Deep cleaning

Our deep-cleaning test is an adaptation of an industry standard test. We use carpets (72” x 27”) similar to those specified by the American Society for Testing and Materials (ASTM) - ours are made of 9/16” high nylon fibers to form a medium-height, cut-pile (plush) rug. We also follow the ASTM test cleaning pattern for moving the vacuum cleaner back and forth across the carpet, and use the test dirt specified in the standard — 90% silica (sand) and 10% talc (Johnson & Johnson’s Baby Powder).

Each rug is preconditioned (vacuumed to remove loose fibers), stored and tested under controlled temperature and humidity (70°F, 40%RH). All vacuum cleaner samples and other needed materials are kept at these conditions at least 16 hours before running the test.

A Statistical test scheme accounts for possible test variations. We test two samples of each model to derive an average deep cleaning score. Two reference vacuum cleaners are used to track test variables.

The test begins with a new bag (where applicable) installed in a clean vacuum cleaner, which we adjust to its highest motor speed and suction. We set the carpet height adjustment to an automatic or medium setting. We use a medium-low setting if medium does not exist. If a vacuum has an odd number of carpet settings, the middle setting would be used. If another vacuum has an even setting, we would use the next setting down. For example, a vacuum with four settings would be tested at the second lowest setting and a vacuum with six settings would be tested at the third lowest setting. If a vacuum's lowest setting is designated for bare floors and is NOT the lowest power head height, it will be excluded from the calculation in determining the setting for carpet cleaning. If it is physically the lowest height, it will be counted as a setting.

We sprinkle the test dirt (100 grams) onto the marked-off test area (18-inch by 54-inch) as uniformly as possible. We embed the dirt into the carpet by dragging a 30-lb. cylindrical bar (19.5 inches wide by 2.75 inches in diameter.), back and forth 20 strokes (A stroke is a movement in one direction).

We vacuum following a strip of "chaser" lights to flash in sequence at a rate of 2.5 seconds per stroke alongside the carpet. The vacuum cleaner is moved across the cleaning test area in 16 back and forth strokes for a total of 40 seconds. During the first eight strokes, the sample is moved across the right-hand side of the cleaning test area and then shifted to the left-hand side to complete the run.

Upon completion, we weigh the rug and vacuum cleaner (to the nearest 0.1 g) and use this information to establish the dirt pickup - used as the basis for evaluating deep cleaning performance.
Bare floor cleaning

Silica sand (40 grams) is sprinkled onto an approximately 9-inch x 20-inch area (lightly textured sheet vinyl surface) and we operate the vacuum (bare floor setting) for two strokes (one forward and one backward) for approximately 1 second per stroke. The amount of sand picked up determines the performance score.

Air flow (Cleaning with Tools)

The protocol to measure airflow involves attaching a vacuum cleaner’s accessory hose to a large diameter cylinder incorporating a 1-inch diameter flow restriction orifice. We measure pressure drop across the orifice when the vacuum is operated.

The test begins with a new bag installed (or a clean bagless collection system) in the vacuum cleaner. We record the pressure drop using a Magnehelic pressure gauge with the empty bag and then we vacuum up 100 grams of wood flour, record the pressure drop and repeat the process one additional time. All the data points are used to develop the air flow score.

Emissions

We conduct emission tests in our Air Quality lab – a sealed, empty room measuring 18 feet long by 11½ feet wide by 8 feet high. We control temperature and humidity within the room to 70° F and 40% RH through dedicated equipment. An air-handling system is equipped with HEPA filtration – used to establish baseline particle concentrations in the room. The room is thoroughly cleaned by damp mopping all surfaces before testing.

We measure the particle concentrations in the room with a Solair 1100 laser airborne particle counter mated to a dilutor and compile the results using a data acquisition system. Particles in the range of 0.1 - 1.0 µm in diameter are counted.

