



Designation: D5438 – 23

Standard Practice for Collection of Floor Dust for Chemical Analysis¹

This standard is issued under the fixed designation D5438; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

1. Scope

1.1 This practice covers a procedure for the collection of a sample of dust from carpets and bare floors that can be analyzed for inorganic metals such as lead and organic compounds such as pesticides and other semi-volatile organic compounds (SVOCs).

1.2 This practice is applicable to a variety of carpeted and bare floor surfaces. It has been tested for level loop and plush pile carpets and bare wood floors, specifically. This practice is not applicable to elevated, non-floor surfaces.

1.3 This practice is not intended for the collection and evaluation of dust for the presence of asbestos fibers.

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.5 This practice describes use of a sampling device, the High-Volume Small Surface Sampler (HVS3). Other event-based sampling devices that use commercially available vacuum attachments are not in scope. Composite sampling using whole vacuum cleaner bags is not in scope. Other approaches for floor or non-floor surface sampling (Practices [D6966](#), [D6661](#), [D7144](#)) are not within the scope.

1.6 This practice only applies to the HVS3. Other dust sampling methods may or may not be directly comparable. Method evaluation for other dust sampling approaches is encouraged. This could be done by comparison with methods outlined in this standard practice for HVS3 or through independent evaluation using field spikes and certified reference materials.

1.7 This practice provides information on dust loading, chemical dust concentration, and chemical dust loading. Information on the type of floor, the floor surface area sampled, and amount of dust collected is required (see Fig. 2). Cleaning the vacuum attachments in between sampling events is also required (see Section [13](#)).

1.8 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.9 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

[D422](#) Test Method for Particle-Size Analysis of Soils (Withdrawn 2016)³

[D1356](#) Terminology Relating to Sampling and Analysis of Atmospheres

[D6661](#) Practice for Field Collection of Organic Compounds from Surfaces Using Wipe Sampling

[D6966](#) Practice for Collection of Settled Dust Samples Using Wipe Sampling Methods for Subsequent Determination of Metals

[D7144](#) Practice for Collection of Surface Dust by Microvacuum Sampling for Subsequent Determination of Metals and Metalloids

[E1](#) Specification for ASTM Liquid-in-Glass Thermometers

[E337](#) Test Method for Measuring Humidity with a Psychrometer (the Measurement of Wet- and Dry-Bulb Temperatures)

[E1137/E1137M](#) Specification for Industrial Platinum Resistance Thermometers

[E1195](#) Test Method for Determining a Sorption Constant (K_{oc}) for an Organic Chemical in Soil and Sediments (Withdrawn 2013)³

[E2251](#) Specification for Liquid-in-Glass ASTM Thermometers with Low-Hazard Precision Liquids

¹ This practice is under the jurisdiction of ASTM Committee [D22](#) on Air Quality and is the direct responsibility of Subcommittee [D22.05](#) on Indoor Air.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ The last approved version of this historical standard is referenced on www.astm.org.

F608 Test Method for Evaluation of Carpet Embedded Dirt Removal Effectiveness of Household/Commercial Vacuum Cleaners

3. Terminology

3.1 *Definitions*—For definitions of terms used in this practice, refer to Terminology **D1356**.

3.1.1 *carpet-embedded dust, n*—soil and other particulate matter, approximately 5 µm equivalent aerodynamic diameter and larger, embedded in carpet pile and normally removable by household vacuum cleaners.

3.1.2 *debris, n*—items (that is, bug parts, plastics, foam, matted hair, gravel, etc.) that would not pass through a 2 mm sieve and would not be considered surface dust or carpet-embedded dust.

3.1.3 *particle size fraction bins, n*—the mass of surface dust or carpet-embedded dust present between two particle-size values.

3.1.3.1 *Discussion*—While this standard practice refers to 150 µm, other potential particle-size values such as 20 µm, 63 µm, 75 µm, 250 µm, 1 mm, 2 mm, and others could be used to define particle size fraction bins. See Specification **E1195** for standard number sieves matched to different particle-sizes.

