



Standard Guide for Testing Cleaning Performance of Products Intended for Use on Resilient Flooring and Washable Walls¹

This standard is issued under the fixed designation D 4488; 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.

^{ε1} NOTE—A warning note was changed editorially in August 2001.

1. Scope

1.1 This guide covers the evaluation of the cleaning performance of products intended for use on resilient flooring or washable walls. Such evaluations specifically exclude windows, mirrors, carpets, ceramic tiles, and laminated counter tops. This guide provides techniques for soiling, cleaning, and evaluating performance of detergent systems under controlled, but practical, hard-surface cleaning conditions.

1.2 Such systems include any detergent intended for cleaning hard surfaces such as resilient flooring, washable wall surfaces, and other hard surfaces, but excluding glass, ceramic, or other glossy surfaces. They may consist of solutions of soluble powdered detergent, dilutions of concentrated liquid detergent, or products intended to be used full strength, for example, foams, sprays, liquid, or paste.

1.3 There is no universal soil/substrate combination that is representative of the many soil-removal tasks required of this type of cleaner in actual use conditions. Choice of soil/substrate and cleaning conditions should be by agreement between the testing laboratory and those using the data to evaluate cleaning performance relative to user experience.

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.* Material Safety Data Sheets are available for reagents. Review them for hazards prior to usage. Specific precautionary statements are given in .

2. Terminology

2.1 Definitions of Terms Specific to This Standard:

2.1.1 *soil*—in hard surface cleaning, foreign matter on a hard surface.

2.1.2 *substrate*—the soiled surface that is being cleaned.

3. Summary of Guide

3.1 Soils are artificially applied in a standardized manner to specified floor or wall substrates. The soiled surfaces are cleaned using a straight-line washability apparatus, and the cleaned substrates are evaluated instrumentally or visually by a panel of judges.

4. Significance and Use

4.1 This guide suggests methodology for cleaning tests. Soil/substrate combinations are generally designed to be analogous to soiled surfaces commonly encountered. This methodology can be used with most soil/substrate combinations. Some example test methods that have worked well in other labs are provided in the annexes. There is no requirement for using the soils listed in the annexes. It is the responsibility of the user to select the appropriate battery of tests for the desired end results.

4.2 The results of tests based on this guide are regarded as diagnostic screening values useful in formulation studies, quality control, and ingredient raw material qualification. This guide is intended to allow a choice in test conditions and soil/substrate combinations appropriate to the evaluation at hand. For interlaboratory comparisons, exact test conditions must be established before test results are compared.

4.3 This guide is applicable to testing all types of multipurpose household cleaners, whether the detergent is prepared by dissolving a soluble powder, a dilutable liquid, or is a pre-diluted product. It may also be useful for evaluation of products or conditions normally associated with industrial or institutional cleaners.

5. Preparation of Soil/Substrate Combinations

5.1 Cleaning performance of a test product depends on the particular combination of test soil and substrate. Soils and substrates to be cleaned should be selected as pairs. The usual criteria for appropriate soil/substrate combinations are: relative ease of discriminability among cleaners to be tested; reproducibility of the test performed; and correlation of test results with consumer experience.

5.1.1 While it may be reasonable to assume that lab tests

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using soil/substrate combinations found in normal practice should correlate with actual cleaning experience, no particular soil/substrate combination is sufficiently representative by itself to provide a reliable index of cleaning performance for all cleaning tasks. Also, lab screening systems are usually much more heavily soiled than those found under real-use conditions, in order to optimize discriminability. It is possible, however, that soil/substrate combinations not actually found in normal usage may provide a test system that correlates well with some actual cleaning conditions.

5.1.2 Preparation of the substrate, such as abrading finished floor tiles, may be necessary.

5.1.3 Natural or accelerated aging of soil, such as baked-on greasy soil, may be desirable for the purposes of enhanced discrimination or better correlation of actual home-use conditions.

5.2 For reliable test results, and to obtain the most information from lab testing, details of soiling and substrate preparation should be documented for appropriate reporting of final results.

6. Experimental Cleaning Test Procedure

6.1 Replication is essential for generation of reliable hard-surface cleaning test results. The number of replicate runs required depends on the soil/substrate combination selected, as well as the intended use of the results.

6.2 Experimental design may range from a simple paired comparison with three replicate runs using three tiles to multiple comparisons extending over days of testing.