We determine the change in particle concentrations in our test room due to brush agitation, airway leakage, and porosity of the dust bag while referencing to baseline room particle conditions. In preparation for testing, we vacuum 50 grams of wood flour into a clean test sample with a new bag. We also uniformly distribute and embed 20 grams of wood flour into the marked-off test area (18-inch by 54-inch) of a medium-pile carpet.

For the first five minutes of the test, we measure the change in background particle concentration in the room. Then we run the vacuum cleaner for five minutes with its rotating brush (or stationary brush if it has no rotating brush) propped off the floor. In this phase, we are measuring the emissions from the bag only. For the last five minutes of the run, the operator, who remains in the room during the test, vacuums the wood flour from the test carpet to
determine how much dust a vacuum cleaner would generate during operation. Room particle levels during testing are used to determine a vacuum’s emissions.

**Noise**

The vacuum cleaner is placed on a medium-pile carpet. We measure the sound pressure level of each vacuum cleaner model using a decibel (dB) meter in a location approximating where a user might be standing (2 feet from the front of the vacuum and 5 feet above the floor). We use clean machines with new bags (where applicable) and adjust them to maximum suction, speed, or power settings while rug height adjustment is set per the deep cleaning test method.

**Ease of Handling**

Ease of handling is a meld of two aspects: ease of carrying and push/pull force. Ease of carrying itself is a meld of two physical factors: weight and handle height. Upright handle height is measured from the ground to the handle when the vacuum cleaner is raised until its foot is just above the ground and it can be carried. We use 25 inches as an ideal height for uprights; those that have an adjustable handle height will be set as close to 25 inches as the adjustment allows. Canister handle height is measured when the canister is sitting on the ground. If the canister is designed to be carried with its “tail” on the ground, handle height will be measured in the position that brings the handle height closest to 25 inches.

Uprights are weighed on a scale that can read to a tenth of a gram. Canisters are weighed in two separate parts: the body and the hose/wand/power nozzle. Vacuums have historically weighed between 9 and 28 pounds, the lighter the better.

**Pushing Ease**

The pushing ease is evaluated by measuring the force it takes to propel a vacuum cleaner back and forth. The vacuum is moved across a test rug as defined in the deep cleaning test. The vacuum is attached to a special test fixture to measure the push and pull forces. The test involves multiple readings from which an average force is calculated.

**Under-furniture clearance**

This protocol is designed to determine the vacuum cleaner’s ability to reach confined areas under furniture. A specially designed test rig is used to measure the depth to which the power nozzle (power head) can reach at different clearance heights. We measure with the test sample’s handle or wand at a 180° angle (or as close to flat as possible without the power head
lifting off the carpet). We measure the depth of the power-head’s penetration beneath a raised obstacle located from 3-inches to 8-inches above the floor/carpet. The results of these measurements are used to calculate a clearance score.

Bag Capacity

The bag capacity is determined by vacuuming up a combination media of fine wood flour and rice. The clean bag’s weight (or dirt container’s) is determined. With the clean bag installed in each machine, 200 grams of wood flour is vacuumed up. Next each machine vacuums up rice until no additional rice can be sucked up. The weight of the media in the bag (or dirt container) is the basis for determining size capacity.

Pet Hair Pick Up

The ability of a vacuum to pick up pet hair is determined by attempting to vacuum up 5 grams of hair from pure-bred Maine coon cats. The hair is placed in an 18-inch by 54-inch section of an ASTM medium pile nylon plush carpet and rolled into the carpet using a 2-inch diameter by 18-1/4 long roller made up of 65 chrome plated washers. The washers are able to rotate on the main shaft to better embed the pet hair into the carpet fibers and the overall weight of the roller and handle is 19.4 pounds. Each vacuum is passed across the carpet 14 times and if the pet hair is removed from the carpet before completing 14 strokes the number is recorded but the test is allowed to continue to give the vacuum the opportunity to get any pet hair off the roller and into the bag or bin. After vacuuming, the power head is clicked into the storage position and the vacuum is rested on its back allowing it to continue to run for up to two minutes. The performance is based on how much and in how many strokes the hair is removed from the vacuumed area and how much remains entangled in the brush, wheels, and bearings.