)
Includes ANSI/ASHRAE addenda listed in Appendix H

Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size

See Informative Appendix H for approval dates by the ASHRAE Standards Committee, the ASHRAE Technology Committee, and the American National Standards Institute.

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ANSI/ASHRAE Standard 52.2-2017, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size

NOTE

Approved addenda, errata, or interpretations for this standard can be downloaded free of charge from the ASHRAE website at www.ashrae.org/technology.

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FOREWORD

ANSI/ASHRAE Standard 52.2-2017 incorporates addenda to the 2012 edition. The goal of the committee was to improve the end-user experience by standardizing reporting or improving the robustness of the test method to reduce variability. The committee's intentions were to provide the best possible information for the end user to select the best air-cleaning devices to protect people and equipment.

Historically, standards for testing air cleaners have been developed in response to the needs of the times. Protection of machinery and coils came first, then reduction of soiling. Now concerns about indoor air quality and respirable particles, protection of products during manufacturing, and protection of HVAC equipment have prompted development of this test standard based on particle size.

Standards Project Committee (SPC) 52.2 was first organized in 1987 to develop a particle size test procedure but was disbanded in 1990 after it became evident that basic research was needed. In 1991, a research contract (ASHRAE Research Project 671, Informative Appendix A, Reference A2) was awarded to review test methodology and recommend approaches for obtaining particle size efficiency data. After the research project was completed and accepted in 1993, SPC 52.2 was reactivated with members representing a broad range of interests. The standard was then formally published in 1999. Changes to the method have been made over the years to improve it and to make it more relevant. The 2017 edition continues that tradition. Appendix H includes a full list of changes by addendum:

a. *Modifications were made to the MERV table to adjust the threshold for specific MERVs and allow for the 16 graduations to be more observable in testing.*
b. *To address user concerns about reproducibility and reliability of the test method, ASHRAE commissioned Research Project RP-1088, a comprehensive round robin of multiple labs, including multiple levels of filtration performance. The changes in the 2017 edition of the standard are based on direct recommendations of the research project.*
c. *Changes were made with the intent of making the data on reports more mandatory. The goal of the committee was to improve user experience by ensuring that reports being provided by labs and manufacturers would share the same data, allowing for a simpler evaluation of products.*
d. *New Informative Appendix K uses the base methodology to test across sequenced filters. This allows users a method of testing their system in a controlled lab environment.*

Description of Standard

This standard addresses two air-cleaner performance characteristics of importance to users: the ability of the device to remove particles from the airstream and its resistance to airflow. Air-cleaner testing is conducted at airflow rates not less than 0.22 m^3/s (472 cfm) nor greater than 1.4 m^3/s (3000 cfm).

A sample of air from a general ventilation system contains particles with a broad range of sizes having varied effects, sometimes dependent on particle size. Coarse particles, for example, cause energy waste when they cover heat transfer surfaces. Fine particles cause soiling and discoloration of interior surfaces and furnishings as well as possible health effects when inhaled by occupants of the space. When air cleaners are tested and reported for efficiency in accordance with this standard, there is a basis for comparison and selection for specific tasks.

The test procedure uses laboratory-generated KCl particles dispersed into the airstream as the test aerosol. A particle counter measures and counts the particles in 12 size ranges, both upstream and downstream, for the efficiency determinations.

This standard also delineates a method of loading the air cleaner with synthetic dust to simulate field conditions. A set of particle size removal efficiency (PSE) performance curves at incremental dust loading is developed and, together with an initial clean performance curve, is the basis of a composite curve representing the minimum performance in each size range. Points on the composite curve are averaged and the averages are then used to determine the minimum efficiency reporting value (MERV) of the air cleaner.

Coarse air cleaners may be tested for particle size removal efficiency when they are clean, with results reported in the prescribed format. (An example of a coarse air cleaner is the so-called "furnace" filter, a flat panel with a cardboard frame and spun glass fiber media.) However, the standard also provides the basis for evaluation using the loading dust efficiency by weight, or "arrestance," as well as an estimate of predicted life called "dust holding capacity."

Electronic Air Cleaners

Some air cleaners, such as externally powered electrostatic precipitators (also known as electronic air cleaners), may not be compatible with the loading dust used in this test method. The dust contains very conductive carbon that may cause electrical shorting, thus reducing or eliminating the effectiveness of these devices and negatively affecting their MERVs. In actual applications, the efficiency of these devices may decline over time, and their service life is dependent on the conductivity and the amount of dust collected.

