Standard Laboratory Test Practice For Evaluation of Carpet Solid Particulate Removal Effectiveness of Residential/Commercial and Central Vacuum Cleaners

The Carpet & Rug Institute

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Standard laboratory practice for evaluation of carpet embedded solid particulate removal effectiveness of residential/commercial and central vacuum cleaners.

1. Scope

1.1 This test practice provides a laboratory test for determining the relative solid particulate removal effectiveness of residential/commercial and central vacuum cleaners when tested under standard conditions.

1.2 This test practice is applicable to all residential/commercial upright, canister, and combination cleaners.

1.3 This test practice applies to solid particulate removal from carpets, not the removal of surface litter and debris.

1.4 This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. Reference Documents

2.1 ASTM F608-97 Evaluation of Carpet Embedded Dirt Removal Effectiveness of Household/Commercial Vacuum Cleaners.

2.2 ASTM E11 Specifications for Wire Cloth Sieves for Testing Purposes

2.3 ASTM D75 Practice for Sampling Aggregates

3. Terminology

3.1 Definitions

3.1.1 *cleanability* - the relative ease with which soils or stains can be removed from material.

3.1.2 *model* - the designation of a group of vacuum cleaners having identical mechanical and electrical construction with only cosmetic or nonfunctional differences.

3.1.3 *repeatability standard deviation* - the standard deviation of test results obtained under repeatability conditions.

3.1.4 *test run* - the definitive procedure that produces a singular measured result.

3.1.5 *unit* - a single vacuum cleaner of the model being tested.

3.1.6 *retained particulate* - the weight of the solid particulate on the test specimen at the initiation of the vacuuming test practice.

3.1.7 *saturation level* - the maximum amount of solid particulate retained by a specific carpet style when applied in accordance with this test practice.

4. Precision & Bias

4.1 No precision and bias has been established.

5. Significance & Use

5.1 This test practice will provide an indication of the capability of a specific vacuum cleaner to remove solid particulate from carpet. The amount of particulate removed in the laboratory practice will differ from that in residential/commercial installations due to variations in carpet styles, soil and other solid particulate composition, the vacuuming process employed by individual operators and other factors.

5.2 In order to provide a uniform basis for measuring the performance in 1.1, standardized test carpets and standardized test solid particulate are employed in this practice.

6. Apparatus

6.1 Weighing scale accurate to 0.01 gram and having a capacity of at least 2000 grams.

6.2 Ball jar capable of containing a 10 3/8" x 39 3/8" (263 mm x 1000 mm) test specimen. The ball jar must have a shaft affixed to the center of the jar parallel to and the width of the test specimen.

6.3 Solid particulate dispenser. A cylindrical device 10 1/4" (260 mm) long x 2 1/8" (55 mm) in diameter, with 1/16" diameter holes spaced at ½" (12.7 mm) increments in a straight line along the bottom. Two rings are affixed to the top edge to hold the solid particulate dispenser parallel with the carpet when placed on the ball mill shaft.

6.4 Conveyor with a minimum bed length of 9 feet (2743 mm) and width of 36" (915 mm). Rigid metal plate affixed to conveyor bed to which carpet template and test specimen are attached. One suitable plate material is 0.25 inch 3003 aluminum. 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 31.5 inches (800 mm) above the test material.

6.5 Tachometer used to calibrate conveyor speed in feet/second.

6.6 Template comprised of the same material as test carpet a minimum of 4" wider than the head of the test vacuum mounted to a rigid metal plate using a full spread of double sided tape.

6.7 Room conditioned and maintained at 70°F ± 5°F and 50% ± 5% relative humidity.

6.8 Upright rotating agitator brush vacuum used during sample preparation.

6.9 Upright rotating agitator brush vacuum used for calibration.

6.10 540 Wedron sand sieved per ASTM D75 used to assure conformance with analysis limits. See Annex.

7. Vacuum Test Material

7.1 RESIDENTIAL CUT PILE[1]		7.2 COMMERCIAL LOOP PILE[2]	
Pile Yarn Weight	25 Oz/Sq Yd ± 7%	Pile Yarn Weight	26 Oz/Sq Yd ± 7%
Color	71107 Light Beige	Color	10830 Multi-Color
Pile Height	.56 Inch	Pile Height	.143 Inch
Gauge	3/16	Gauge	1/8
Stitches/Inch	6.5	Stitches/Inch	8.0
Yarn	1500/2, Heatset, 3.0 tpi x3.0 tpi	Yarn	2120/3, Air Entangled 3050 2 ply
Face Fiber	Nylon 6 (Honeywell)	Face Fiber	Nylon 6 Shaw Extruded Solution Dyed
Treatment	Soil Resist treated (3M Scotchguard)	Treatment	Soil Resist treated (Shaw Generic)
Primary Backing	28 x 11 pick count woven polypropylene	Primary Backing	24 x 13 pick count woven polyprop
Secondary Backing	16 x 5 pick count woven polypropylene	Secondary Backing	woven polypropylene

[1] A suitable carpet is manufactured by Shaw Industries, Inc. Style A3571 Equalizer, Color 71107

[2] A suitable carpet is manufactured by Shaw Industries, Inc. Style 50782 Vocation, Color 10830

8. Conditioning

8.1 Test room - temperature and humidity are maintained in standard laboratory conditions, 70°F ± 5°F and 50% ± 5% relative humidity in which all conditioning and vacuum cleaner testing is done.

