



# Standard Specification for Reinforced Liquid Coating Encapsulation Products for Leaded Paint in Buildings<sup>1</sup>

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## 1. Scope

1.1 This specification covers minimum material performance requirements and laboratory test procedures for 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,

1.2 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 for guidance.

1.3 This specification complements Specification E1795 for non-reinforced liquid coating encapsulation products.

1.4 This specification does not cover the use of encapsulation products on industrial steel structures nor residential exterior coated metal surfaces because no corrosion control requirements are included.

1.5 This specification applies to any liquid-applied product incorporating reinforcement materials as part of the system. Reinforcement materials are continuous fabric or mesh and are applied in the field. These materials are typically applied between a base and top coat. These products are used to encapsulate a leaded paint surface with the intent of reducing human exposure to lead in paint.

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.23 on Lead Hazards Associated with Buildings.

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

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

1.8 *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.*

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

- D16 Terminology for Paint, Related Coatings, Materials, and Applications
- D823 Practices for Producing Films of Uniform Thickness of Paint, Varnish, and Related Products on Test Panels
- D1005 Test Method for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers
- D1212 Test Methods for Measurement of Wet Film Thickness of Organic Coatings
- D1308 Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes
- D1475 Test Method For Density of Liquid Coatings, Inks, and Related Products
- D1653 Test Methods for Water Vapor Transmission of Organic Coating Films
- 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 Measuring Adhesion by Tape Test

<sup>2</sup> 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.

- D3924 Specification for 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
- D3891 Practice for Preparation of Glass Panels for Testing Paint, Varnish, Lacquer, and Related Products
- 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
- D4541 Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
- 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
- E1795 Specification for Non-Reinforced Liquid Coating Encapsulation Products for Leaded Paint 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 Light Apparatus for UV Exposure of Nonmetallic Materials

## 2.2 Federal Test Methods Standard 141C:<sup>3</sup>

- 2011 Preparation of Steel Panels
- 2012 Preparation of Tin Panels

## 2.3 Federal Test Methods Standard 141D:<sup>3</sup>

- 3011 Condition in Container

### 3. Terminology

3.1 *Definitions*—For definitions of terms used in this specification, refer to Terminologies [D16](#) and [E1605](#).

### 4. Classification

4.1 *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 (for example, test methods described in [10.9](#) and [10.10.1](#) not conducted).

4.2 *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 (for example, test method [10.10.2](#) not conducted).

4.3 *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.

### 5. Performance Requirements

5.1 Performance requirements that shall be met for a 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.

### 6. Sampling

6.1 A 3.8-L (1-gal) sample of the encapsulant coating is usually sufficient for conducting the specified tests.

6.2 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. Reinforcement materials shall be evaluated to ensure they are undamaged.

6.3 Thickening, settling, and separation are undesirable and objectionable if the coating 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 Federal Test Method Standard No. 141C.

6.4 Sample the encapsulation product 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.

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

### 7. Number of Tests

7.1 The number of tests that shall be conducted for each performance property is given in [Table 1](#).

### 8. Retesting

8.1 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.

### 9. Test Specimens

9.1 An encapsulation product shall be comprised of all principal components in the system, including the base and

<sup>3</sup> Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, <http://dodssp.daps.dla.mil>.

