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Standard Specification for Non-Reinforced Liquid Coating Encapsulation Products for Leaded Paint in Buildings¹

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1. Scope

1.1 This specification covers minimum material performance requirements and laboratory test procedures for non-reinforced liquid coating encapsulation products (single or multiple-coat systems) for leaded paint in buildings. Performance properties addressed in this specification are:

- 1.1.1 Impact resistance,
- 1.1.2 Adhesion,
- 1.1.3 Dry abrasion resistance,
- 1.1.4 Water vapor transmission,
- 1.1.5 Water and chemical resistance,
- 1.1.6 Surface burning characteristics,
- 1.1.7 Volatile organic compound (VOC) content,
- 1.1.8 Weathering,
- 1.1.9 Aging,
- 1.1.10 Scrub resistance,
- 1.1.11 Mildew resistance,
- 1.1.12 Paintability/repairability,
- 1.1.13 Flexibility, and
- 1.1.14 Tensile properties.

1.2 This specification does not address the selection of an encapsulation product for specific use conditions. Specific use conditions may require performance values other than those stated in this specification. See Guide E1796.

1.3 This specification does not cover the use of corrosion-inhibiting primers prior to encapsulation products on either industrial steel structures or on residential coated metal surfaces. Types of Direct-To-Metal (DTM) primers in conjunction with lead paint encapsulants has not been investigated. Use of primers to yield substrates acceptable to receive an encapsulant, and to inhibit future corrosion of encapsulated substrates, should be evaluated by trial applications at each specific project.

1.4 This specification applies to any non-reinforced liquid applied product that relies primarily on adhesion for attach-

ment to the surface. These products are used to encapsulate a leaded paint surface with the intent of reducing human exposure to lead.

1.5 The results of the test methods included in this specification will not necessarily predict field performance.

1.6 The values stated in SI units are to be regarded as standard. The values given in parentheses after SI units are provided for information only and are not considered standard.

1.7 *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.*

1.8 *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
- D16 Terminology for Paint, Related Coatings, Materials, and Applications
 - D522/D522M Test Methods for Mandrel Bend Test of Attached Organic Coatings
 - D823 Practices for Producing Films of Uniform Thickness of Paint, Coatings and Related Products on Test Panels
 - D1005 Test Method for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers
 - D1193 Specification for Reagent Water
 - D1212 Test Methods for Measurement of Wet Film Thickness of Organic Coatings
 - D1308 Test Method for Effect of Household Chemicals on Clear and Pigmented Coating Systems
 - D1356 Terminology Relating to Sampling and Analysis of Atmospheres

¹ This specification is under the jurisdiction of ASTM Committee D22 on Air Quality and is the direct responsibility of Subcommittee D22.12 on Sampling and Analysis of Lead for Exposure and Risk Assessment.

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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.

- D1475 Test Method for Density of Liquid Coatings, Inks, and Related Products
- D1653 Test Methods for Water Vapor Transmission of Organic Coating Films
- D2370 Test Method for Tensile Properties of Organic Coatings
- D2486 Test Methods for Scrub Resistance of Wall Paints
- D2794 Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
- D3273 Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
- D3274 Test Method for Evaluating Degree of Surface Disfigurement of Paint Films by Fungal or Algal Growth, or Soil and Dirt Accumulation
- D3359 Test Methods for Rating Adhesion by Tape Test
- D3891 Practice for Preparation of Glass Panels for Testing Paint, Varnish, Lacquer, and Related Products
- D3924 Specification for Standard Environment for Conditioning and Testing Paint, Varnish, Lacquer, and Related Materials
- D3925 Practice for Sampling Liquid Paints and Related Pigmented Coatings
- D3960 Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
- D4060 Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
- D4214 Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films
- D4414 Practice for Measurement of Wet Film Thickness by Notch Gages
- D4708 Practice for Preparation of Uniform Free Films of Organic Coatings
- D7091 Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals
- E84 Test Method for Surface Burning Characteristics of Building Materials
- E1605 Terminology Relating to Lead in Buildings
- E1796 Guide for Selection and Use of Liquid Coating Encapsulation Products for Leaded Paint in Buildings
- E2239 Practice for Record Keeping and Record Preservation for Lead Hazard Activities
- G154 Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials
- 2.2 *Federal Test Methods Standard 141C*:³
 - 2011 Preparation of Steel Panels
 - 2012 Preparation of Tin Panels
- 2.3 *Federal Test Methods Standard 141D*:³
 - 3011 Condition in Container

3. Terminology

3.1 *Definitions*—For definitions of terms used in this specification, refer to Terminologies D16, D1356, and E1605.

