Designation: F 608 – 07ε1

An American National Standard

Standard Test Method for Evaluation of Carpet Embedded Dirt Removal Effectiveness of Household/Commercial Vacuum Cleaners[1]

This standard is issued under the fixed designation F 608; 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.

ε[1] NOTE—Added two research report references to Section 11 editorially in March 2008.

1. Scope

1.1 This test method covers only a laboratory test for determining the relative carpet dirt removal effectiveness of household/commercial vacuum cleaners when tested under specified conditions.

1.2 This test method is applicable to household/commercial types of upright, canister, and combination cleaners.

1.3 The test method applies to embedded dirt removal from carpets, not the removal of surface litter and debris.

1.4 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.5 *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:* [2]

D 75 Practice for Sampling Aggregates

E 11 Specification for Wire Cloth and Sieves for Testing Purposes

E 177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

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

F 884 Test Method for Motor Life Evaluation of a Built-In (Central Vacuum) Vacuum Cleaner

F 922 Test Method for Motor Life Evaluation of an Electric Motorized Nozzle

F 1038 Test Method for Motor Life Evaluation of a Canister, Hand-held, Stick, and Utility Type Vacuum Cleaner Without a Driven Agitator

F 1334 Test Method for Determining A-Weighted Sound Power Level of Vacuum Cleaners

F 1409 Test Method for Straight Line Movement of Vacuum Cleaners While Cleaning Carpets

3. Terminology

3.1 *Definitions:*

3.1.1 *cleaning ability, dry*, *n*—the potential of a vacuum cleaner to remove dirt from a surface (sometimes referred to in the industry as *cleanability, dry*).

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

3.1.3 *population*, *n*—the total of all units of a particular model vacuum cleaner being tested.

3.1.4 *repeatability limit, r*—the value below which the absolute difference between two individual test results obtained under repeatability condition may be expected to occur with a probability of approximately 0.95 (95 %).

3.1.5 *repeatability standard deviation, S_r*—the standard deviation of test results obtained under repeatability conditions.

3.1.6 *reproducibility limit, R*—the value below which the absolute difference between two test results obtained under reproducibility conditions may be expected to occur with a probability of approximately 0.95 (95 %).

3.1.7 *reproducibility standard deviation, S_R*—the standard deviation of test results obtained under reproducibility conditions.

3.1.8 *sample*, *n*—a group of vacuum cleaners taken from a large collection of vacuum cleaners of one particular model which serves to provide information that may be used as a basis for making a decision concerning the larger collection.

[1] This test method is under the jurisdiction of ASTM Committee F11 on Vacuum Cleaners and is the direct responsibility of Subcommittee F11.21 on Cleanability.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

3.1.9 *test run*, *n*—the definitive procedure that produces a singular measured result.

3.1.10 *unit*, *n*—a single vacuum cleaner of the model being tested.

4. Significance and Use

4.1 This test method provides an indication of the capability of the vacuum cleaner to remove embedded dirt from carpeting. This test method is based upon results of home cleaning tests so that, in most cases, a reasonable correlation exists between home and laboratory results. The amount of dirt picked up in the laboratory test may not be the same as in the home; however, it will show that, in most cases, a vacuum cleaner that performs well in the laboratory will perform well in a home. Laboratory results may differ due to variations in the homes, carpets, dirt, and other factors (see Section 6).

4.2 In order to provide a uniform basis for measuring the performance described in 1.1, standardized test carpets and a standardized test dirt are employed in this procedure.

5. Apparatus

5.1 *Weighing Scale for Weighing Carpets*, accurate to 0.035 oz (1 g) and having a weighing capacity of at least 15 lb (6.82 kg).[3]

5.2 *Weighing Scale (for Weighing Test Dirt and Dirt Container*, (see 9.2.2.1*(2)*), accurate to 0.0035 oz (0.10 g) and having a weighing capacity of at least 1.1 lb (500 g).[4]

5.3 *Stopwatch*, with a second hand or other type of equipment capable of establishing the specified rate of movement and total cycle time.

5.4 *Voltmeter*, to measure input volts to the vacuum cleaner, to provide measurements accurate to within ±1 %.