**TABLE 1 Performance Requirements For Reinforced Liquid Coating Encapsulation Products**

Performance Property	Minimum Performance Requirement	Tested in Accordance with Paragraph	Minimum Number of Tests
Impact resistance	9 J (80 in. lbf) without cracking to the substrate	10.2	Two panels
Adhesion	700 kPa (100 lbf/in. <sup>2</sup> )	10.3	Three panels
Dry abrasion resistance	For all reinforcements: no abrasion through the reinforcement after 1000 cycles Additionally, for mesh-type reinforcements: coating present within the mesh	10.4	Two panels
Water vapor transmission	No minimum; report test result <sup>A</sup>	10.5	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	10.6/10.6.1	Two tests for each reagent
Water and chemical resistance—immersion test	After 1 h recovery period, no evidence of blistering, cracking, or delamination After 24 h recovery period, indistinguishable hardness of the exposed and unexposed surfaces	10.6/10.6.2	One panel examined in each of three locations
Surface burning characteristics	Flame spread index (FSI) <25 Smoke development rating <50	10.7	One panel
Volatile organic compound (VOC) content	No minimum; report test result <sup>B</sup>	10.8	See Practice <a href="#">D3960</a>
Weathering—exterior end-use products	After exposure: chalking: 8 rating adhesion: 700 kPa (100 lbf/in. <sup>2</sup> )	10.9	three panels
Aging—exterior end-use products	After a >6 h recovery period after completing exposure: adhesion: 700 kPa (100 lbf/in. <sup>2</sup> )	10.10.1	Three panels
Aging—interior end-use products	After a >6 h recovery period after completing exposure: adhesion: 700 kPa (100 lbf/in. <sup>2</sup> )	10.10.2	Three panels
Scrub resistance	No erosion of the encapsulant to the substrate after 1200 cycles	10.11	Two panels
Mildew resistance	Mildew resistance rating: 8	10.12	Three panels
Paintability	Adhesion rating: 5A	10.13.1	Two panels each tested at three locations
Repairability	Adhesion: 700 kPa (100 lbf/in. <sup>2</sup> )	10.13.2	Three panels

<sup>A</sup> Minimum performance depends on architectural and end use conditions (see [1.2](#)).

<sup>B</sup> VOC requirements may be specified in ordinances promulgated by authorities having jurisdiction.

topcoats, the reinforcement material, and primer, if specified, for field application. Except for dry abrasion and adhesion 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.

## 9.2 Preparation of Test Panels:

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

9.2.2 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.

9.2.3 Product application shall be performed using the draw-down procedure, where applicable, in accordance with Test Methods [D823](#). Determine the dry-film thickness in accordance with Test Method [D1005](#) for free films or Practice [D7091](#) for films on steel panels except when the manufactur-

er's written instructions reference only wet-film thickness. In this case, measure 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. The dry-film thickness shall remain constant for all tests.

9.2.3.1 Mechanical fasteners shall not be used in preparing the test panels.

9.2.4 Prepare steel panels in accordance with Method 2011 of Federal Test Method Standard No. 141C.

9.2.5 Prepare glass panels in accordance with Practice [D3891](#).

9.2.6 Curing shall be performed under standard laboratory conditions in accordance with Specification [D3924](#). The cure time shall be seven days unless otherwise agreed upon between the purchaser and the seller. The cure time shall remain constant for all tests.

## 9.3 Laboratory Conditions:

9.3.1 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  $23 \pm 2^\circ\text{C}$  ( $73.5 \pm 3.5^\circ\text{F}$ ) and  $50 \pm 5\%$  relative humidity.

## 10. Test Methods

10.1 Testing conducted in accordance with this specification shall be performed on the entire encapsulation product system, whether single or multiple coat, as applied in the field, except for scrub resistance, volatile organic compound (VOC) content, and permeability, which are performed on the top coat only.

10.2 *Impact Resistance*—Determine the impact resistance in accordance with Test Method **D2794** using 0.80-mm (0.032-in.) zinc phosphate treated, cold-rolled steel panels as the substrate and 16-mm (0.625-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  $5\times$  to  $7\times$  magnification.

10.3 *Adhesion*—Determine the degree of adhesion in accordance with Test Method **D4541** using 0.25-mm (0.10-in.) tin plated steel panels as the substrate. The size of the test area on the panel shall be a minimum of 75 by 150 mm (3 by 6 in.). Do not score around adhesion dolly. Prior to conducting the pull-off adhesion test procedure, adhere the tin-plated steel panel to a 6.4-mm (0.25-in.) thick steel panel of a size equal to or greater than the tin-plated panel. An elcometer appropriate for measuring adhesion in the range of 0 to 3.5 MPa (0 to 500 psi) shall be used. Record the mode of failure, whether between the coating and substrate or between the coating and reinforcement.