³ Available from DLA Document Services, Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, <http://quicksearch.dla.mil>.

3.2 *Definitions of Terms Specific to This Standard*:

3.2.1 *lead inaccessibility, n*—the ability of an encapsulation product to resist or inhibit the transport of lead to its surface.

4. Materials

4.1 Materials needed for conduct of tests are listed in the individual requirements.

4.2 Materials needed to conduct activities according to citations given are listed within the cited document.

5. Classification

5.1 *Type I: Interior Use Only*—Type I defines encapsulation products intended for interior use. These products shall meet the requirements of this specification except those for weathering and exterior aging (that is, test methods described in 11.9 and 11.10.1 not conducted).

5.2 *Type II: Exterior Use Only*—Type II defines encapsulation products intended for exterior use. These products shall meet the requirements of this specification except that for interior aging (that is, test method described in 11.10.2 not conducted).

5.3 *Type III: Either Exterior or Interior Use*—Type III defines encapsulation products intended for either interior or exterior use. These products shall meet all the requirements of this specification.

6. Performance Requirements

6.1 Performance requirements that shall be met for a non-reinforced liquid coating encapsulation product are given in Table 1.

NOTE 1—In addition to those given in Table 1, performance requirements for three other properties are of concern for liquid coating encapsulation products. These are combustion toxicity, emissions during application and curing, and lead accessibility. However, requirements for these properties cannot be included in this specification at this time because there are no adequate ASTM or Federal test methods for determining them. Requirements for two of these properties, combustion toxicity and emissions during application and curing, may be subject to regulations or ordinances promulgated by authorities having jurisdiction. The user of this specification is advised to determine whether such regulations or ordinances exist. The addition of requirements for these properties to this specification will be undertaken when suitable test methods are available.

7. Sampling

7.1 A 3.8-L (1-gal) sample is usually sufficient for the recommended tests.

7.2 Prior to sampling, establish the condition of the container since damage to it may cause evaporation, skinning, or other undesirable effects. Excessive storage time and temperature fluctuations may cause settling or changes in viscosity. Materials beyond the manufacturer's stated shelf life shall not be sampled.

7.3 Thickening, settling, and separation are undesirable and objectionable if the coating, after storage, cannot be readily made suitable for application with a reasonable amount of stirring. Determine the conditions in the container in accordance with Method 3011 of the Federal Test Method Standard No. 141C.

TABLE 1 Performance Requirements for Reinforced Liquid Coating Encapsulation Products

Performance Property	Minimum Performance Requirement	Tested in Accordance with Section	Minimum Number of Tests
Impact resistance	9 J (80 in-lbf) without cracking to the substrate	11.2	Two panels
Adhesion	5A rating	11.3	Two panels each tested at three locations
Dry abrasion resistance	Film thickness loss: <20 %	11.4	Two panels
Water vapor transmission	No minimum; report test result ^A	11.5	Three cups
Water and chemical resistance—spot test	After 1 h recovery period, no evidence of blistering, cracking, or delamination After 24 h recovery, indistinguishable hardness of the exposed and unexposed surfaces	11.6/11.6.1	Two tests for each reagent
Water and chemical resistance—immersion test	After 2 h drying period, adhesion rating: 5A	11.6/11.6.2	Two panels each tested at three locations
Surface burning characteristics	Flame spread index (FSI) <25 Smoke development rating <50	11.7	One panel
Volatile organic compound (VOC) content	No minimum; report test result ^E	11.8	See Practice D3960
Weathering—exterior end-use products	After exposure: chalking: 8 rating adhesion: 5A rating flexibility: no cracking or other visual defects tensile properties: <35 % change from initial value	11.9	Chalking and Adhesion: two panels each tested at three locations ^C Flexibility: three panels Tensile properties: ten specimens
Aging—exterior and interior end-use products	After minimum 6 h recovery: adhesion: 5A rating flexibility: no cracking or other visual defects tensile properties: <35 % change from initial value	11.10.1: for exterior products 11.10.2: for interior products	Adhesion: two panels each tested at three locations Flexibility: three panels Tensile properties: ten specimens
Scrub resistance	No erosion of the encapsulant to the substrate after 1200 cycles	11.11	Two panels
Mildew resistance	Mildew resistance rating: 8	11.12	Three panels
Paintability	Adhesion rating: 5A	11.13.1	Two panels each tested at three locations
Repairability	Adhesion rating: 5A	11.13.2	Two panels each tested at three locations
Flexibility	No cracking or other visual defects	11.14	Three panels
Tensile Properties	No minimum; report test result ^A	11.15	Ten specimens