5.5 *Voltage-Regulator System*, to control the input voltage to the vacuum cleaner. The regulator shall be capable of maintaining the vacuum cleaner's rated voltage ±1 % and rated frequency having a wave form that is essentially sinusoidal with 3 % maximum harmonic distortion for the duration of the test.

5.6 *Dirt Embedment Tool*, with the roller locked (see Fig. 3).

5.7 *Dirt Dispenser*—Dispensing system that provides the operator with a method to distribute the test dirt *uniformly* on the carpet test area.

5.8 *Carpet-Conditioning Equipment*, to support the test carpet during new carpet conditioning and the removal of residual dirt from the test carpet before each test run (Fig. 4).

5.9 *Rotating Agitator Conditioning Vacuum Cleaner/Equipment*, for conditioning new test carpets and removing residual dirt from the test carpet before each test run. This cannot be the unit being tested.

NOTE 1—Automated methods for spreading the test dirt, embedding the test dirt, and cleaning and reconditioning the test carpets are acceptable if they do not change the results of this test method.

5.10 *Temperature and Humidity Indicators*, to provide temperature measurements accurate to within ±1°F (±½ °C) and humidity measurements accurate to within 2 % relative humidity.

5.11 *Supporting Surface*—A flat surface consisting of a piece of ¾-in. (19-mm) thick exterior grade plywood with the "A" surface upward to support the test carpet and pad. If necessary, the four corners (only) of the test carpet and pad may be fastened to the supporting surface by any acceptable means.

5.12 *Rotating Agitator Reference Vacuum Cleaner*, one, for calibrating test carpets (see 9.3).

5.13 *Straight-Air Canister Reference Vacuum Cleaner*, one, for calibrating test carpets (see 9.3).

6. Materials

6.1 Standard carpets conforming to Specification F 655,

6.2 Standard carpet padding conforming to Specification F 655,

6.3 Test dirt (see Annex A1),

6.3.1 Silica sand (see Annex A1), and

6.3.2 Talc (see Annex A1).

7. Sampling

7.1 A minimum of three units of the same model vacuum cleaner selected at random in accordance with good statistical practice, shall constitute the population sample.

7.1.1 To determine the best estimate of cleaning ability effectiveness for the population of the vacuum cleaner model being tested, the arithmetic mean of the cleaning ability rating of the sample from the population shall be established by testing it to a 90 % confidence level within ±5 % of the mean value of the cleaning ability rating.

7.1.2 Annex A3 provides a procedural example for determining the 90 % confidence level and when the sample size shall be increased.

NOTE 2—See Annex A3 for method of determining 90 % confidence level.

8. Conditioning

8.1 *Test Room*—Maintain the test room in which all conditioning and vacuum cleaner testing is performed at 70 ± 5°F (21 ± 3°C) and 45 to 55 % relative humidity.

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

9. Procedure

9.1 *Test Carpet Preparation*:

9.1.1 *Preconditioning New Test Carpet Samples*:

9.1.1.1 New test carpets shall conform to Specification F 655.

[3] The sole source of supply of the apparatus (OHAUS Models GT-8000, LB30-CO and 1119D) known to the committee at this time is OHAUS, Inc., Florham Park, NJ. (It is recommended that the scale read directly in grams.) If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

[4] The Mettler-Toledo Model PM 2000, available from Mettler-Toledo, Inc. Box 71, Hightstown, NJ 08520, the OHAUS Model GT-8000 available from OHAUS, Inc. Florham Park, NJ, or equivalent, have been found suitable for this purpose. (It is recommended that the scale read directly in grams.) If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