NOTE 2—The tin-plated steel panel is adhered to the steel panel to stiffen the substrate, thereby minimizing the effect of substrate rigidity on the test results. Adhesives that are used successfully to adhere to the pull-off loading fixture are suitable for adhering the tin-plated panel to the steel panel.

10.4 *Dry Abrasion Resistance*—Determine the 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 the 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. Conduct the test for 1000 cycles, or until the reinforcement abrades away, whichever is the shorter number of cycles. Examine the abraded specimen visually using  $5\times$  to  $7\times$  magnification to judge whether abrasion has occurred totally through the reinforcement and, in the case of mesh-type reinforcements, to determine the presence of encapsulant coating with the mesh.

10.5 *Water Vapor Transmission*—Determine the water vapor transmission in accordance with Test Method **D1653**, Method A (Dry Cup Method), Condition A. Test the encapsulant system as free film having a minimum thickness of 0.075 mm (0.003 in.).

10.6 *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.

10.6.1 *Spot Test*—Conduct the spot test using the reagents listed in **10.6.1.1-10.6.1.9**. 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. After completing the chemical exposure, allow the specimen to recover for 1 h, and then 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.

10.6.1.1 *Ethyl Alcohol* (50 %/50 % ethyl alcohol/water by volume).

10.6.1.2 *Acetic Acid* (5 %/95 % glacial acetic acid/water by volume).

10.6.1.3 *Sodium Hydroxide* (5 %/95 % sodium hydroxide/water by mass).

10.6.1.4 *Hydrochloric Acid* (5 %/95 % hydrochloric acid (37)/water by volume).

10.6.1.5 *Citric Acid* (5 %/95 % citric acid/water by mass).

10.6.1.6 *Corn Oil*.

10.6.1.7 *Phosphoric Acid* (2 %/98 % phosphoric acid/water by volume).

10.6.1.8 *Trisodium Phosphate* (5 %/95 % trisodium phosphate/water by mass).

10.6.1.9 *Distilled Water*.

10.6.2 *Immersion Test*—Conduct the immersion test in a beaker 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 from rusting. After removal from the water, allow the specimen to recover for 1 h, and then 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 three sets of water-immersed and adjacent unexposed areas with a wood tongue depressor; judge whether the hardness of the water-immersed and unexposed areas can be subjectively distinguished.

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

10.8 *Volatile Organic Compound Content*—Determine the VOC content in accordance with Practice **D3960**.

10.9 *Weathering*—For encapsulation products designated for exterior use, determine the degree of weathering in accordance with Practice **G154**. Conduct the practice for 1000 h under fluorescent lamps with a peak emission at 313 nm and a time/temperature cycle of 4 h ultraviolet (UV) at  $60^\circ\text{C}$  and 4 h condensation at  $50^\circ\text{C}$ . After exposure, evaluate the degree of chalking in accordance with Test Methods **D4214**, Method A, using wool felt of a contrasting color. Determine the degree of adhesion in accordance with Test Method **D4541** (10.3). (See **Note 2**.)

10.10 *Aging*—There is no applicable ASTM or federal test method for measuring aging for encapsulation products; however, the following test method, involving subjecting test panels to cycling from high to low temperatures, shall be performed.

10.10.1 *Exterior Products*—Expose the panels coated with exterior use products to twelve cycles (three cycles shall be performed on one day, resulting in a four-day test) with each cycle involving the following time/temperature changes: 50 ± 2°C (120 ± 5°F) for 1 h, room temperature for 15 min, −15°C (0°F) for 1 h, and room temperature for 15 min. Store the panels at −15°C (0°F) overnight. After exposure, allow coating to recover for at least 6 h and then determine the degree of adhesion in accordance with Test Method **D4541** (10.3). (See **Note 2**.)

10.10.2 *Interior Products*—Expose the panels coated with interior use products to 40°C (100°F) for a period of two weeks. After exposure, allow coating to recover for at least 6 h and then determine the degree of adhesion in accordance with Test Method **D4541**. (See **Note 2**.)

**NOTE 3**—If an absence of color change after exposure to aging tests is desirable, conduct the tests using an encapsulant product of the color to be used in the field. Evaluate and report the visual color change. The minimum performance is as agreed upon by the purchaser and the seller.

