

Regulation No. 24 Control of Volatile Organic Compound Emissions

APPENDIX "M"

11/29/94

Test Method for Determining the Performance of Alternative Cleaning Fluids¹

This appendix presents a test method for evaluating the performance of alternative cleaning fluids. Any fluids may be tested, but the primary intent is that it will be used to evaluate the performance of alternatives relative to a VOC solvent. It is a screening technique designed to determine whether the alternative(s) cleans at least as well as a currently used VOC solvent in a simple, standardized wiping application. The results of this procedure may not mimic those that would be achieved for a different scenario in an industrial setting (e.g., spraying or wiping a complex shape). However, any cleaning fluids that are unsatisfactory in this test can be eliminated from consideration for more complicated site-specific tests. This test method has not yet been validated.

a. Standard Test Method For Determining the Performance of Alternative Cleaning Fluids.

1. Introduction. Industrial plants use VOC solvents to clean numerous contaminants from a variety of materials in different configurations. Alternative solvents and cleaning fluids exist that would produce lower VOC emissions from many of these cleaning applications. This method involves comparative testing of an existing VOC solvent with alternatives using one standardized cleaning procedure. It is a screening technique that identifies which alternative fluids clean as well as or better than an existing VOC solvent. Because it may not reproduce the plants' actual cleaning procedure, nor determine the effect of the alternative on the performance of coatings applied to the cleaned surface, it is likely that additional site- or industry-specific tests will be needed before the alternatives that pass this screening test are adopted.

The method is based on ASTM Method D 4828-91 for determining the practical washability of organic coatings. Changes were made to the method to allow its use in new applications. The changes include a wider variety of acceptable test panel materials, contaminants, and cleaning fluids. Procedures for evaluating the results are also different. The cleaning apparatus and procedure were not modified.

b. Applicability and Principle.

¹Material in this Appendix has been derived from Appendix F of Alternative Control Techniques Document--Industrial Cleaning Solvents, EPA-453/R-94-015.

1. Applicability. This method applies to the determination of the relative ease of removal of contaminants from a variety of materials/surfaces by manual or mechanical cleaning with a sponge and various solvents or other cleaning solutions.
2. Principles. A contaminant is applied to a test panel to represent a typical industrial cleaning situation. One portion of the soiled panel is scrubbed with a sponge and the existing solvent, and another portion is scrubbed with a sponge and an alternative solvent or cleaning solution that produces lower VOC emissions. The performance of the alternative is then rated as (1) worse than the existing solvent, or (2) as good as or better than the existing solvent.

c. Apparatus.

- 2 1. Sponge and Holder
2. Contaminant Applicator
3. Weight, 100 g
4. Balance, Weighing Accurately to 0.1 g
5. Doctor or Bird Film Applicator, having a 7-mil (0.018-mm) clearance by 6-in. (150-mm) film width
6. Panels of various materials, 17½ by 6½ by ¼ in. (455 by 165 by 6.3 mm)
7. Washability Machine³
8. Masking Tap
9. Straightedge, approximately 17 in (430 mm) in length
10. Cotton Tipped Swabs
11. Medicine Droppers
12. Suction Plate, for drawdowns

d. Reagents and Materials.

1. Contaminants. Examples that may be used with this test method include, but are not limited to pencil, crayon, ball-point pen, waterborne felt-tip markers,

²A sponge, 3 by 3¼ by 1¼ in. (75 by 95 by 45 mm), Part No. AG-8116, and a metal holder, Part No. AG-8115, available from BYK-Gardner, Inc., 2435 Linden Lane, Silver Spring, MD 20910 or a sponge, Part No. WA 2222, and metal holder, Part No. WA 2220, available from Paul N. Gardner Co., 316 N.E. First Street, Pompano Beach, Florida 33060-6699 have been found acceptable for this purpose. An equivalent may be used.

³Washability machine, Model AG-8100, available from BYK-Gardner, Inc. or Model WA 2037D, available from the Paul N. Gardner Co., have been found suitable for this purpose. Other straight-line wash testers may be adapted to meet the requirements of this test method.

grease, and mineral oil.

2. Solvents and Cleaning Solutions. Examples that may be used with this test method include any VOC solvent or alternative cleaning fluid.
3. Test Panels. Different types of panels may be selected to match the cleaning application. Examples include, but are not limited to, glass, stainless steel, aluminum, and plastic. The surface may be painted or unpainted.

e. Preparation of Apparatus.