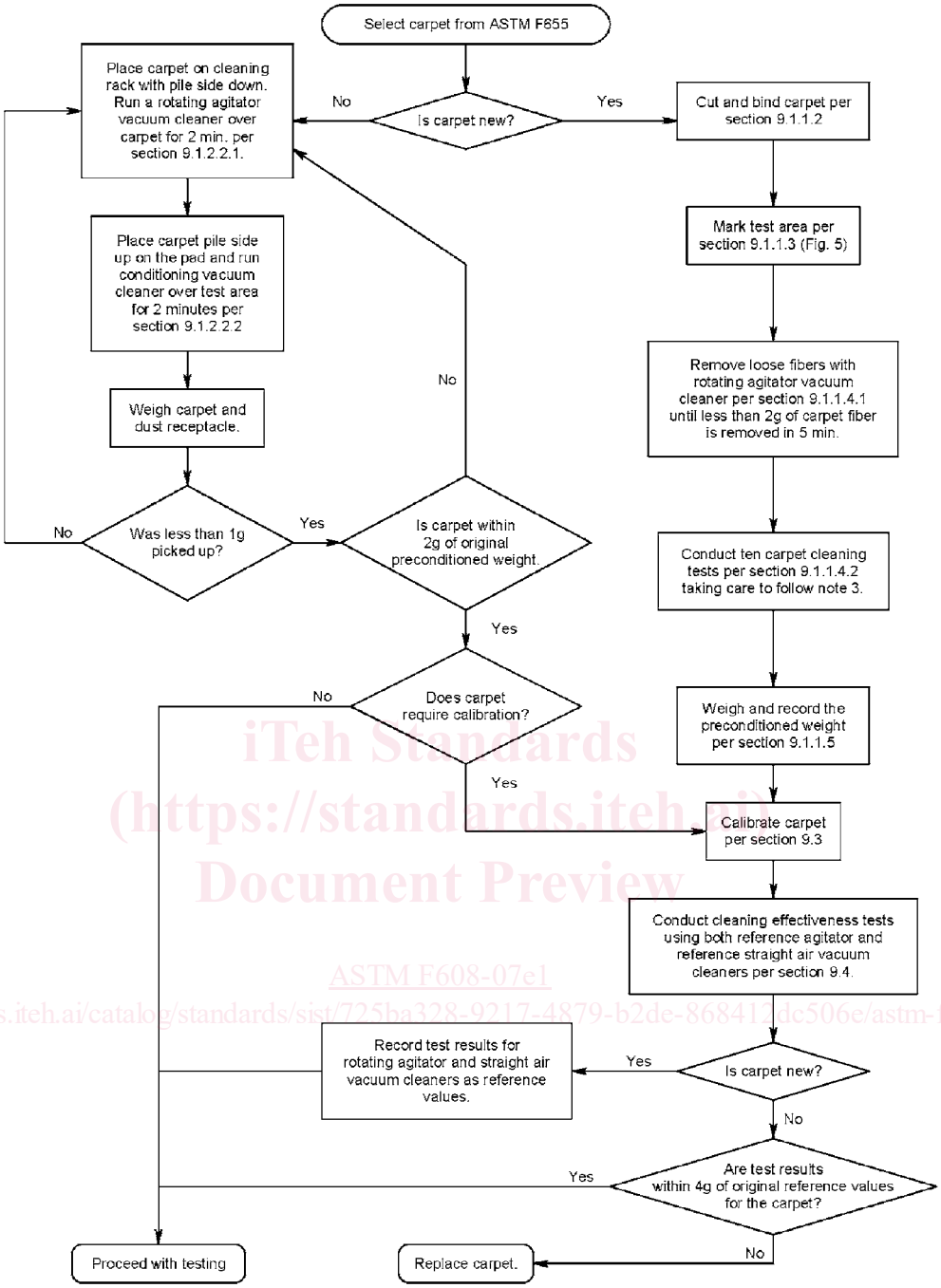


FIG. 1 Carpet Conditioning/Calibration Procedure

9.1.1.2 Cut a sample of each test carpet to a size of 27 by 72 in. (690 by 1830 mm) minimum. If the warp direction or "lay" of the carpet can be determined, it shall be in the 72 in. direction as indicated in Fig. 5. Carpets shall be bound on all sides.

9.1.1.3 Mark the test area on each carpet as indicated in Fig. 5.

9.1.1.4 *Precondition New Test Carpet Samples*:

(1) Precondition the entire area of the carpet by cleaning with the rotating agitator conditioning vacuum cleaner. Continue the operation until less than 2 g of carpet fiber is picked up in 5 min.

