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Standard Guide for Environmental and Performance Verification of Factory- Applied Liquid Coatings¹

This standard is issued under the fixed designation D7270; 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 guide provides a generic testing procedure to verify the air pollution-prevention characteristics and basic properties of liquid coatings applied to metal, plastic, wood, or composite substrates in a factory/manufacturing environment. Thus it may be used to evaluate these liquid coatings to verify their volatile organic compound (VOC) and organic hazardous air pollutant (HAP) content as well as basic performance properties.

1.2 This guide is adapted from a procedure used by the US Environmental Protection Agency (EPA) to establish third party verification of the physical properties and performance of coatings that have potential to reduce air emissions. The data from the verification testing is available on the internet at the EPA's Environmental Technology Verification (ETV) Program website (<http://www.epa.gov/etv/centers/center6.html>) under the "P2 Innovative Coatings and Coating Equipment Pilot."

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

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

- B117 Practice for Operating Salt Spray (Fog) Apparatus**
- B499 Test Method for Measurement of Coating Thicknesses by the Magnetic Method: Nonmagnetic Coatings on Magnetic Basis Metals**
- D522 Test Methods for Mandrel Bend Test of Attached Organic Coatings**
- D523 Test Method for Specular Gloss**
- D1729 Practice for Visual Appraisal of Colors and Color Differences of Diffusely-Illuminated Opaque Materials**
- D1735 Practice for Testing Water Resistance of Coatings Using Water Fog Apparatus**
- D2244 Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates**
- D2369 Test Method for Volatile Content of Coatings**
- D2794 Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)**
- D3359 Test Methods for Rating Adhesion by Tape Test**
- D3363 Test Method for Film Hardness by Pencil Test**
- D3792 Test Method for Water Content of Coatings by Direct Injection Into a Gas Chromatograph**
- D3960 Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings**
- D4017 Test Method for Water in Paints and Paint Materials by Karl Fischer Method**
- D4060 Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser**

¹ This guide is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.55 on Factory Applied Coatings on Preformed Products.

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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.

D4457 Test Method for Determination of Dichloromethane and 1,1,1-Trichloroethane in Paints and Coatings by Direct Injection into a Gas Chromatograph (Withdrawn 2019)³

D5402 Practice for Assessing the Solvent Resistance of Organic Coatings Using Solvent Rubs

D5767 Test Method for Instrumental Measurement of Distinctness-of-Image (DOI) Gloss of Coated Surfaces

D6133 Test Method for Acetone, *p*-Chlorobenzotrifluoride, Methyl Acetate or *t*-Butyl Acetate Content of Solvent-borne and Waterborne Paints, Coatings, Resins, and Raw Materials by Direct Injection Into a Gas Chromatograph

D6438 Test Method for Acetone, Methyl Acetate, and Parachlorobenzotrifluoride Content of Paints, and Coatings by Solid Phase Microextraction-Gas Chromatography

D6695 Practice for Xenon-Arc Exposures of Paint and Related Coatings

D6886 Test Method for Determination of the Weight Percent Individual Volatile Organic Compounds in Waterborne Air-Dry Coatings by Gas Chromatography

2.2 EPA Methods:⁴

EPA Method 24 Surface Coatings (Determination of Volatile Matter Content, Water Content, Density, Volume Solids, and Weight Solids of Surface Coatings)

EPA Method 311 HAPS in Paints and Coatings (Analysis of Hazardous Air Pollutant Compounds in Paints and Coatings by Direct Injection Into a Gas Chromatograph)

3. Significance and Use

3.1 The primary objective of this verification guide is to determine the “air pollution-prevention potential” (possible reduction in VOC or HAP emissions) of factory-applied liquid coatings.

3.2 The overall objective of this guide is to verify the above pollution-prevention characteristics and basic performance characteristics of liquid coating technologies. Use of this guide can increase acceptance of more environmentally friendly technologies for product finishing with an accompanying reduction in emissions to the atmosphere. The specific objectives of this guide are to (1) quantify the VOC and HAP content of liquid coatings and (2) verify the basic quality and durability performance of these coatings.

3.3 The primary criteria for verification of liquid coatings will be:

3.3.1 Confirm that use of the coating will significantly reduce VOC and HAP content or emissions (or both) during application or cure, or both.

3.3.2 Confirm that the coating can provide an acceptable finish (appearance, hardness, flexibility, etc.) for the intended end use.

3.4 The test results from this guide can provide to potential users the best data available to determine whether the coating will provide a pollution-prevention benefit while meeting the finish quality requirements for its intended use. This guide intends to supply end users with unbiased technical data to assist them in this decision-making process.

3.5 The quantitative air pollution-prevention potential depends on a multitude of factors; therefore, the liquid coatings are to be applied in accordance with the coating vendor’s instructions and the resulting verification data reflect only the specific conditions of the test. To quantify the environmental benefit (air pollution-prevention potential), a test to quantify the VOC or HAP emissions from the new liquid coatings will be conducted and compared to data for existing coatings typically used in the target industry.

4. Testing Site

4.1 To accelerate the transition of environmentally friendly processes to the manufacturing base, the test facility should offer the ability to test processes and products on representative commercial equipment. The coating application equipment in the test facility should be available for the pilot-scale testing performed in this guide (for example, surface pretreatment, powder coating, electrocoating, wet spray, and conventional forced-air and infrared ovens, as applicable). Layouts of an example of an approved test facility are shown in **Appendix X1, Figs. X1.1 and X1.2**, respectively. Examples of the various testing laboratories and their representative equipment holdings that are relevant to the approved test facility verification projects are listed in **Table X1.1**.

4.2 A test plan, referred to as a Testing and Quality Assurance Protocol (T/QAP), will be established to provide the testing details that are dependent upon the specific liquid coating being tested. Some general guidelines and procedures can be applied to each T/QAP. These include:

4.2.1 A detailed description of each part of the test will be provided. The selection of tests to be performed, test details, evaluation methods and acceptance criteria are defined by the end use requirements of the coating. These details should be incorporated into a test plan that is unique to each coating. This will include a detailed design of experiments and a schematic diagram of testing to be performed.

4.2.2 Critical and noncritical factors will be listed. Noncritical factors will remain constant throughout the testing. Critical factors will be listed as control (process) factors or response (coating product quality) factors.

4.2.3 The T/QAP will identify the testing site.

4.2.4 Regardless of where the testing is performed, the approved test facility will ensure that the integrity of third-party testing is maintained.

4.2.5 Regardless of where the testing is performed, the Quality Assurance (QA) portion of the guide will be strictly adhered to.

4.2.6 A statistically significant number of samples will be analyzed for each critical response factor (see **Table 1**). Variances (or standard deviations) of each critical response factor will be reported for all results.

³ The last approved version of this historical standard is referenced on www.astm.org.

⁴ US EPA, Office of Air Quality Planning and Standards (OAQPS), TTN EMC Webmaster (C304-03), Research Triangle Park, NC 27711 (website, www.epa.gov/ttn/emc).