1. Washability Machine. Level the apparatus before use and operate at 37 ± 1 cpm. (A cycle consists of a complete forward and reverse stroke.)
2. Sponge and Holder. Add sufficient weight to the holder in the form of metal sheets or other flat weights to give a combined weight of 1,000 g, including the dry sponge.
3. Test Panel. Prepare paint coated panels by the following procedure. Stir the material thoroughly and strain, if necessary, to remove all skins and particles. Draw down the coating on the panel. Apply the coating in 3 to 4 s from end to end to prevent pin holes or holidays in the film. Air dry all panels in a horizontal position for 7 days in a room maintained at $73 \pm 3.5^\circ\text{F}$ ($23 \pm 2^\circ\text{C}$) and $50 \pm 5\%$ relative humidity as described in Specification D3924, or under conditions specifically applicable to the material under test. Prepare enough panels with each paint for all the projected tests.

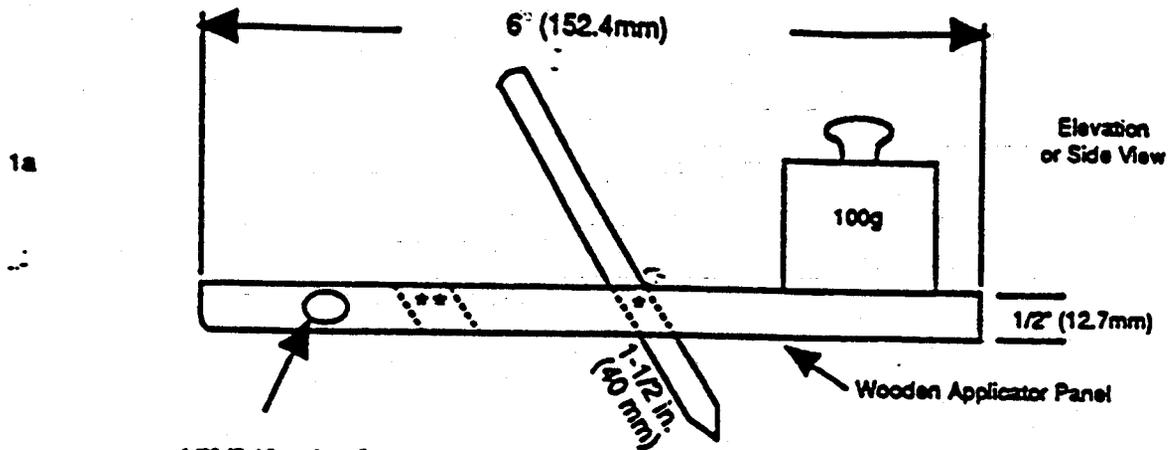
Before use, clean the top of the test panel (painted or unpainted) to be sure it is free of specks.

f. Procedure.

1. Application of Contaminants.
 - i. Apply the selected contaminants to the test panel (or coating on the panel) in one straight line parallel to ~~the length~~ of the panel for the manual method of cleaning, or in a pair of lines perpendicular to the length of the panel for the mechanical method of cleaning.
 - ii. Apply solid contaminants using the apparatus shown in Figure M-1. Insert pencil, crayon, pen or similar items into the appropriately sized hole and secure its position so it extends

1½ in. (40 mm) beyond the panel (see Figure 1(a)). Secure the medium in position with a piece of masking tape (see Figure 1(b)). Put the wooden applicator panel at one end of the test panel and place the 100-g weight on its top face at the end nearest to the marking device, as shown in Figure 1(b), securing it with a piece of tape. Allow the nonweighted end of the wooden applicator panel to rest on the surface of the test panel, then hold it by the outer edges and pull it along the entire length of the panel (see Figure 1(c)).

- iii. Apply liquid contaminants using hand-held cotton-tipped swabs. Immerse one end of a cotton-tipped swab in an appropriate solvent or cleaning solution and allow to remain totally immersed until the cotton tip is saturated (approximately 10 to 15 sec). Remove the tip from the liquid and apply the first of two parallel lines to the test panel using the straightedge to assist in drawing the lines. Adjustment of pressure on the cotton tip may be required to provide a line of uniform intensity. Reimmerse the cotton tip in the liquid and then draw the second line. Repeat with a clean or unused cotton tip for each liquid being used. Permit the



1/8" (3.18mm) radius
Grip area to pull panel
located here on each side; approx.

- * 5/16" (8mm) hole bored at approximately 45° angle (for pencil and pen)
- * * 5/8" (16mm) hole bored at approximately 45° angle (for magic marker).