(2) Run ten carpet-embedded dirt removal effectiveness test runs in accordance with 9.4.2-9.4.18.

NOTE 3—Recondition the new test carpet following each preconditioning test run. It is not necessary, however, to meet the requirements set forth in 9.1.2.1 with respect to the preconditioned weight.

9.1.1.5 Weigh and record the preconditioned weight of the carpet.

9.1.1.6 Run a test carpet calibration in accordance with 9.3.

9.1.2 *Reconditioning Used Test Carpet Samples*:

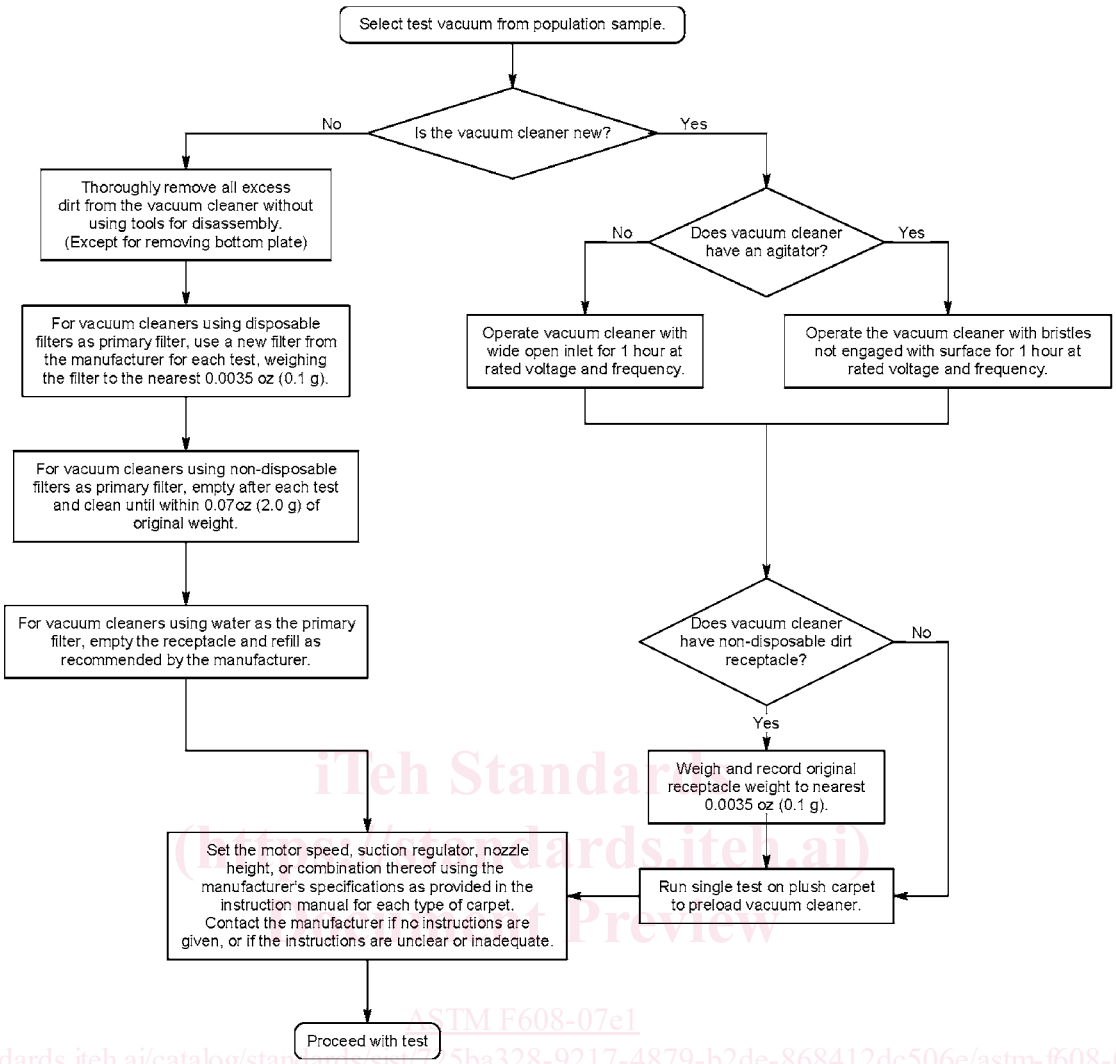


FIG. 2 Vacuum Cleaner Conditioning Procedure

9.1.2.1 To remove the residual dirt and stabilize the moisture content, clean the carpet with a rotating agitator conditioning vacuum cleaner until its weight does not exceed its previously measured, original preconditioned weight (9.1.1.5) by more than 0.07 oz (2 g) or less than 0.035 oz (1 g) is picked up by the conditioning vacuum cleaner using the following procedure.

9.1.2.2 *Procedure*:

(1) Place the carpet on the carpet cleaning rack (Fig. 4) with the pile side down. Run the rotating agitator conditioning vacuum cleaner over the carpet for 2 min concentrating on the test area at 1.8 ft/s (0.55 m/s); then run the rotating agitator conditioning vacuum cleaner thoroughly over the entire carpet area at least one time.