^A Minimum performance depends on architectural and end use conditions (see 1.2).

^B VOC requirements may be specified in ordinances promulgated by authorities having jurisdiction.

^C The chalking and adhesion tests can be conducted on the same panels provided that chalking is first performed.

7.4 Sample the encapsulant in accordance with Practice D3925. Determine the density in accordance with Test Method D1475 and repeat until two successive readings agree within 90 g (0.2 lb). Samples for testing may then be taken.

7.5 Report the size of the container from which the sample was taken and product identification codes.

8. Number of Tests

8.1 The number of tests that shall be conducted for each performance property is given in Table 1.

9. Retesting

9.1 In cases where encapsulation products fail to pass one or more requirements of this specification, retesting shall be permitted. Both the original data and the retesting data for each requirement for which retesting was conducted shall be used in determining whether the requirement is met.

10. Test Specimens

10.1 A non-reinforced liquid coating encapsulation product shall be comprised of all principal components in the system, including the base and top coats and primer, if specified, for field application. Except for adhesion testing and dry abrasion testing, where specialty primers may be used for flash rust

resistance, primers shall not be used solely for product performance testing in accordance with this specification.

10.2 Preparation of Test Panels:

10.2.1 The test specimen (substrate) shall be the encapsulant coated test panel.

10.2.2 Prior to product application, the tin-plated steel panels shall be solvent cleaned in accordance with Method 2012 of the Federal Test Method Standard No. 141C. Supplement the test panel cleaning procedure with an additional cleaning so that water wets the entire surface of the panel. Dry and wipe clean.

10.2.3 Product application shall be performed using the draw-down procedure in accordance with Practices D823. Determine dry-film thickness in accordance with Test Method D1005 for free films and Practice D7091 for films on steel panels except when the manufacturer's written instructions reference only wet-film thickness. In this case, determine wet-film thickness in accordance with Test Methods D1212 or Practice D4414. If a range of thickness is specified by the manufacturer for field application, the minimum value of this range shall be used for product testing in accordance with this specification. Dry-film thickness shall remain constant for all tests.

10.2.4 Preparation of steel panels shall be in accordance with Method 2011 of Federal Test Method Standard No. 141C.

10.2.5 Preparation of glass panels shall be in accordance with Practice **D3891**.

10.2.6 Curing shall be performed under standard laboratory conditions in accordance with Specification **D3924**. Cure time shall be 7 days unless otherwise agreed upon between the purchaser and seller. Cure time shall remain constant for all tests.

10.3 *Preparation of Free-Film Specimens:*

10.3.1 Free-film specimens shall be prepared in accordance with Practice **D4708**.

10.4 *Laboratory Conditions:*

10.4.1 Where applicable, all test methods and practices included in this specification shall be performed under standard laboratory conditions in accordance with Specification **D3924**. ASTM standard conditions for laboratory testing are 23 °C ± 2 °C (73.5 °F ± 3.5 °F) and 50 % ± 5 % relative humidity

11. Test Methods

11.1 The laboratory testing shall be performed on the entire non-reinforced liquid coating encapsulation product system, whether single or multiple coat, as applied in the field.

