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ANSI/ASHRAE Standard 145.2-2025
Laboratory Test Method for Assessing the Performance of Gas-Phase Air-Cleaning Systems: Air-Cleaning Devices

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Preview

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 air processed by building HVAC systems typically contains a variety of compounds in gaseous form. The concentrations of these compounds may vary from trace amounts in most cases to the toxic levels that can be encountered near a spill or other extraordinary event. Whenever gaseous compounds reach unacceptable levels, or may be expected to reach such levels, air cleaning may be used to improve the usability of the space or to protect the building occupants, HVAC system components, or contents of the building. These concerns exist not only for commercial buildings but for industrial workspaces as well.

This standard provides a performance test method both for individual air cleaners and for complete devices designed to be used for full-scale commercial in-duct gaseous-compound air cleaning.

This standard describes a test procedure with quality-control constraints to measure percent removal efficiency for a relatively low-concentration challenge and by-product production levels of gaseous-compound removal devices when challenged under steady-state conditions. This removal efficiency is intended to be used for the E_f variable required in the IAQ Procedure of ANSI/ASHRAE Standard 62.1. After the low concentration efficiency test, the procedure moves to either an extended low-concentration test period or to a removal capacity test. The extended low concentration efficiency test is intended for electronic air cleaner (EAC) devices (nonsorbent) to show longer-term stable performance. The capacity test is designed to simulate the capture performance of commercially available sorbent-based HVAC filters under controlled, representative conditions. Sorbent-based air cleaners often have a high removal efficiency initially but lower efficiency over time. The capacity test allows comparison across sorbent air cleaners. This test could be applied to other devices that have good efficiency at high concentrations.

The air cleaners to be tested using this standard are intended to remove gaseous compounds that are present at low-to-modest levels and nuisance odors, thereby protecting building occupants, contents, and processes and reducing corrosion. The test end point may be a chemical breakthrough that exceeds a minimum removal efficiency or a time limit. This test may be used to evaluate filters/devices for use in a building designed and/or operated according to the ASHRAE Standard 62.1 IAQ procedure. This test method is not intended to test filters whose function is to protect against extraordinary events producing gaseous chemicals that are immediately threatening to the health of building occupants.

A companion small-scale, low-flow-rate version of this test procedure—ANSI/ASHRAE Standard 145.1, Laboratory Test Method for Assessing the Performance of Gas-Phase Air-Cleaning Systems: Loose Granular Media—provides comparable sorptive granular media challenges at a much lower nominal flow rate of 1.7 m^3/h (28.32 L/min, or 1.0 ft^3/min). This smaller scale provides a lower potential operator exposure and, with its much smaller footprint, is much more amenable to local exhaust venting and allows relatively easy cleanup. The Standard 145.1 test method does not apply to EACs.

The test challenge compounds used may be hazardous, so the safety of those conducting the tests is of paramount importance. The primary personal hazard associated with the test method is inadvertent inhalation. This procedure incorporates steps designed to reduce personal inhalation exposures, and these should be followed carefully. Merely following these steps does not, however, ensure safe operation.

Each test organization is responsible for training, equipping, protecting, and monitoring the exposure of its personnel.

The laboratory test apparatus, equipment, test protocol, quality control guidelines, and equipment calibration recommendations provided are intended to achieve repeatability within ±10% of the measured value. Where possible, the method specifies the performance required of hardware and instrumentation rather than prescribing the specific characteristics of these items in detail.

This test method was not developed to allow accurate test chemical measurement from saturated airstreams, so water scrubbers and similar technologies cannot be tested by this method.

The testing under this methodology can be conducted by modifying (e.g., adding temperature and relative humidity [RH] control and instrumentation) some large-scale rigs designed previously for testing per ANSI/ASHRAE Standard 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size. This adds versatility to the apparatus, allows switching back and forth between particle and gas testing, and increases the overall testing cost-effectiveness. Thus, many of the requirements for Standard 52.2 are retained for this gas cleaner method and are cited by reference to this earlier docu-

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ment, rather than repeating them verbatim. Additionally, some characterization testing, such as challenge compound dispersal uniformity ahead of the test substrate, if previously conducted for Standard 52.2 and found to be acceptable prior to the gas-phase testing, is accepted as sufficient for the gas testing of this standard as well.

The most useful performance data for gaseous-compound air-cleaning devices are those obtained at the design airflow rate when challenged with the chemical contaminating the space and at the use conditions. The results of such a test best determine the air cleaner lifetime that can be expected. Many applications require control of mixed compounds present at very low levels for extended periods (months), and in this case, the test becomes excessively expensive. On the other hand, a test can be conducted according to this standard at a fixed flow rate, temperature, RH, and at an elevated challenge concentration relative to expected use levels. Such a test is shorter, reducing testing cost, but the test results are directly useful only for ranking different air cleaners. A substantial body of theory and data supports extrapolation of breakthrough times for many physically adsorbed hydrocarbons across several orders of magnitude in concentration. Such extrapolation is not generally accepted for chemisorbed chemicals such as the acid gases or for the performance of EACs.

Test challenge concentrations and conditions allowable under this method are presented in detail in the main sections of this standard.

1. PURPOSE

The purpose of this standard is to provide a standard laboratory test method for assessing the performance of gas-phase air-cleaning devices. The results of these tests can provide information to the engineer useful for the design and selection of air-cleaning equipment and the design of air-cleaning systems for controlling indoor concentrations of gaseous air contaminants.

2. SCOPE

2.1 This standard prescribes a full-scale laboratory test method for measuring the performance of in-duct gas-phase air-cleaning devices. This test is conducted under steady-state conditions at elevated gas challenge concentrations (relative to ventilation applications) and, therefore, shall be used to compare devices rather than directly predict performance in any particular application.

2.2 The method of testing measures the performance of air-cleaning devices for removing one or more specified gaseous contaminants or gas mixtures intended to simulate operation during service life. This standard defines procedures for the dispersion of the gases required for conducting the test. It also provides a method for determining gas concentrations upstream and downstream of the air-cleaning device to calculate removal efficiency.

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

2.4 The test method defined by this standard is applied to a sample device that is assumed to be representative of other devices marketed with the same brand and model number.

2.5 This standard does not apply to stand-alone room air cleaners.

3. DEFINITIONS, ACRONYMS, AND ACCEPTED SAMPLING AND ANALYTICAL METHODS

3.1 Definitions. Key terms are defined below for the purposes of this standard. Definitions for "adsorbent" and "challenge compound" are taken from IS0 29464.[1] For definitions not provided here, refer either to ASHRAE Terminology [2] or to ASTM *Standard Terminology Relating to Activated Carbon*.[3] Otherwise, common usage shall apply.

absorption: transport and dissolution of one substance into another to form a mixture having the characteristics of a solution.

adsorbent: material having the ability to capture and retain gases or vapors on its surface by physical or chemical processes.

adsorption (physical): process in which molecules of a gas or vapor adhere by physical processes (Van der Waals forces) to the surface, both the outer surface and the inner pore surfaces, of a solid substance. [***Informative Note:*** This is a reversible process under specific conditions.]

air cleaner: device used to remove airborne impurities from air. [***Informative Note:*** In the context of this standard, "airborne impurities" refers to gaseous compounds.]