



Standard Test Method for Motor Life Evaluation of an Upright Vacuum Cleaner¹

This standard is issued under the fixed designation F 555; 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 test method covers motor life evaluation of household or commercial, single and dual motor upright vacuum cleaners (uprights with separate motors for creating the vacuum and driving the floor brush). Self-propelled or power-assist cleaners are not within the scope of this test method.

1.2 This test method is limited to evaluation of the upright vacuum cleaner electric motor(s).

1.3 This test method provides a test to determine operating life of the motor(s), before servicing is needed, by an accelerated laboratory procedure. Motor(s) are tested while mounted and operated in the upright vacuum cleaner.

1.4 *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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

D 75 Practices for Sampling Aggregates²

E 337 Test Method for Measuring Humidity with a Psychrometer (the Measurement of Wet-Bulb and Dry-Bulb Temperatures)³

F 431 Specification for Air Performance Measurement Plenum Chamber for Vacuum Cleaners⁴

F 608 Laboratory Test Method for Evaluation of Carpet-Embedded Dirt Removal Effectiveness of Household Vacuum Cleaners⁴

F 655 Specification for Test Carpets and Pads for Vacuum Cleaner Testing⁴

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *motor life*—limited by failure of motor. Failure is motor stoppage. In the case of a dual motor upright, the test will be continued until both motors (vacuum motor and floor

brush motor) have failed. The motor that fails first will be replaced so that the test may continue on the other motor. The motor life of each motor will be recorded separately.

3.1.1.1 *Discussion*—Any failure integral with the motor, such as armature assembly, field assembly, housing(s), bearings, motor cooling fan/or primary air moving fan, brush assemblies, motor mounted non-resettable thermal protection devices, or any other component judged to be integral with the motor, shall be judged as motor stoppage.

4. Significance and Use

4.1 The test results provide an indication of the motor life of an electric upright vacuum cleaner in operating life. End of motor life will be judged in accordance with Section 3.

5. Apparatus and Materials

5.1 *Voltage Regulator*, capable of maintaining 120 ± 2 V rms with a wave form that is essentially sinusoidal with 3 % maximum harmonic distortion for the duration of the test.

5.2 *Voltmeter*, to provide measurements accurate to within ± 1 %.

5.3 *Timer and Switch*, having the capacity to control the off/on duty cycle of the cleaner during the life test.

5.4 *Sharp Edge Orifice Plate*—The orifice, a $1\frac{1}{4}$ in. (32 mm) diameter, shall be in accordance with Fig. 2 of Specification F 431.

5.5 *Wattmeter*, to provide measurements accurate to within 1 %.

5.6 *Plenum Chamber*, conforming to the plenum chamber described in Specification F 431.

5.7 *Water Manometer*, or equivalent instrument measuring in increments of 0.1 in. (2.54 mm).

5.8 *Barometer*, to provide measurements accurate to ± 0.05 in. Hg (1.27 mm Hg), with scale divisions 0.02 in. (0.51 mm) or finer.

5.9 *Thermometer*, having a range of at least 18 to 80°F (−8 to +27°C) and graduated in 1°F (0.5°C) increments.

5.10 *Psychrometer*, meeting the requirements of Test Method E 337 with thermometers graduated in increments of 1°F (0.5°C).

5.11 *Test Carpet*, conforming to the level loop carpet described in Specification F 655. A carpet that provides equivalent nozzle loading results may be used.

5.12 *Carpet Padding*, conforming to the padding described in Specification F 655.

¹ This test method is under the jurisdiction of ASTM Committee F-11 on Vacuum Cleaners and is the direct responsibility of Subcommittee F11.30 on Durability-Reliability.

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² *Annual Book of ASTM Standards*, Vol 04.03.

³ *Annual Book of ASTM Standards*, Vol 11.03.

⁴ *Annual Book of ASTM Standards*, Vol 15.07.

5.13 *Test Fixture*—A moving surface, covered by the test carpet supported on the test pad, which moves with a horizontal reciprocating motion, for a stroke distance of 27 in. (686 mm) in each direction at the average rate of 1.8 ft/s (0.55 m/s), which results in 24 cycles (forward and back) per minute. This motion shall be generated by rotating a 13.5-in. (343-mm) radius arm which shall be connected to the platform with an arm at least 24 in. (610 mm) long or equivalent. This device shall provide means to hold the cleaner fixed by its handle stationary in the operating position while it is in contact with the reciprocating surface (see Fig. 1). Optionally, the cleaner can be moved through the same cycle as stated above while the carpeted platform is held stationary (see Fig. 1). For either option, the reciprocating motion shall follow the same duty cycle as specified for the vacuum cleaner in 7.7. For the optional test fixture of Fig. 1, the reciprocating arm must be at either end of its horizontal motion at the start of each “on” portion of the cycle.

5.14 *Test Dirt*, Wedron sand/talc mixture. See Annex A1.

