

Standard Laboratory Practice For Quantifying Respirable Particulate Emissions Generated by Residential/Commercial Vacuums and Central Vacuum Systems

1. Scope

- 1.1 This test practice provides a laboratory test for the measurement of respirable particulate generated as a direct result of the vacuuming process.
- 1.2 This test practice is applicable to all residential/commercial upright, canister, central vacuum systems and combination cleaners.
- 1.3 This test practice applies to test dust removal from floor coverings, not the removal of surface litter and debris.
- 1.4 This test practice may involve hazardous materials, operations, and equipment. This test practice does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this test practice to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. Reference Documents

ASTM F2608 Test Method for Determining the Change in Room Air Particulate Counts as a Result of the Vacuum Cleaning Process.

3. Precision & Bias

- 3.1 No precision and bias has been established.

4. Significance & Use

- 4.1 This test practice will determine the amount of respirable particulate from a specific floor covering during the vacuuming process. The amount of dust generated in the laboratory practice will differ from that in residential/commercial installations due to variations in floor covering styles, soil and other solid particulate compositions, the vacuuming process employed by individual operators, the air exchange rate of HVAC systems and other factors.
- 4.2 In order to provide a uniform basis for measuring the performance in 1.1, a

standardized test chamber, equipment, floor covering material and dust particulate are employed in this practice.

5. Apparatus

- 5.1 Conditioned laboratory at $70^{\circ}\text{F} \pm 5^{\circ}\text{F}$ and $50\% \pm 5\%$ relative humidity to be used for sample preparation.
- 5.2 Environmentally Controlled Test Chamber 16' x 8' x 8' nominal dimensions with stainless steel interior, two observation windows on one side and door, externally sealable ports, internal electrical outlet and fluorescent lighting, conditioned and maintained at $70^{\circ}\text{F} \pm 5^{\circ}\text{F}$ and $50\% \pm 5\%$ relative humidity.
- 5.3 LIEBERT MANUFACTURING DATAMATE 850 CFM fan/coil and chilled water module set to maintain $70^{\circ}\text{F} \pm 5^{\circ}\text{F}$ and $50\% \pm 5\%$ relative humidity environmental conditions or other similar equipment capable of maintaining specified conditions.
- 5.4 Purafil 2000 CFM Room Air Purifier containing a Type A HEPA filter with minimum filter efficiency of 99.97% on 0.3 μg particulate.
- 5.5 Electronic air cleaner designed to remove airborne particles down to 0.01 microns. This air cleaner is positioned in the chamber purge system to back up the HEPA filter in 5.4.
- 5.6 Real time aerosol monitor capable of measuring airborne particulate concentrations from 0.1 $\mu\text{g}/\text{m}^3$ to 40 mg/m^3 with resolution to 0.01 mg/m^3 . Data logging averaging periods are 10 sec with report generating maximum, minimum and average particulate emissions concentrations over the duration.
- 5.7 Weighing scale accurate to 0.01 gram and having a capacity of at least 2000 grams.
- 5.8 Ball jar capable of containing a 10 3/8" x 39 3/8" (263 mm x 1000 mm) test specimen.
- 5.9 Solid particulate dispenser. A cylindrical device 1.5" x 1.5" with 18 1/32 holes evenly spaced in two rows centered around the circumference.
- 5.10 Cylindrical ceramic mill stones - quantity 160 of 0.5" diameter/quantity 35 of .813" diameter. ¹
- 5.11 Conveyor with a minimum bed length of 14 feet (4.3 meters) and width of 36" (915 mm). Conveyor must be capable of maintaining specified test speed both forward and reverse. Conveyor bed must be equipped with brackets to hold the test vacuum stationary during testing and the vacuum handle at thirty one and one-half (31.5) inches above the test material.

- 8.3 Mark the test specimen with test identification number.
- 8.4 Prepare test material for conditioning by vacuuming edges to remove loose fibers and latex with a rotating agitator equipped CRI Green Label approved vacuum.
- 8.5 Condition prepared sample a minimum of 16 hours in the standard laboratory conditions prior to testing.