11.2 *Impact Resistance*—Determine impact resistance in accordance with Test Method **D2794** using 0.80 mm (0.032 in.) zinc phosphate treated, cold-rolled steel panels as substrate and 16 mm (5/8 in.) punch diameter. The impact shall be applied directly to the encapsulant coating. After impact, examine the encapsulant coating visually for the presence of cracks using 5 to 7× magnification.

11.3 *Adhesion*—Determine the degree of adhesion in accordance with Test Methods **D3359**, Method A, using 0.25 mm (0.010 in.) tin plated steel panels as substrate.

11.4 *Dry Abrasion Resistance*—Determine dry abrasion resistance in accordance with Test Method **D4060** using CS-17 wheels, a 1 kg mass, and 0.80-mm (0.032-in.) cold-rolled steel panels as substrate. Where applicable, it is not prohibited to use specialty primers on the steel panel for flash rust resistance, although such primers may not be a component of the encapsulant product system. If used, subtract the thickness of the primer coat from the total film thickness of the test panel when calculating the percent film-thickness loss occurring during abrasion. Conduct the abrasion for 1000 cycles. Before initiating abrasion, draw diagonal lines with a marking pen from corner to corner across the test panel to measure film loss consistently. Measure initial and final film thickness on four abrasion locations on the encapsulant surface according to Practice **D7091** using an electronic thickness gauge. Select these four locations along the diagonal lines approximately 30 mm (1.25 in.) from all four corners of the test panel.

11.5 *Water Vapor Transmission*—Determine the water vapor transmission in accordance with Test Methods **D1653**, Method A (Dry Cup Method), Condition A. Test the encapsulant product as a free film that has a thickness specified by the manufacturer for product application.

11.6 *Water and Chemical Resistance*—Determine the resistance to water and chemicals in accordance with Test Method **D1308**, using 0.25-mm (0.010-in.) tin-plated steel panels as the substrates for the immersion test and glass panels as the substrates for the spot tests.

11.6.1 *Spot Test*—Conduct the spot test using the reagents listed in 11.6.1.3 through 11.6.1.11. For each reagent, add 3 mL to a cotton ball placed on the coated glass panel. Cover the cotton ball with a watch glass or other suitable device. Remove the cotton ball after 24 h and gently pat the specimen dry with a paper towel. Then allow the specimen to recover for 1 h, and examine it by unaided eye for evidence of blistering, cracking, or delamination. After a 24-h recovery period, evaluate for evidence of softening by lightly rubbing the reagent-exposed area and an adjacent unexposed area with a wood tongue depressor; judge whether the hardness of the exposed and unexposed areas can be subjectively distinguished.

11.6.1.1 Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society where such specifications are available.⁴ Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

11.6.1.2 *Purity of Water*—Unless otherwise indicated, references to water shall be understood to mean reagent water as defined by Type I of Specification **D1193**.

11.6.1.3 *Ethyl Alcohol*, (1+1 ethyl alcohol/water by volume).

11.6.1.4 *Acetic Acid*, (1+19 glacial acetic acid/water by volume).

11.6.1.5 *Sodium Hydroxide*, (1+19 sodium hydroxide/water by mass).

11.6.1.6 *Hydrochloric Acid*, (1+19 hydrochloric acid (37 %)/water by volume).

11.6.1.7 *Citric Acid*, (1+19 citric acid/water by mass).

11.6.1.8 *Corn Oil*.

11.6.1.9 *Phosphoric Acid*, (1+19 phosphoric acid/water by volume).

11.6.1.10 *Trisodium Phosphate*, (1+19 trisodium phosphate/water by mass).

11.6.1.11 *Distilled Water*.

11.6.2 *Immersion Test*—Conduct the immersion test by immersing one half of the panel in distilled water for 24 h at standard laboratory conditions. Protect the backs, sides, and edges of the panel against rusting. After removal from the water, allow the panel to dry for 2 h at standard laboratory conditions before testing for adhesion in accordance with **11.3**.

11.7 *Surface Burning Characteristics*—Determine surface burning characteristics in accordance with Test Method **E84** using Sterling Board or equivalent as substrate.

⁴ACS Reagent Chemicals, Specifications and Procedures for Reagents and Standard-Grade Reference Materials, American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.