



Designation: D 6266 – 00a

Test Method for Determining the Amount of Volatile Organic Compound (VOC) Released From Waterborne Automotive Coatings and Available for Removal in a VOC Control Device (Abatement)¹

This standard is issued under the fixed designation D 6266; 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 describes the determination of the amount of volatile organic compound (VOC) released from applied waterborne automotive coatings that is available for delivery to a VOC control device. The determination is accomplished by measuring the weight loss of a freshly coated test panel subject to evaporation or drying and by analysis of the VOC or water content in the coating.

1.2 This test method is applicable to the VOC released from application and baking operations after the paint has been applied in a simulation of a production process, or in an actual production facility.

1.3 Symbols and calculations from several other methods that determine VOC: Practice D 3960, EPA 450/3-88-018 and EPA 450/3-84-019 have been incorporated into this test method. The majority of symbols and calculations used in this test method are unique because this test method deals uniquely with differences in weight of applied paint samples that have been subject to drying, curing or solvent addition.

NOTE 1—Training and knowledge of the product being evaluated are essential for obtaining meaningful data from this test method. It is recommended that several practice runs be performed, and the laboratories repeatability evaluated before performing this test on the test samples.

1.4 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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 whoever uses this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to its use.*

2. Referenced Documents

2.1 ASTM Standards:

¹ This test method is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.21 on Chemical Analysis of Paints and Paint Materials.

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D 343 Specification for 2-Ethoxyethyl Acetate (95 %) Grade²

D 1186 Test Methods for Nondestructive Measurement of Dry Film Thickness of Non-magnetic Coatings Applied to a Ferrous Base³

D 1193 Specification for Reagent Water⁴

D 1475 Test Method for Density of Liquid Coatings, Inks, and Related Products³

D 2369 Test Method for Volatile Content of Coatings³

D 2697 Test Method for Volume Nonvolatile Matter in Clear or Pigmented Coatings³

D 3960 Practice for Determining Volatile Organic compound (VOC) Content of Paints and Related Coatings³

D 4017 Test Method for Water in Paints and Paint Materials by Karl Fisher Method³

E 145 Specification for Gravity-Convection and Forced-Ventilation Ovens⁵

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method⁶

2.2 U.S. EPA Standards:⁷

EPA 450/3-88-018 (Dated December, 1988). Environmental Protection Agency Protocol for Determining the Daily Volatile Organic Compound Emission Rate of Automobile and Light Duty Truck Topcoat Operations. This protocol describes procedures for determining VOC emission reduction credit in abatement processes.

EPA Federal Reference Method 24 - (Ref. 40CFR, part 60, Appendix A). Determination of Volatile Matter Content, Water Content, Density, Volume Solids, of Surface Coatings.

EPA 450/3-84-019 Procedures for Certifying Quantity of Organic Compound Emitted by Paint, Ink, and Other Coatings

² Discontinued 1980; see 1979 *Annual Book of ASTM Standards*, Part 29.

³ *Annual Book of ASTM Standards*, Vol 06.01.

⁴ *Annual Book of ASTM Standards*, Vol 11.01.

⁵ *Annual Book of ASTM Standards*, Vol 14.04.

⁶ *Annual Book of ASTM Standards*, Vol 14.02.

⁷ Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.



3. Summary of Test Method

3.1 This procedure measures the loss of VOC from a freshly coated surface by; (a) determining the difference in weight of a coated test panel before and after various steps in a process, (b) analyzing a sample of the applied coating for VOC or water content, or both, by gas chromatography (GC), or Karl Fisher, or both, before and after various steps in a process, and (c) calculating the VOC directly or after subtracting the water content. With these analyses, it is possible to relate the VOC loss to the volume of solids deposited on the test panel at each step of a process. The information obtained is used to determine the amount of VOC available for removal by the VOC control device at each step of a process (see Fig. 1).

4. Significance and Use

4.1 This test method provides basic engineering data that may be used to determine the amount of VOC delivered to the inlet of a VOC control device. The procedure is useful for establishing the quantity of VOC that is evolved from the coating in the flash zone or bake oven and available to be incinerated, although the same procedure can be followed when other forms of VOC abatement are used.

4.2 The total amount of VOC removed from the process by the VOC control device is a function of the amount available as given by this test method combined with the VOC removal efficiency of the control device.