6.3 A complete cleaning evaluation will usually require analysis of an appropriate composite result, taking into account

several different soil/substrate combinations, and possibly more than one set of test conditions, for example, use-dilution, water hardness, etc.

6.4 Appropriate controls should be considered when testing. For example, a test control could be a commercial liquid detergent for which the test lab has established some index of cleaning performance prior to the test at hand. Another control could be water without detergent.

6.5 Test conditions that should normally be reported in all tests include the following:

6.5.1 Conditions pertinent to scrubbing apparatus, for example, weights (if any), cycles per test, brushes, sponges, or other scrubbing substrate used (specify).

6.5.2 Water used for dilution, if any, including temperature and hardness.

6.5.3 Use-dilution of detergent with water.

7. Performance Evaluation

7.1 Cleaning performance is frequently taken as a linear function of reflectance using a reflectometer, color difference meter, or gloss meter (specify). Other methods such as visual rating may be useful, depending on the needs and capabilities of the lab. See the examples in the annexes.

8. Statistical Evaluation and Interpretation of Results

8.1 It is strongly recommended that appropriate statistical analysis of test results be conducted to establish confidence limits on test results and to establish a basis for comparison with subsequent or previous test results.

ANNEXES

(Mandatory Information)

A1. GENERAL

A1.1 The following procedures are included as an aid to the development of uniform methodology for lab cleaning tests. The methods described below have been found to work well in

other laboratories. For inter-laboratory tests, exact test conditions, including preparation of soils and substrates, must be specified.

A2. GREASY SOIL/PAINTED MASONITE WALLBOARD TEST METHOD²

A2.1 *Summary of Test Method*—Latex painted masonite wallboard is soiled with a mixture of melted, oily soils containing a small amount of carbon black, and allowed to set overnight. The detergent is applied to a sponge that scrubs half the soiled substrate using a straight-line washability apparatus. The other half of the soiled substrate is scrubbed with a second detergent. Cleaning performance is taken as a linear function of reflectance value.

A2.2 Apparatus:

A2.2.1 *Reflectometer*³, any photometer capable of accurately measuring changes to substrate reflectance. See Fig. A2.1.

A2.2.2 *Template*, see Fig. A2.1.

A2.2.3 *Straight-Line Washability Apparatus*⁴.

³ Photovolt Model 670 with Search Unit 610Y and Green Tristimulus, or its equivalent, has been found suitable for this purpose. Available from Photovolt, Inc. NY, NY.

⁴ BYK-Gardner Model AG-8100 available from BYK-Gardner USA, Silver Spring, MD, or the Gardco D-10 available from the Paul N. Gardner Co., Pompano Beach, FL, or equivalents, have been found suitable for this purpose.

² Johnson, M. A., "A Greasy Soil Hard Surface Cleaning Test," *Journal Am. Oil Chem. Soc.*, Vol 61, 1984.