Passive Electrostatic Fibrous Media Air Filters

Some fibrous media air filters have electrostatic charges that may be either natural or imposed on the media during manufacturing. Such filters may demonstrate high efficiency when clean and a drop in efficiency during their actual use cycle. The initial conditioning step of the dust-loading procedure described in this standard may affect the efficiency of the filter but not as much as would be observed in actual service. Therefore, the minimum efficiency observed during testing may be higher than that achieved during actual use.

Not an Application Standard

Users should not misinterpret the intent of this standard. This is a test method standard, and its results are to be used to directly compare air cleaners on a standardized basis irrespective of their applications. Results are also used to give the design engineer an easy-to-use basis for specifying an air cleaner. It is entirely possible that an industry organization may use this test method as the basis for an application standard with, for example, different final resistances.

Footnotes are used throughout this standard to provide nonmandatory guidance for the user in addition to the nonmandatory guidance found in the informative appendices. Footnotes are for information only and are not part of the standard.

Acknowledgments

SSPC 52.2 wishes to acknowledge with thanks the contributions of many people outside the voting membership, including European filtration authorities who made suggestions through the committee's international member. We are also indebted to the many media/filter manufacturers and third-party companies that have supported the committee by providing access to skilled and informed volunteers.

1. PURPOSE

This standard establishes a test procedure for evaluating the performance of air-cleaning devices as a function of particle size.

2. SCOPE

2.1 This standard describes a method of laboratory testing to measure the performance of general ventilation air-cleaning devices.

2.2 The method of testing measures the performance of air-cleaning devices in removing particles of specific diameters as the devices become loaded by standardized loading dust fed at intervals to simulate accumulation of particles during service life. The standard defines procedures for generating the aerosols required for conducting the test. The standard also provides a method for counting airborne particles of 0.30 to 10 µm in diameter upstream and downstream of the air-cleaning device in order to calculate removal efficiency by particle size.

2.3 This standard also establishes performance specifications for the equipment required to conduct the tests, defines methods of calculating and reporting the results obtained from the test data, and establishes a minimum efficiency reporting system that can be applied to air-cleaning devices covered by this standard.

3. DEFINITIONS AND ACRONYMS

3.1 Definitions. Some terms are defined below for the purposes of this standard. When definitions are not provided, common usage shall apply (see Informative Appendix G, Reference 1).

aerosol particle counter (OPC): an instrument that samples, counts, and sizes aerosol particles. While several different technologies exist for aerosol particle counters (e.g., optical, aerodynamic, electrostatic mobility), only optical aerosol particle counters based on light scattering are used in this standard. Optical aerosol particle counters are often referred to as "OPCs" and, when the particles are sized into a number of sizing channels, are also sometimes referred to as "aerosol spectrometers."

airflow rate: the actual volume of test air passing through the device per unit of time, expressed in m^3/s (ft^3/min [cfm]), to three significant figures.

arrestance (A): a measure of the ability of an air-cleaning device with efficiencies less than 20% in the size range of 3.0 to 10.0 µm to remove loading dust from test air. Measurements are made of the weight of loading dust fed and the weight of dust passing the device during each loading step. The difference between the weight of dust fed and the weight of dust passing the device is calculated as the dust captured by the device. Arrestance is then calculated as the percentage of the dust fed that was captured by the device.

average arrestance (A_{avg}): for an air-cleaning device with efficiencies less than 20% in the size range of 3.0 to 10.0 µm, the average value of the arrestances made on the device during the loading test, weighted by the amounts of dust fed to the device during each incremental dust loading step.

charge neutralizer: a device that brings the charge distribution of the aerosol to a Boltzman charge distribution. This represents the charge distribution of the ambient aerosol.

coefficient of variation (CV): standard deviation of a group of measurements divided by the mean.

correlation ratio data acceptance criteria: criteria used to determine the adequacy of the correlation data, further defined in Section 10.6.2.

correlation ratio (R): the ratio of downstream to upstream particle counts without the test service installed in the test duct. It is determined from the average of at least three samples. This ratio is used to correct for any bias between upstream and downstream sampling and counting systems, and its calculation is described in Section 10.3.

device: throughout this standard the word *device* refers to air-cleaning equipment used in general ventilation for the removal of particles—specifically, the air cleaner being tested.

disposable air filters: filters that are designed to operate through a specified performance range and then be discarded and replaced.

dust holding capacity (DHC): the total weight of the synthetic loading dust captured by the air-cleaning device over all of the incremental dust loading steps.

dust increment: the amount of dust fed during a definite part of the loading procedure.

face area: the gross area of the device exposed to airflow. This area is measured in a plane perpendicular to the axis of the test duct or the specified direction of airflow approaching the device. All internal flanges are a part of this area, but items such as mounting hardware and electrical raceways normally mounted out of the airstream are not included. Face area is measured in m^2 (ft^2) to three significant figures.