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ANSI/ASHRAE Standard 52.2-2025
Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size

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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

The 2024 edition of ANSI/ASHRAE Standard 52.2-2024 includes a new Informative Appendix I that adds an optional method for bioaerosol testing of devices, other than UV, using a Standard 52.2 duct with aerosolized microorganisms. A new $PM(X)_{52.2}$ particle removal efficiency is added based on particle mass for three sizes of particles. The effects of particulate matter (PM) on human health have been extensively studied in the past decades. The results are that fine dust can be a serious health hazard, contributing to or even causing respiratory and cardiovascular diseases. For the outdoor environment, the U.S. Environmental Protection Agency (EPA), the World Health Organization (WHO), the European Union, and other national agencies have established acceptable air-quality standards according to concentrations of particulate matter classified per their aerodynamic sizes, defined as PM2.5 and PM10, and measured according to strict prescriptive methods and sampling times. As there is growing interest in relating indoor air quality to outdoors, Standard 52.2 adds the calculated filter efficiency measured with an optical diameter between 0.3 and 10 μm. The calculated efficiency, based on the E1 (0.3–1.0), E2 (1.0–3.0), and E3 (3.0–10.0) ranges, is $PM1_{52.2}$, $PM2.5_{52.2}$, $PM10_{52.2}$. The PM "52.2" designation is not the same as the EPA PM mainly due to different size cut off ranges and different particle measurement methods. Although not exactly equivalent to the EPA PM size designation, PM 52.2 will give reasonable approximation. Finally, terminology in Section 3 of the standard has been substantially updated to improve clarity, and a new Informative appendix K is add to map appendicies in the 2025 edition to those in the 2017 edition.

Description of Standard

This standard addresses two performance characteristics of importance to users: the ability of the air cleaner 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 removal 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 removal 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.

Low-efficiency 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 low-efficiency air cleaner is the so-called "furnace" filter, a flat panel with a cardboard frame and spun-glass fibrous 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 (ESPs, which are one example of 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 air cleaners and negatively affecting their MERVs. In addition, ESPs do not increase in resistance to airflow, so the dust loads of 52.2 cannot be done per the method. In actual applications, the removal efficiency of these air cleaners may decline over time.

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 to airflow.

Informative notes are included throughout this standard to provide nonmandatory guidance for the user in addition to the nonmandatory guidance found in the informative appendices. These notes 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. TERMINOLOGY

3.1 Definitions. Some terms are defined below for the purposes of this standard. When definitions are not provided, common usage shall apply.

aerosol: solid and/or liquid particles suspended in air.

air cleaner: device or system for removing contaminants from air in a ventilation system, building, or other enclosed space. (***Informative Note:*** Air cleaners include, but are not limited to, filters. In the context of this standard, an air cleaner is a duct-mounted device used to remove particles.)

airflow rate: the volume of air passing through an air cleaner under test per unit of time; expressed in m^3/s (ft^3/min [cfm]).

arrestance (A): a measure of the ability of an air cleaner to remove a standard test dust from the air passing through it under given operating conditions; expressed as a weight percentage.

average arrestance (A_{avg}): ratio of the total amount of loading dust retained by an air cleaner to the total amount of dust fed up to final test pressure differential.

bioaerosol: system of viable particles suspended in air. (***Note:*** Viable particles include fungi, bacteria, and viruses.)

captured dust release rate: the particle count in a given size range shed from a filter per particle-counter sample volume and sample time after dust loading.

charge neutralizer: a device that brings the charge distribution of a test aerosol to a Boltzman charge distribution (i.e., the average charge found in the ambient air).

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