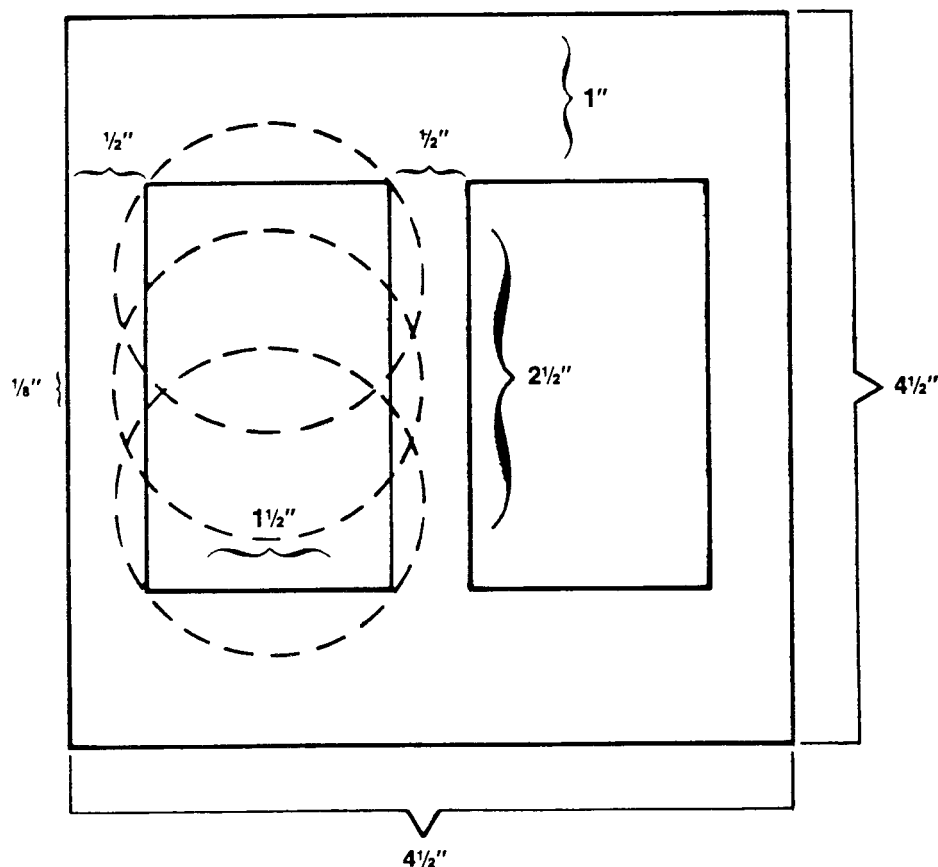


FIG. A2.1 Template for Use With Reflectometer

A2.2.4 *Graduated Cylinder*, calibrated to deliver 100 mL, and

A2.2.5 *Graduated Volumetric Pipet*, 10 mL.

A2.3 Materials and Manufacture:

A2.3.1 *Masonite Wallboard Tiles*— $\frac{1}{8}$ -in. thick, cut $4\frac{1}{2}$ by $4\frac{1}{2}$ in.

A2.3.2 *Latex Paint*⁵—non-yellowing flat white.

A2.3.3 *Vegetable Shortening*⁶—from local grocery store.

A2.3.4 *Lard*⁷.

A2.3.5 *Partially Hydrogenated Soybean Oil*⁸—with polyglycerol esters of fatty acids added.

A2.3.6 *Carbon Black*⁹.

A2.3.7 *Sponges*¹⁰—cellulose sponge cut to size, $1\frac{3}{4}$ by $3\frac{5}{8}$ by $1\frac{1}{2}$ in.

A2.3.8 *Tap Water*—80 ppm hardness, as CaCO_3 .

A2.3.9 *Cheesecloth Wipes*¹¹, 18 by 36 in.

A2.3.10 *Large Binder Clip*¹², 1- in. capacity.

A2.4 Procedure:

A2.4.1 *Tile Preparation*—Double-coat masonite tiles with latex paint using a paint roller, and allow to set overnight. Cure tiles at 45°C for 24 h.

A2.4.2 *Soil Preparation*—Blend a melt of 33 g vegetable shortening, 33 g lard, and 33 g vegetable oil with 1 g carbon black on a steam bath. Prepare fresh soil each day.

A2.4.3 *Soil Application*—Fold the cheesecloth in half several times to end up with a $2\frac{1}{2}$ by 2-in. piece. Put the binder clip on the open $2\frac{1}{2}$ -in. long edge of the folded cheesecloth. Using the clip as a handle, soak the cheesecloth in the hot soil and apply the soil to the white-painted masonite wallboard tiles using six strokes. (see Fig. A2.2). The soil temperature should be maintained and the soil should be stirred throughout the application process. Allow the soiled substrate to dry overnight at room temperature.

A2.4.4 *Cleaner Preparation*—Prepare all cleaner dilutions volumetrically as necessary. Water is at an ambient temperature (20 to 30°C) and a specified hardness.

⁵ California Paints, or equivalent, have been found suitable for this purpose.

⁶ Crisco, or equivalent, has been found suitable for this purpose (trademark of Procter and Gamble, Cincinnati, OH).

⁷ Armour lard, or equivalent, has been found suitable for this purpose (trade mark of Armour Co., Phoenix, AZ).

⁸ Pathmark vegetable oil, or equivalent, has been found suitable for this purpose (trademark Supermarkets General, Woodbridge, NJ).

⁹ Neo Spectra Mark II Powder, or equivalent, has been found suitable for this purpose (trademark of Cities Service Co., Tulsa, OK).

¹⁰ Shop-Rite brand sponges, or equivalent, have been found suitable for this purpose (trademark of Wakefern Corp., Elizabeth, NJ).

¹¹ VWR catalog No. 21910-105, or equivalent, has been found suitable for this purpose. Available from VWR Scientific, Plainfield, NJ.

¹² ACCO brand, No. 72100, or equivalent, has been found suitable for this purpose.