(2) Place the carpet (pile side up) on the pad, on the plywood supporting surface, and clean it with the rotating agitator conditioning vacuum cleaner for 2 min, concentrating on the test area; then run the rotating agitator vacuum cleaner thoroughly over the entire area at least one time.

(3) Weigh the carpet.

(4) Keep alternating 9.1.2.2*(1)* and 9.1.2.2*(2)*, always ending with the pile side up, until the carpet weight meets the requirement of 9.1.2.1.

(5) Change the disposable primary filter after a maximum of every 4 runs on the conditioning vacuum cleaner or more often if required.

NOTE 4—A high-cleaning performance rotating agitator vacuum cleaner is recommended for reducing the time to recondition the carpet.

9.1.3 *Reconditioning Used Carpet Padding*:

9.1.3.1 Clean the carpet padding by shaking weekly or more often, if necessary, to remove any collected dirt.

9.1.3.2 Replace the carpet padding when it has holes, tears, or other signs of wear.

9.2 *Preparation of Test Vacuum Cleaners*:

9.2.1 *New Test Vacuum Cleaners*:

9.2.1.1 Run the vacuum cleaner in at rated voltage ±1 % and rated frequency with filters in place.

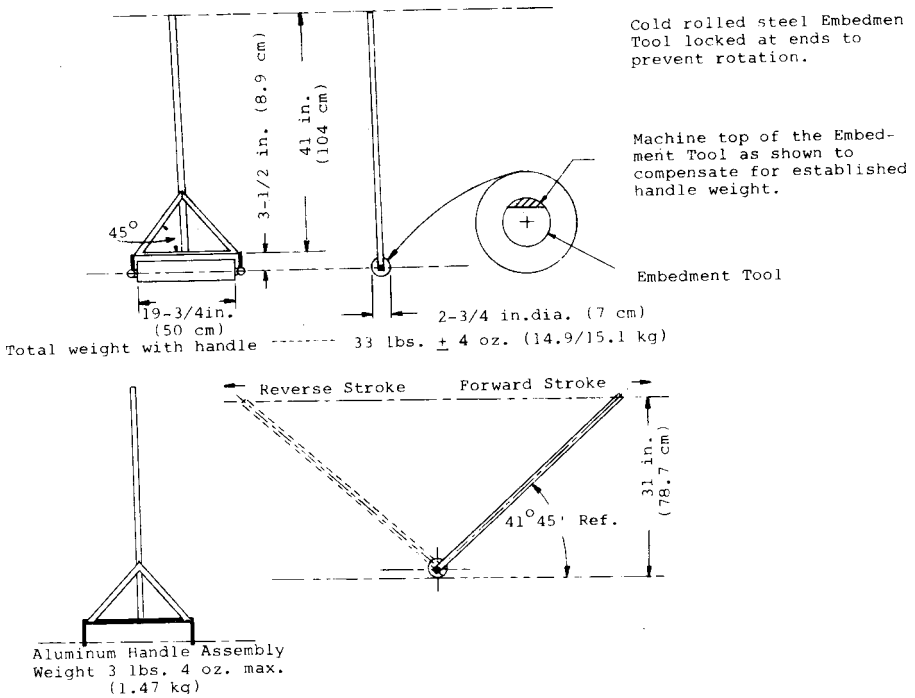


FIG. 3 Dirt Embedment Tool

(1) Preconditioning a Rotating Agitator Type Vacuum Cleaner—In a stationary position, operate the vacuum cleaner for 1 h with the agitator bristles not engaged on any surface.