10.11 *Scrub Resistance*—Determine the scrub resistance in accordance with Test Method **D2486**, Method A, testing only the top coat of the reinforced encapsulation product system.

10.12 *Mildew Resistance*—Determine the resistance to mildew in accordance with Test Method **D3273**. Determine the rating in accordance with Test Method **D3274**.

10.13 *Paintability/Repairability*—There is no applicable ASTM or federal test method for measuring these properties; however, the following two methods shall be performed.

10.13.1 *Paintability Tests*—Apply the encapsulation coating to a 0.25-mm (0.010-in.) tin-plated steel panel. After curing, apply a coat of a commercially available acrylic latex paint in accordance with the paint manufacturer's specification for film thickness. After the cure time specified for the latex paint has elapsed, determine the degree of adhesion between the encapsulant and the latex paint in accordance with Test Method **D3359**, Method A.

10.13.2 *Repairability Test*—Apply the encapsulation system to a 0.25-mm (0.010-in.) tin-plated steel panel. After curing,

apply a coat of the encapsulation topcoat and allow to cure. Determine the degree of adhesion between the two coats in accordance with Test Method **D4541** (see **Note 2**).

**NOTE 4**—Coats of different colors applied to the test panel may aid in the identification of visual defects in the coated surface after performance of the adhesion test.

## 11. Record Keeping

11.1 All supporting data and reports of tests conducted shall be kept by the encapsulant supplier in accordance with Practice **E2239**.

## 12. Report

12.1 The report shall include the following:

12.1.1 The name, address, phone number, and e-mail address of the laboratory performing the tests as well as the name of the quality assurance supervisor responsible for the testing,

12.1.2 A brief description of the encapsulation product tested including the use of any primers, base and topcoats, application instructions, and substrates used for preparing test panels,

12.1.3 Dry film thickness of the cured encapsulation product,

12.1.4 Cure conditions including time, temperature, and relative humidity,

12.1.5 Product identification codes,

12.1.6 Description of the acrylic latex paint (used in the paintability test, 10.13.1) including brand name and the manufacturer's product code,

12.1.7 Test specimen identification codes, and

12.1.8 The average results of all the performance tests conducted in accordance with this specification.

## 13. Marking

13.1 Containers shall be marked, at a minimum, with the following information:

13.1.1 Usable shelf life and proper storage conditions, and

13.1.2 ASTM classification type (see Section 4).

## 14. Keywords

14.1 abatement; encapsulant; encapsulation; lead; leaded paint; liquid coating; liquid coating encapsulation product; reinforced liquid coating encapsulation product

**APPENDIX**
**(Nonmandatory Information)**
**X1. ALPHABETICAL LIST OF TEST METHODS AND PRACTICES**

X1.1 This appendix presents a summary table of the ASTM test methods and practices, and also federal test method standards included in this specification.

**TABLE X1.1 Alphabetical List of Test Methods and Practices**

Test Method	Section	ASTM Test Method or Practice	Federal Test Method Std. No. 141C
Adhesion	10.3	D4541	
Aging	10.10		
Chalking	10.9	D4214	
Condition in container	6.3		3011
Density or weight per gallon	6.4	D1475	
Dry abrasion resistance	10.4	D4060	
Dry-film thickness	9.2.3	D1005, D7091	
Film application on test panels	9.2.3	D823	
Glass panel preparation	9.2.5	D3891	
Impact resistance	10.2	D2794	
Mildew resistance	10.12	D3273, D3274	
Paintability	10.13.1	D3359	
Repairability	10.13.2	D4541	
Sampling	6.4	D3925	
Scrub resistance	10.11	D2486	
Standard laboratory conditions	9.2.6	D3924	
Steel Panel Preparations	9.2.4		2011
Surface burning characteristics	10.7	E84	
Tin panel preparation	9.2.2		2012
VOC content	10.8	D3960	
Water and chemical resistance	10.6	D1308	
Water vapor transmission	10.5	D1653	
Weathering	10.9	G154	
Wet-film thickness	9.2.3	D1212, D4414	

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