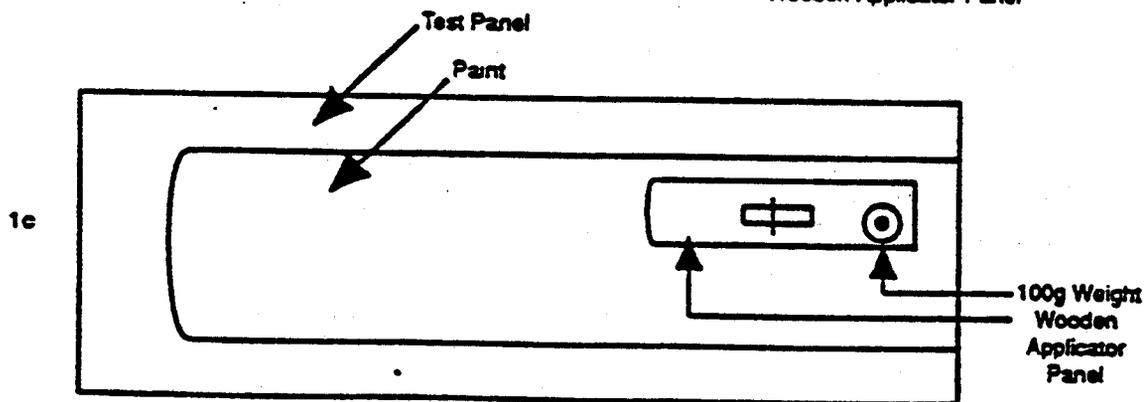
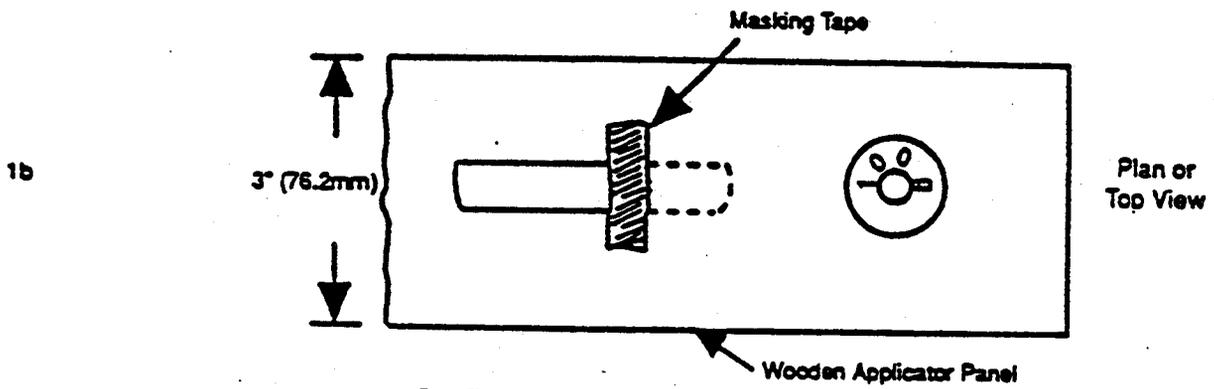


Figure M-1. Contaminant Application.
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contaminants to dry at least 1 hour under the same temperature and humidity conditions as in 5.4. Note 1 - Only one contaminant may be tested at one time. Typically, as noted above, this will mean the application of one line for manual cleaning or two parallel lines of contaminant for mechanical cleaning. As shown in Figure M-2, one section of the panel will be used to test an alternative cleaning fluid. However, the panel may be long enough to allow evaluation of more than one alternative cleaning fluid in a single test.

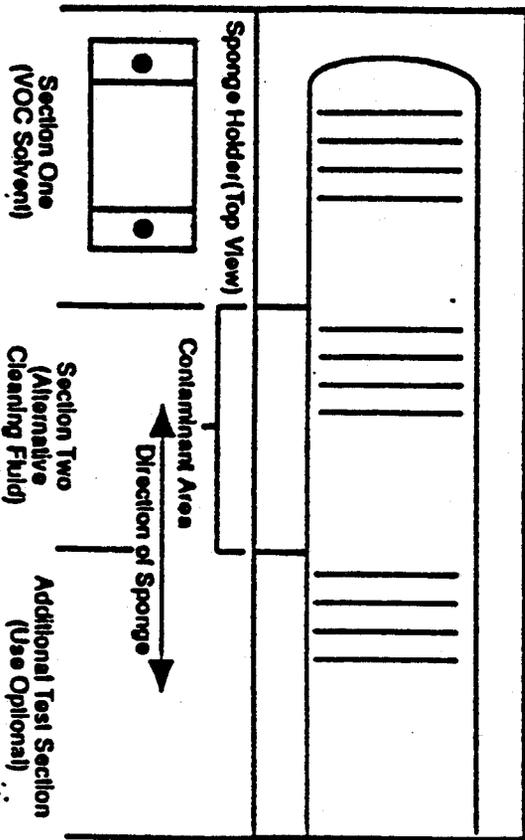
2. Cleaning.