6. Sampling

6.1 Test a minimum of three units (or a large sample size if desired) of any model. Select all samples at random in accordance with good statistical practice. Results shall provide an 80 % confidence level within $\pm 10\%$ of the mean value. If not, test additional samples or reduce the results by the penalty factor as calculated in 7.10.

7. Procedure For Motor Life Evaluation

7.1 Determine initial performance as follows:

7.1.1 Seal the nozzle opening to the plenum chamber with a manometer (or equivalent) connected to the chamber and with a 1¼-in. (32-mm) diameter sharp-edge orifice in the holder. For the test, connect the agitator drive belt and a clean filter or filter bag to the cleaner. The agitator shall be operating freely with the handle in the operating position as shown in Fig. 1.

7.1.2 With the cleaner sealed to the plenum chamber and without an orifice plate in the holder, energize the cleaner at 120 ± 2 V, 60 Hz, for 5 min to stabilize motor temperatures. If the rated voltage of the upright vacuum cleaner is other than 120 V, run it at the rated voltage ± 2 V rms.

7.1.3 With the cleaner operating at a constant rated voltage, insert the 1¼-in. (32-mm) diameter sharp-edge orifice into the holder on the orifice box.

7.1.4 Record the manometer reading as soon as the reading stabilizes.

7.1.5 Record the wattage of the cleaner on the plenum chamber. The wattage reading is used to monitor the cleaner load.

7.1.6 Measure the airflow and wattage reading every 168 h to determine if some component has failed and degraded performance, reducing the load on the cleaner during the life test. If degradation exceeds 40 % see 7.9.1-7.9.3.

7.1.7 Monitor the suction of the cleaner during the test in addition to the weekly measurement on the plenum chamber to maintain loading and to ensure that no mechanical problems exist.

7.2 Use a new section of carpet and padding without holes, tears, or other signs of wear when the test is started. Tautly secure the carpet. The lay of the carpet pile shall be such that during the forward stroke, the cleaner moves in the direction of the lay of the carpet pile. See Fig. 1.

7.3 Install the cleaner on the test fixture as shown in Fig. 1.

7.4 If various settings are provided, set the motor speed setting, suction regulator, nozzle height, or a combination thereof, in accordance with the manufacturer’s specified setting for using the cleaner on the level loop test carpet. The setting shall be the same as that used for the Cleanability Embedded Dirt Carpet Test in Laboratory Test Method F 608.

7.5 Keep the load within limits by controlling changes in the carpet, agitator brush, drive belt, and airflow as determined in 7.5.1-7.5.4.

7.5.1 Replace the carpet when one fourth of the pile height is worn away, except at the beginning and end of the stroke path.

7.5.2 During the life test, change the agitator brush(s) every 168 h of cycling time.

7.5.3 Change the drive belt every 168 h of cycling time or if it ceases to drive the agitator on the test carpet prior to 168 h.

7.5.4 During the life test, change the disposable or clean the reusable primary and secondary filters every 168 h of cycling time or when the airflow decreases 40 % due to filter clogging. To determine if the filters must be changed or cleaned prior to the 168 h period, conduct an initial dust clogging test in accordance with the procedure described in Annex A4.

7.6 Perform all tests in a controlled ambient atmosphere

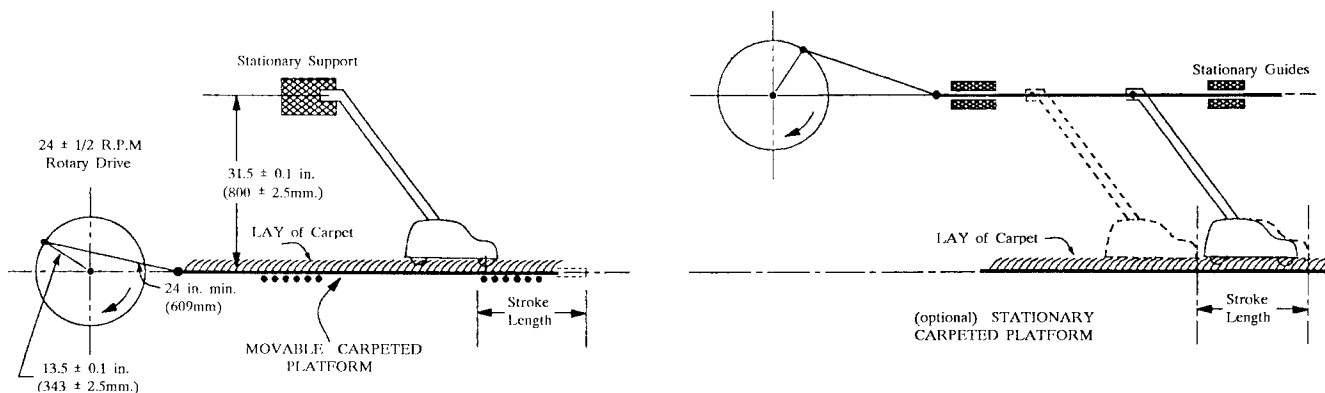


FIG. 1 Test Fixture