(2) Preconditioning a Straight-Air Type Vacuum Cleaner—Operate the vacuum cleaner for 1 h with a wide-open inlet (without hose).

9.2.1.2 For vacuum cleaners with non-disposable dirt receptacles, weigh and record the receptacle's original weight to the nearest 0.0035 oz (0.10 g).

9.2.2 *Used Test Vacuum Cleaners*:

9.2.2.1 Recondition a used test vacuum cleaner, prior to each test run, as follows:

(1) Thoroughly remove excess dirt from the vacuum cleaner. Without using tools for disassembly, clean the entire outer surface, brushes, nozzle chamber, ductwork, inside of the chamber surrounding the primary filter, and inside hose and wands. Check the condition of all mechanisms for signs of wear or damage.

(2) For vacuum cleaners using disposable filters as the primary filters, use a new disposable primary filter from the manufacturer for each test run. Weigh the filter to the nearest 0.0035 oz (0.10 g) and install it as recommended by the vacuum cleaner manufacturer.

(3) For vacuum cleaners using water as the primary filter, empty the receptacle and refill as recommended by the manufacturer.

(4) For vacuum cleaners using non-disposable dirt receptacles, empty in accordance with the manufacturer's instructions after each test run and clean the receptacle until its weight is within 0.07 oz (2 g) of its original weight. Weigh the receptacle to the nearest 0.0035 oz (0.10 g) and install it as recommended by the vacuum cleaner manufacturer.

NOTE 5—It is recommended that a replaceable brush drive belt for vacuum cleaner agitators be changed after each four test runs, if considered applicable, using manufacturer's instructions. Any other maintenance task, such as cleaning the brush belt with distilled water, should only be done in accordance with manufacturer's recommendations.

9.2.3 *Test Vacuum Cleaner Settings*:

9.2.3.1 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.

9.2.3.2 All straight line movement (see Test Method F 1409), sound power (see Test Method F 1334), and motor life evaluation (see Specification F 655 and Test Methods F 884, F 922, and F 1038) tests shall be conducted using the same settings (nozzle, motor speed, suction regulator, etc.) for each specific carpet.

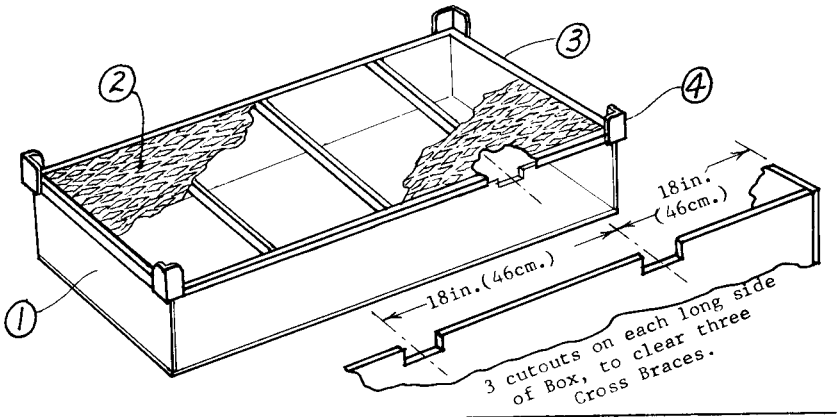
9.2.4 *Reference Vacuum Cleaners (Calibration)*:

9.2.4.1 Use the reference vacuum cleaners only for determining the reference rating of carpets and for the verification of carpet acceptability (see 9.3).

9.2.4.2 Maintain the performance of the reference vacuum cleaners throughout the acceptable life of the carpet (i.e. nozzle suction, bristle extension, motor and agitator speeds, etc.).