3.1.4 *surface dust, n*—soil and other particulate matter, approximately 5 µm equivalent aerodynamic diameter and larger, adhering to floor surfaces and normally removable by household vacuum cleaners.

4. Summary of Practice

4.1 The sampling method described in this practice is taken from work published in Roberts et al. **(1-3)**,⁴ and Stamper et al. **(4)**. Appendix F of this published report also contains information on the construction of the HVS3 sampler **(5)**.

4.2 Particulate matter is withdrawn from the carpet or bare floor by means of vacuum-induced suction which draws through a sampling nozzle at a specific velocity and flow rate, and the particles are separated mechanically by a cyclone. The cyclone is designed to efficiently separate and collect particles approximately 5 µm mean aerodynamic diameter and larger. However, much smaller particles are also collected at unknown efficiencies. The sampling system allows for height, air flow, and suction adjustments to reproduce systematically a specific air velocity for the removal of particulate matter from carpeted and bare floor surfaces, so that these sampling conditions can be repeated.

NOTE 1—Side-by-side comparison of the HVS3 and a conventional upright vacuum cleaner revealed that both collected particles down to at least 0.2 µm and that the HVS3 was more efficient at collecting particles smaller than 20 µm than conventional vacuum cleaners **(6)**. If desired, a fine-particle filter may be added downstream of the cyclone to collect 99.9 % of particles above 0.2 µm aerodynamic mean diameter.

4.3 The particulate matter in the air stream is collected in a catch bottle attached to the bottom of the collection cyclone.

This catch bottle shall be capped for storage of the sample and transported to the laboratory for analysis.

5. Significance and Use

5.1 This practice may be used to collect dust from carpeted or bare floor surfaces for gravimetric or chemical analysis. The collected sample is substantially unmodified by the sampling procedure.

5.2 This practice provides for a reproducible dust removal rate from level loop and plush carpets, as well as bare floors. It has the ability to achieve relatively constant removal efficiency at different loadings of floor dust.

5.3 This practice also provides for the efficient capture of semivolatile organic chemicals associated with the dust. The test system can be fitted with special canisters downstream of the cyclone for the capture of specific semivolatile organic chemicals that may volatilize from the dust particles during collection.

5.4 This practice does not describe procedures for evaluation of the safety of floor surfaces or the potential human exposure to floor dust. It is the user's responsibility to evaluate the data collected by this practice and make such determinations in the light of other available information.

5.5 This practice provides per-event dust chemical concentration and chemical loading. Advantages and trade-offs of different sampling approaches have been discussed **(7)**.

5.6 This practice uses a removable, cleanable dropout jar that facilitates per-event sampling. Other per-event vacuum attachments are commercially available. These are not directly comparable with composite sampling done using whole vacuum cleaner bags.

6. Interferences

6.1 There are no known interferences to the determination of dust loadings covered by this practice.

7. Apparatus

7.1 *Sampling Apparatus*, which may be constructed from commercially available vacuum cleaners and attachments (as shown in **Fig. 1**):

7.1.1 The dimensions of the sampling apparatus (nozzle size, cyclone diameter, cyclone inlet diameter, etc.) are interdependent. The flow rate must produce a sufficient velocity both at the sampled surface and in the cyclone. The cyclone must have a cut diameter of 5 µm at the same velocity that will provide a horizontal velocity of 40 cm/s at 10 mm from the nozzle in the carpet material, or 5 mm from the nozzle on bare floors. The fundamental principles of this device have been discussed in detail in Roberts et al. **(1-3)**.

7.1.2 *Nozzle*—The edges and corners of the sampling nozzle shall be rounded to prevent catching the carpet material. The nozzle must be constructed to allow for sufficient suction to separate loose particles from the carpet or bare floor and carry them to the cyclone. It must have an adjustment mechanism to establish the nozzle lip parallel to the surface and to achieve the proper suction velocity and pressure drop across the nozzle. A

⁴ The boldface numbers in parentheses refer to the list of references at the end of this standard.