



Standard Test Method for Measuring Maximum Function Volume of the Primary Dirt Receptacle in a Vacuum Cleaner¹

This standard is issued under the fixed designation F 888; 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 reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method is applicable to household types of upright, canister, and combination vacuum cleaners.

1.2 This test method provides a measurement in dry quarts or litres of the maximum functional volume of the primary dirt receptacle when installed in the vacuum cleaner.

1.3 *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.* For specific hazards statements see Notes 1 and 2.

2. Significance and Use

2.1 This test method covers a procedure to determine the maximum functional volume of the primary dirt receptacle when installed in the vacuum cleaner.

2.2 This test method provides the maximum amount of test media that the primary dirt receptacle will hold and may be more than the volume obtained when filled to the manufacturer's recommended fill line.

3. Apparatus

3.1 *Voltmeter*, to measure input voltage to the cleaner, to provide measurements accurate to within $\pm 1\%$.

3.2 *Voltage Regulator System*, to control the input voltage to the cleaner. The regulator must be capable of maintaining a 120 ± 1 V RMS with a wave form that is essentially sinusoidal with 3 % maximum harmonic distortion for the duration of the test.

3.3 *Temperature Measuring Equipment*, to provide measurements accurate to within $\pm 1^\circ\text{F}$ (0.5°C).

3.4 *Humidity Measuring Equipment*, to provide measurements accurate to within $\pm 2\%$ relative humidity.

3.5 *Adapter*, to be attached to the cleaning nozzle of upright cleaners for use in directing card punchings into the nozzle. See Fig. 1.

3.6 *Volume Measuring Container*, to measure volume of granulated cork. This shall have a capacity of one dry quart. See Fig. 2. The container shall be made of transparent material to ensure no voids when filled with granulated cork. As an option, a 1-L container can be used.

3.7 *Weighing Scale*—The scale shall be accurate to 0.035 oz (1 g) and have a weighing capacity of at least 15 lb (6.82 kg).

4. Materials

4.1 *New Granulated Cork*—Premium Grade 6 to 14 sieve size.²

4.2 *Coarse-Grade Air Cleaner Test Dust*, see Table 1. As an option, talc may be used. See Table 2.

5. Sampling

5.1 *Determination of Sample Size*—A sample of sufficient size of each model shall be tested until a 90 % confidence level is established within $\pm 5\%$ of the mean value. A minimum of three samples shall be tested. All samples shall be selected at random in accordance with good statistical practices.

5.2 *Determination of Maximum Functional Volume for Each Unit*—The maximum functional volume for each unit shall be an average of three runs with a spread meeting the repeatability statement in 8.1.1. (See Appendix X1 for example.)

6. Conditioning

6.1 Maintain the test room at $70 \pm 5^\circ\text{F}$ ($21 \pm 3^\circ\text{C}$) and 45 to 55 % relative humidity.

6.2 Expose all components involved in the test to the controlled environment for at least 16 h prior to the start of the test.

NOTE 1—**Caution:** Store sufficient 100 qt or 100-L increments of granulated cork in such a manner that when used they are in a state of constant mass/unit volume.

7. Procedure

7.1 Establish density of granulated cork in grams per dry quarts or grams per litres as follows:

¹ This test method is under the jurisdiction of ASTM Committee F-11 on Vacuum Cleaners and is the direct responsibility of Subcommittee F11.23 on Filtration.

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² The test material, available from Wiley Cork, Inc., 16th Locust Street, Wilmington, DE 19802, has been found suitable for this purpose.