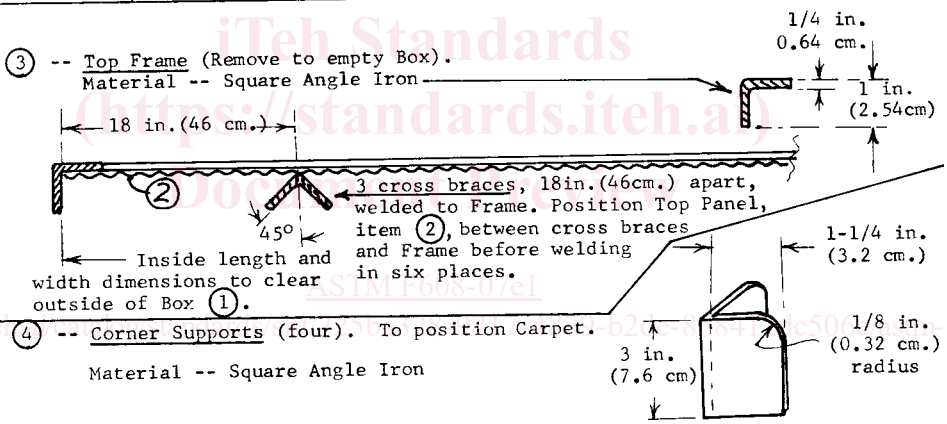
9.3 *Test Carpet Calibration*:

9.3.1 The purpose of calibration is to determine when the test carpet needs to be replaced by establishing a reference rating for each new preconditioned test carpet and to check this rating 50 or fewer test runs.



(1) -- Five Sided Box with open top.
Outside Dimensions, Length -- 72 in. (183 cm.)
Width -- 27 in. (69 cm.)
Depth -- 12 in. (30.5 cm.)
Material -- Plywood, 3/4 in. (1.9 cm.) thick.
Optional -- Bottom of box may be sloped downward to center opening to simplify emptying of test dirt accumulation.

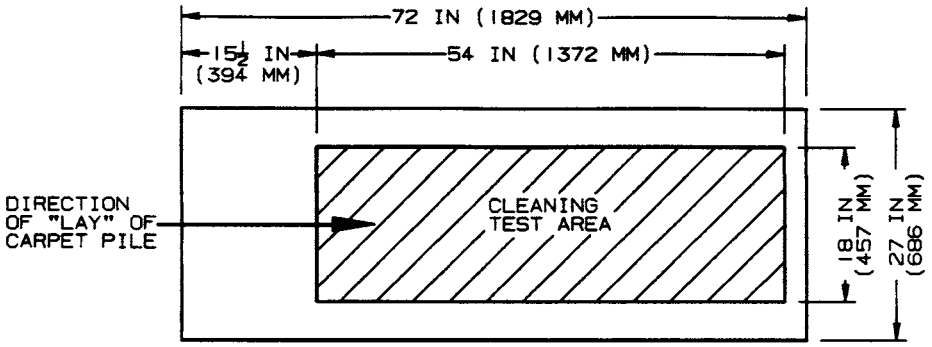
(2) -- Flattened Expanded Steel Top Panel, .070 in. (1.8 mm) thick, with "75% open" area, and with diamond shaped openings:—
center-to-center, 2.1 in. (5.3 cm.) LWD
center-to-center, 0.93 in. (2.4 cm.) SWD
opening dimensions, 1.78 in. (4.5 cm.) LWD
opening dimensions, 0.688 in. (1.7 cm.) SWD
NOTE: Demcor Style "3/4 in.-#13" material has been found to be acceptable. (Designer's Metal Div'n. of Southern Electric, Inc.)



(3) -- Top Frame (Remove to empty Box).
Material -- Square Angle Iron
3 cross braces, 18in.(46cm.) apart, welded to Frame. Position Top Panel, item (2), between cross braces and Frame before welding in six places.

(4) -- Corner Supports (four). To position Carpet.
Material -- Square Angle Iron

FIG. 4 Carpet Cleaning Rack



NOTE—Cleaning test area should be positioned as shown. First forward stroke of cleaner is in direction with "lay" of carpet.

FIG. 5 Test Carpet