9. Vacuum Cleaner Conditioning

- 9.1 Preconditioning a New Test Vacuum Cleaner - Run the vacuum cleaner in at rated voltage $\pm 1\%$ and rated frequency with filters in place for one (1) hour.
- 9.2 Preconditioning Rotating Agitator Type Vacuum Cleaner in a stationary position. Operate the vacuum cleaner for one (1) hour with the agitator bristles not engaged on any surface.
- 9.3 Preconditioning a Straight-Air Canister Vacuum Cleaner-Operate the vacuum cleaner for one (1) hour with a wide-open inlet (without hose).
- 9.4 Test Vacuum Cleaner Settings. If various settings are provided, set the motor speed setting, suction regulator, nozzle height, or combination thereof using the manufacturer's specifications as provided in the instruction manual for each type of carpet. Contact the manufacturer if no instructions are given, or if the instructions are unclear or inadequate.

10. Procedure.

- 10.1 Prepare test carpet in accordance to 8.
- 10.2 Place Prepared-Conditioned sample in ball jar along with solid particulate dispenser containing 5 grams of ISO Test Dust, quantity 160 of 0.5" diameter/quantity 35 of 0.813" diameter ceramic mill stones.
- 10.3 Run ball jar five (5) minutes ± 10 seconds at 40 RPMs.
- 10.4 Carefully remove test specimen from ball jar to prevent dislodging ISO Test Dust.
- 10.5 Place sample with particulate in template on conveyor in test chamber with pile lean if present, towards the vacuum.
- 10.6 Install vacuum with new bag on the template 4-6 inches in front of the test specimen.
- 10.7 Exit the test chamber and initiate the particulate monitoring devices which

are programmed to take continuous readings throughout the duration of the test.

- 10.8 Energize the chamber purge/room air purifier until the established base line particulate level has reached equilibrium as determined by the particulate monitors.
- 10.9 De-energize both the chamber purge/room air purifier and room conditioning equipment. (Testing is to be conducted in a static environment).
- 10.10 Immediately energize vacuum and monitor emissions for ten (10) minutes \pm 5 seconds.
- 10.11 Set conveyor counter at the proper number of passes to accomplish 10 minutes \pm 5 seconds of back and forth vacuuming at 1.8 ft/sec, then energize conveyor and continue to monitor emissions for an additional ten (10) minutes \pm 5 seconds.
- 10.12 At the conclusion of 10 minutes of vacuuming de-energize the conveyor with the vacuum in its original position, then de-energize the vacuum.
- 10.13 Continue to monitor particulate emissions an additional four (4) minutes \pm 5 seconds after de-energizing the vacuum.
- 10.14 Prior to entering the test chamber, energize the chamber purge/room air purifier, then proceed into the test chamber. Remove test specimen then clean chamber surfaces with HEPA and microfiber cloth vacuum. Install a new vacuum bag if so equipped and new prepared test specimen then repeat 10.1 through 10.13 until the required number of specimens (3) have been tested.

11. Report

- 11.1 Vacuum cleaner manufacturer, model, filter and bag types and other descriptive information.
- 11.2 Complete test material description, fiber type, pile weight and pile height.
- 11.3 Solid particulate type and amount.
- 11.4 Speed of travel of vacuum cleaner expressed in feet/second.
- 11.5 The time and number of passes the vacuum cleaner ran over the test carpet.
- 11.6 Type and model of particulate monitors.
- 11.7 The number of logged points; start time/date; total elapsed run time;

averaging time; data logging averaging period; overall average concentration; overall maximum and minimum concentrations with data point number.

11.8 Peak concentration during vacuuming.

APPENDIX A

ANNEX

(Mandatory Information)

ISO 12103 1, A2 Fine Test Dust Particle Distribution

Cumulative Volume Numeric Data	
Micron Size	% Less Than
1	2.6
2	11.3
3	20.4
4	28.9
5	35.8
7	44.6
10	52.9
20	70.7
40	88.2
80	99.8