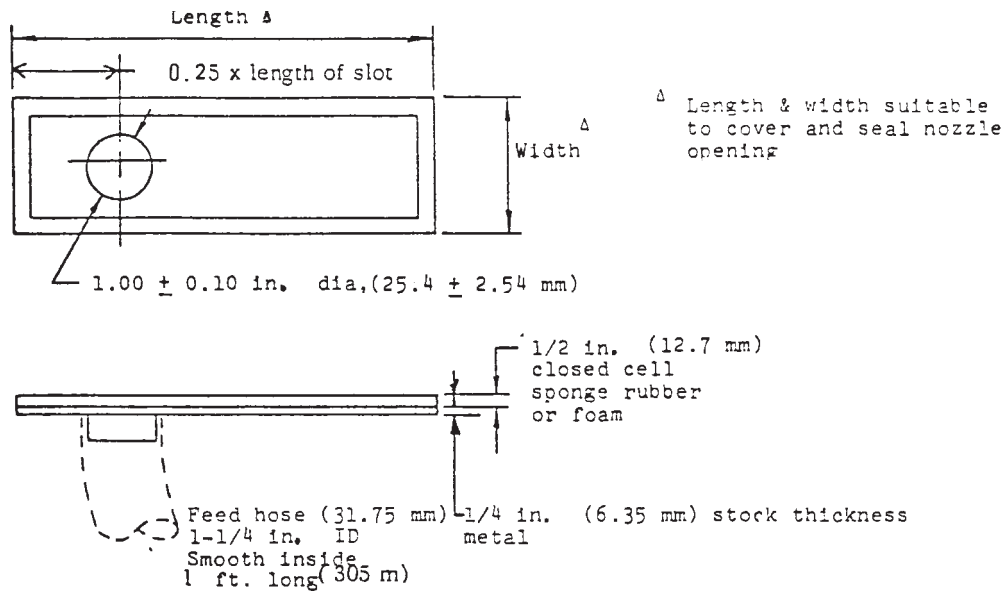


FIG. 1 Adapter Plate for Uprights

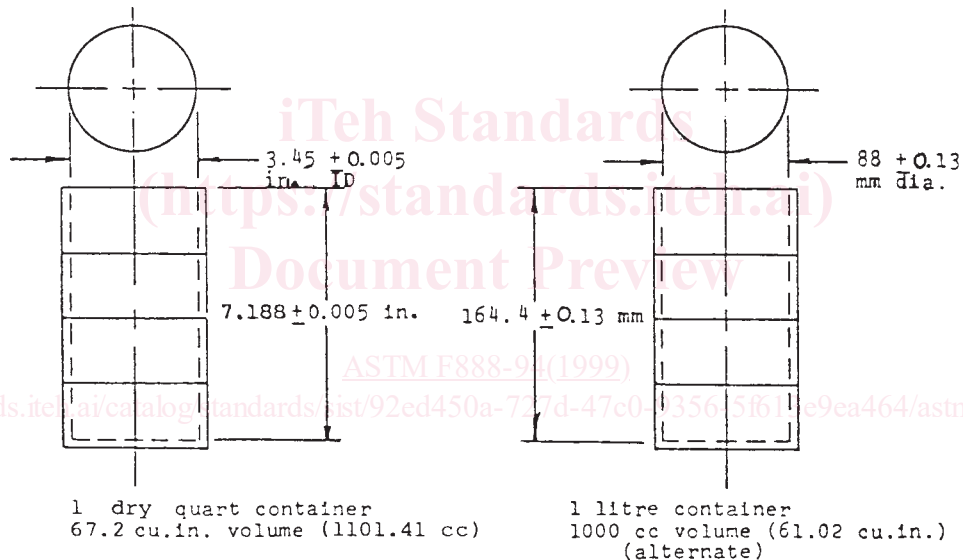


FIG. 2 Volume Measuring Container

7.1.1 Weigh the empty container.

7.1.2 Withdraw 100 qt or 100 L from the bulk quantity.

7.1.3 From the quantity withdrawn in 7.1.2, fill the container with granulated cork by gently pouring the granulated cork through the funnel shown in Fig. 3.³ Move the funnel around in a horizontal plane to ensure even filling of the container. Do not shake or disturb the container during this operation. Introduce the granulated cork at a uniform rate of 1 qt/min or 1 L/min ± 10 s.

7.1.4 Weigh the filled container.

TABLE 1 Analysis of Coarse Grade Air Cleaner F-11 Test Dust^{A, B}

Particle Size Distribution by Volume	
Size, μm	Coarse Grade (% less than)
5.5	13 ± 3
11	24 ± 3
22	37 ± 3
44	56 ± 3
88	84 ± 3
176	100

^A The information in Table 1 is contained in "Air Cleaner Test Code," SAE Technical Report J726b.

^B A satisfactory test dust is available from Powder Technology, Inc., 1119 Riverwood Drive, Burnsville, MN 55337.

7.1.5 Subtract the results of 7.1.1 from the results of 7.1.4 for the weight of 1 qt or 1 L of granulated cork.

³ A 10½-in. diameter utility funnel, Stock No. 78026, available from U.S. Plastic Corp., 1390 Newbrecht Rd., Lima, OH 45801 has been found suitable for this purpose.

TABLE 2 Analysis of Unscented Commercial Grade Talcum^A

Particle Size Distribution by Weight, %	
0.5 %	44 μ
12.5 %	20–43.9 μ
27.0 %	10–19.9 μ
23.0 %	5–9.9 μ
20.0 %	2–4.9 μ
8.0 %	1–1.9 μ
9.0 %	0.9 μ

^A USP Grade Supreme Talc or the equivalent has been found satisfactory for this purpose. It is available from Cypress Industrial Minerals Co., U.S. Route 206 Montgomery Township, Belle Mead, NJ 08502.

7.1.6 Set the measured quantity of granulated cork aside.

7.1.7 Repeat 7.1.3-7.1.6 ten times. Calculate the mean weight.

7.1.8 Return the 10-qt or 10-L samples to the withdrawn quantity of 7.1.2.

7.1.9 If testing is completed in the same day by the same technician, use the mean result of 7.1.7 in subsequent calculations until the quantity withdrawn is depleted. Otherwise, recalculate the 10-qt mean.

