

ANSI/ASHRAE 52.1-1992

ASHRAE[®] STANDARD

AN AMERICAN NATIONAL STANDARD

Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter

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**AMERICAN SOCIETY OF HEATING,
REFRIGERATING AND
AIR-CONDITIONING ENGINEERS, INC.**

1791 Tullie Circle, NE • Atlanta, GA 30329

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Cognizant TC: TC 2.4, Particulate Air Contaminants
and Particulate Contaminant Removal Equipment
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1. PURPOSE

To establish test procedures for evaluating the performance of air-cleaning devices for removing particulate matter, to establish specifications for the equipment required to conduct the tests, to define methods of calculation from the test data, and to establish formats for reporting the results obtained.

2. SCOPE

This standard establishes procedures to measure the ability of air-cleaning devices to remove dust as they become loaded with a standard synthetic dust. The dust-removal performance is measured in two ways: first by the percentage of the weight of the synthetic dust captured by the filter (ASHRAE weight arrestance) and second by comparing the blackening of targets both upstream and downstream of the air-cleaning device using ambient atmospheric dust (ASHRAE dust-spot efficiency).

The procedures in this standard do not measure the ability of the air cleaner to remove particles of specific diameters.

This standard is not intended for testing air cleaners exhibiting ASHRAE dust-spot efficiencies of greater than 98%.

3. GENERAL

The three performance characteristics of greatest interest to users of air cleaners are the ability of the cleaner to remove particulates from the airstream, its resistance to airflow, and its operating time before cleaning or replacement is required.

Airborne dust at any one location has a broad range of particle sizes. The effects of dust in building ventilation systems depend on particle size. Coarse dust, for example, will eventually plug finned cooling coils; fine dusts discolor surfaces. Lint can blind cooling coils and prefilters and significantly shorten or lengthen filter life. Different types of air cleaners are needed to cope with these problems.

This standard defines a procedure (ASHRAE weight arrestance) for measuring the ability of air cleaners to remove the coarser fraction of airborne dust. Another procedure is defined (ASHRAE dust-spot efficiency) for measuring the ability of air cleaners to reduce the staining potential of atmospheric dust.

The term "efficiency" is often used to refer to the percentage of dust removed by an air cleaner regardless of the measurement method; this standard has adopted different terms to avoid confusing the two procedures. The text usually shortens these terms to "arrestance" and "efficiency." The terms "air cleaner" and "air filter" are used interchangeably.

For the arrestance measurement, a relatively coarse synthetic test contaminant is fed to the filter and the percentage of the weight of that contaminant removed from the airstream is measured. Both the average particle diameter and the concentration of this test dust are considerably larger than for typical atmospheric dusts.

For the dust-spot efficiency test, the standard uses ambient atmospheric dust at the test duct inlet.

The dust collected by an air filter alters its performance. In general, at a given airflow, the more dust collected the more pressure drop across the filter. Pressure drop (resistance) in most cases determines the point at which the filter is changed or cleaned and is therefore an important characteristic of the filter. An attempt is made in this standard to characterize the performance changes due to dust loading. The same synthetic contaminant used for arrestance measurement is fed to the filter to determine resistance change. This feeding is interrupted periodically to measure the weight of dust fed, resistance, dust-spot efficiency, and arrestance. Since the contaminant used for loading is not typical of natural atmospheric dust, its effects on the filter may not be the same as an equal amount of atmospheric dust. The value of the loading test is for rating and to some extent ranking filters. The performance values obtained in accordance with the standard cannot be used by themselves to predict the air cleanliness of a specific ventilated space or the service life of an installed filter.

The standard defines uniform test apparatus, test procedures, and reporting requirements. Because of the possibility of user confusion between the types of performance tests, the standard states that all performance tests applicable to the filter type must be carried out and values for each performance characteristic reported. The standard allows filters with low dust-spot efficiencies to be reported as having "less than 20% ASHRAE dust-spot efficiency" without performing that test.

4. DEFINITIONS

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

ASHRAE arrestance: a measure of the ability of a device to remove ASHRAE dust from test air. The weight of ASHRAE dust fed and the weight of dust passing the device during a time interval are first measured. Arrestance is then the percentage of the dust captured by the device expressed to an accuracy of two significant figures. Within this standard, the tag "ASHRAE" is dropped to save space; elsewhere, all references to tests claiming to be made by this standard must carry the complete designation.

ASHRAE atmospheric dust-spot efficiency: a measure of the ability of the device to remove atmospheric dust from the test air. The measurement is made by comparing the light transmission of stains on paper targets sampling air upstream and downstream of the device. Atmospheric dust-spot efficiency is reported to an accuracy of two significant figures expressed in percent. Within this standard, the tags "ASHRAE" and "atmospheric" are dropped to save space; elsewhere, all references to tests claiming to be made by this standard must carry the complete designation.

ASHRAE synthetic arrestance dust: a compounded test dust consisting by weight of 72% standardized air cleaner test dust, fine; 23% powdered carbon; and 5% No. 7 cotton linters. Specifications for these components are