8.2 All components involved in the test shall remain and be exposed in the controlled environment for at least 16 hours prior to the start of the test.

9. Test Carpet

9.1 New test carpet shall conform to 5.1 and/or 5.2.

9.2 Cut three samples of each test carpet to a size of 39 3/8" (1000 mm) warp x 10 3/8" (263 mm) Fill.

9.3 Mark the test specimen with test identification number

9.4 Prepare carpet for testing by clipping selvedge edge. Install carpet into template with pile lean if present towards vacuum. Vacuum to remove loose fibers and latex with an upright rotating agitator equipped CRI Green Label approved vacuum, using 10 passes at 1.8 ft./second.

9.5 Place prepared carpet specimens individually on ventilated racks a minimum of 16 hours prior to testing.

10. Test New Vacuum Cleaners

10.1 Preconditioning a New Test Vacuum Cleaner - Run the vacuum cleaner in at rated voltage ± 1% and rated frequency with filters in place for one (1) hour.

10.2 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.

10.3 Preconditioning a Straight-Air Canister Vacuum Cleaner-Operate the vacuum

cleaner for one (1) hour with a wide-open inlet (without hose).

10.4 Set 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.

11. Carpet Solid Particulate Removal Effectiveness Test Practice.

11.1 Prepare test carpet in accordance to 7.

11.2 Weigh test specimen to nearest 0.01 gram. Record this weight as prepared-conditioned sample weight.

11.3 Weigh to the nearest 0.01 gram the new test vacuum bag prior to installation. Record this weight as initial bag weight, then install new bag into vacuum cleaner.

11.4 Place test vacuum on carpet template 4" - 6" in front of test specimen and securely affix to brackets on conveyor with handle height set at thirty one and one-half (31.5) inches above test specimen.

11.5 Place Prepared-Conditioned sample in ball jar along with solid particulate dispenser containing 40 grams of 540 Wedron sand. [3]

11.6 Run ball jar five (5) minutes ± 10 seconds at 40 RPM's.

11.7 Carefully remove test specimen from ball jar to prevent dislodging solid particulate. Reweigh and record this weight as sample weight with particulate.

11.8 Place sample with particulate in template on conveyor with pile lean if present towards the vacuum. Initiate movement of conveyor at 1.8 feet/second, making four shift passes (two forward and two reverse passes covering test material and templates). See 4 shift pass diagram.

11.9 At the end of the last pass allow the vacuum to run on the template carpet approximately ten (10) seconds to clear the system of test solid particulate. De-energize the vacuum, remove the bag and re-weigh. Record this weight as final bag weight.

11.10 Carefully remove test specimen and reweigh. Record this weight as sample weight after vacuuming.

11.11 Install the control vacuum 6.9 at 9.4 after a maximum of every tenth test to check calibration and record results.

12. Calculations

12.1 Prepared-conditioned sample weight
12.2 Initial Bag Weight
12.3 Particulate applied 40 grams
12.4 Sample weight with particulate
12.5 Retained Particulate (#4 - #1)
12.6 Sample Weight after Vacuuming
12.7 Total Particulate Removed (#4 - #6)
12.8 Final Bag weight
12.9 Total Particulate Captured (#8 - #2)
12.10 Bag Particulate Captured (%)
12.11 Vacuum Efficiency Removal (%)

[3] Saturation level of solid particulate on cut pile (7.1) test material is not less than 37 grams; saturation level of loop pile (7.2) test material is not less than 30 grams.

13. Report

13.1 Vacuum cleaner manufacturer, model, bag and filter type and other descriptive

information.

13.2 Complete test material description.
13.3 Solid particulate type and amount.
13.4 Speed of travel of vacuum cleaner expressed in feet/second.
13.5 Number of passes the vacuum cleaner made over the test carpet.
13.6 Bag particulate captured in percentage.
13.7 Efficiency of solid particulate removed expressed as a percentage of the Retained Particulate applied.
13.8 Standard Deviation
13.9 Coefficient of Variation

ANNEX

(Mandatory Information)

A1 Solid Particulate[4]

A1.140 grams of silica sand in the following particle size range

U.S. Std Sieve #	**Actual**
20	0.0
30	0.0
40	1.1
50	37.5
70	44.3
100	12.5
140	3.8
200	0.8
270	0.0
PAN	0.0
Grain Fineness #	51.2

[4] Source for silica sand conforming to specifications:

Wedron Silica
P.O. Box 119
Wedron, IL 60557
Phone (815)433-2449

4 SHIFT PASS
Vacuum Test Method