7.1.10 When quantity withdrawn is depleted, select another 100-qt or 100-L sample in accordance with 7.1.2-7.1.9.

7.2 Prepare the test cleaner as follows:

7.2.1 Install new or clean primary and secondary filters.

7.2.2 Prepare the primary dirt receptacle prior to conducting the measurement test run.

7.2.2.1 For cleaners using disposable primary filters, use a new manufacturer's recommended bag, weigh the filter to the nearest 0.035 oz (1.0 g) and install in accordance with the manufacturer's recommended procedure. Repeat this process for each test. Perform the bag prior to installation to ensure full installation.

7.2.2.2 For cleaners using cloth filter bags or other types of nondisposable dirt receptacles, empty them in accordance with the manufacturer's instructions after each test run, and clean the receptacle until its weight is within 0.14 oz (4 g) of the previous weight.

7.3 Energize the cleaner for 5 min at 120 ± 1 V, 60 Hz.

7.3.1 Place an upright cleaner so that the moving bristles clear the supporting surface and no loose dirt is picked up.

7.3.2 For a straight air canister or combination cleaner, operate with hose only, unrestricted and positioned such that no loose dirt is picked up.

7.4 Precondition the primary filter as follows:

7.4.1 Measure and calculate the total primary filtering area excluding seams, joints, treated seal area, mounting means, and multiple thickness of media. Measure multiple thicknesses that are intended for a specific filtering purpose as a single ply. Open, measure, and take a mean measurement from three bags from the same sample as the bags to be tested.

7.4.2 Prepare 0.0023 oz of test dust per square inch of primary filter area (0.010 g/cm²) (see Table 1 and Table 2). Feed the test dust at the rate of 0.7 ± 0.07 oz/min (20 ± 2 g/min) into the intake port to inflate the bag.

7.5 Testing has shown that the test media, granulated cork, can be reused a maximum of ten times without affecting the maximum functional volume measurement.

NOTE 2—**Caution:** If granulated cork is reused, the density in grams per dry quarts or grams per litres must be reestablished (see 7.1-7.1.10).

7.6 Introduce the granulated cork at a uniform rate of 1 qt/min or 1 L/min ± 10 s until the cleaner will not accept any more granulated cork.

7.6.1 For an upright cleaner, without attached hose or attachment port, feed the granulated cork through the adapter on the nozzle. Use only adapter shown in Fig. 1 or equivalent. The handle of the upright cleaner should be placed in the position specified in the instruction book for above-the-floor cleaning.

7.6.2 For an upright cleaner with attached hose or attachment port, feed the granulated cork through hose attached or the hose provided for the attachment port. The handle of the upright cleaner should be placed in the position specified in the instruction book for above-the-floor cleaning.

7.6.3 For canister and combination cleaners, feed the granulated cork through the hose accompanying the model being tested. The hose and cleaner must be placed in such a manner that their position will allow a uniform pickup from the container (see Fig. 4).

7.7 De-energize the cleaner after it will accept no more granulated cork.

7.8 Carefully remove the primary dirt receptacle containing the collected granulated cork. Do not include any granulated cork remaining outside the primary dirt receptacle system, including the delivery tube, in the maximum functional volume measurement.

7.9 Weigh the primary filter and collected granulated cork.

7.10 Calculate the weight of granulated cork collected in the primary filter by subtracting the filter and test dust weight as described in 7.2.2 and 7.4.2 from the full bag weight (see 7.9). Calculate the maximum functional volume by dividing the total weight of collected granulated cork by the average weight of granulated cork per quart or litre in accordance with 7.1.

7.11 Record the maximum functional volume in dry quarts or litres to the nearest tenth.

7.12 The maximum functional volume for a single test is the number of quarts or litres of granulated cork collected by the primary dirt receptacle. The maximum functional volume of a given cleaner is the mean value of three tests meeting the repeatability statements specified in 8.1.1. (See Appendix X1 for example.)

8. Precision and Bias

8.1 *Precision*—These statements are based on an inter-laboratory test involving six laboratories and four units. The range of maximum functional volume of the units was from 0.90 to 8.2 dry quarts.⁴

8.1.1 *Repeatability* (single-operator-laboratory, multi-day)—For maximum functional volume values in excess of 5 dry quarts, the standard deviation within a laboratory divided by the average (coefficient of variation) with the same analyst was found to be 1.2 % or less. Two values from a sample of three tests in excess of 5 quarts should be considered suspect

⁴ Supporting data are available on loan from ASTM Headquarters, 1916 Race St., Philadelphia, PA 19103. Request RR:F11-1004.