5. Apparatus and Materials for the Analyses

NOTE 2—*Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specification of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination. The references to purity of water, unless otherwise indicated, shall be understood to mean Type II reagent grade water conforming to Specification D 1193.

Sample Preparation:

5.1 *Thin Steel Panels*, with an area of 310 cm² (48 in.²) or smaller.

5.2 *Laboratory Balance*, with accuracy to 0.001 g (minimum).

5.3 *Laboratory Spray Booth*, for application of the test coating, with air flow representative of production conditions.

5.4 *Spray Application Equipment*, selected to represent that used in a production process or sufficiently similar that the equipment will produce comparable performance.

5.5 *Film Thickness Gage*, for measuring dry paint thickness on metal surfaces (see Test Methods D 1186).

5.6 *Laboratory Force-Draft Bake Oven, Type-IIA or Type IIB*, as specified in Specification E 145.

5.7 *Wide-Mouth Glass Jars*, with TFE-fluorocarbon-lined caps or polypropylene copolymer bottles, one for each sample.

5.8 *Smooth Aluminum Foil*, (grade may vary).

5.9 *Ultrasonic Cleaner unit*, with 0.95 L (1 qt) capacity minimum.

5.10 *Laboratory Scale Paint Shaker* (violent agitation) 3.8 L (1-gal) capacity.

5.11 *Wood tongue Depressor or Tweezers*, if desired to roll foil.

Apparatus and Reagents for GC Analysis:

5.12 *Gas Chromatograph*, equipped with a flame ionization detector, electronic reporting integrator, capillary split injection port, and autosampler (where available).

5.13 *Chromatographic Syringe*, (10.0 µL).

5.14 *Analytical Balance*, accurate to 0.1mg is needed, for this method.

5.15 *Sealable Vials*, (20 mL) scintillation.

5.16 *Medicine Droppers*.

5.17 *Analytical Column*—capillary, (30 meter) (0.25 mm) inside diameter,

5.17.1 film thickness, fused silica DB-5 or equivalent.

5.18 *Autosampler Vials*.

5.19 *Pipet Volumetric*.

5.20 *Volumetric Flask*, for calibration standard and internal standard solutions.

5.21 *Bottles*, with good sealing caps for standard solutions.

5.22 *Solvents Standards*, expected to be found in the coating to be tested.

5.23 *Tetrahydrofuran (THF)*—HPLC grade, uninhibited.

5.24 *Cyclohexanol*—98 % or appropriate grade reagent.

5.25 *Water*.

5.26 *Acetone*—HPLC grade.

5.27 *Methanol*—HPLC grade.

5.28 *Dimethylformamide (DMF)*—HPLC grade.

5.29 *Chromatography Gases*—Helium of 99.9995 % purity or higher. Hydrogen of 99.9995 % minimum purity. Air, “dry” quality, free of hydrocarbons.

Apparatus and Reagents for KF Analysis:

5.30 *40-mL Volatile Organic Analysis (VOA) Vials*, with TFE-fluorocarbon lined caps.

5.31 *Methanol*—Low water grade (<0.008 % by K.F.)

5.32 *Karl Fisher Titrator*, or equivalent coulometric.

5.33 *Reagents*, appropriate for titrator.

5.34 *Associated Glassware*, for the tests (pipettes, volumetric flasks, etc).

5.35 *Water*, for calibration of the test instrument.

Apparatus and Reagents for Solids Density (Test Methods D 2369, D 1475, D 2697; EPA Federal Reference Method 24):

5.36 *Syringe*, 5 mL.

5.37 *Weighing or Bottle* with eye dropper.

5.38 *Test Tube*, with new cork stopper.

5.39 *Aluminum Foil Dish*, 58 mm (2.3 in.) in diameter by 18 mm (0.71 in.) high with a smooth bottom surface.

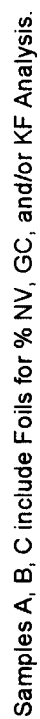
5.40 *Laboratory Force-Draft Bake Oven Type IIA or Type IIB*, as specified in Specification E 145.

5.41 *Analytical Balance*, with accuracy to 0.1 mg.

5.42 *Toluene*, minimum technical grade,

5.43 *Ethoxyethyl Acetate*, minimum technical grade, Specification D 343.





Karl Fisher (KF)	8.5
G. C. Analysis	8.6
% Non-Volatiles	8.7

FIG. 1 Test Panel Processing