- i. Soak the sponge in the solvent or solution at ambient temperature until saturated. Remove the sponge and squeeze with one hand until no more liquid drips from the sponge. Replace the sponge in the holder and pour 15 ± 1 mL of solvent or cleaning solution on the exposed face of the sponge.
- ii. Apply 5 mL of solvent or cleaning solution in parallel bands to each contaminant line.

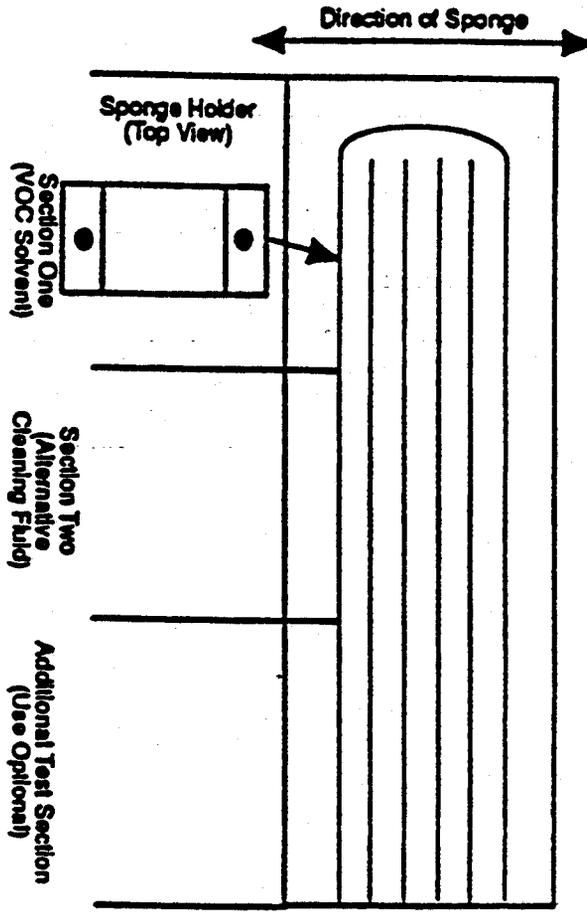
3. Manual Method. Place the sponge and holder at one end of the panel so that its long axis is perpendicular to the length of the panel (see Figure M-2). Rub the sponge across the panel over the contaminant lines, exerting minimum downward pressure. Continue rubbing until all the contaminants are removed or to a maximum of 100 cycles. If all the contaminants are removed prior to 100 cycles, stop and record the number of cycles before proceeding to 6.5.

4. Mechanical Method

- i. Place the sponge and holder at one end of the panel so that its long axis is parallel to the length of the panel (see Figure M-2). Attach the sponge and holder to the cable of the washability machine. Allow the sponge to travel a maximum of 100 cycles. If all the contaminants are removed prior to 100 cycles, stop and record the number of cycles before proceeding to 6.5.



Mechanical Wash



Manual Wash

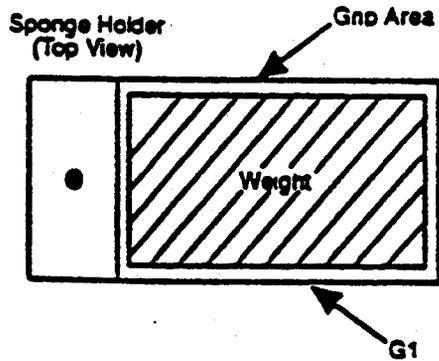
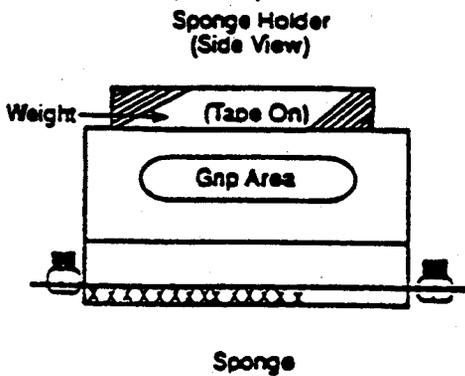


Figure M-2. Panel Layout and Brush Holder Diagram
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- ii. Remove the test panel and evaluate the condition of each in the path of the sponge and rate as follows:
 - A. Worse than existing solvent.
 - B. As good as or better than existing solvent.

When a contaminant is removed prior to 100 cycles, note the number of cycles in which each contaminant was removed.

g. Report. Report the Following Information:

- 1. Type of contaminants, solvents, or cleaning solutions, and washing method used and the results obtained in 6.5.
- 2. Any contaminants that were removed in less than 100 cycles.
- 3. Any deviation from the recommended procedure.

h. Precision and Bias

- 1. Precision - Unknown.
- 2. Repeatability - Unknown.
- 3. Reproducibility - Unknown.
- 4. Bias - Unknown.