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Standard Guide for Selection and Use of Liquid Coating Encapsulation Products for Leaded Paint in Buildings[1]

This standard is issued under the fixed designation E1796; 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 is intended to provide building users such as private building owners, contractors, architects, homeowners, and regulatory authorities with assistance in selecting an appropriate liquid coating encapsulation product for architectural residence and child-care facility use situations for abating leaded paint. This guide also provides information that can be used to assist in the following: (*1*) determining whether a painted surface is suitable for encapsulation, (*2*) applying a liquid coating encapsulation product, (*3*) evaluating installed liquid coating encapsulation products, and (*4*) maintaining the encapsulated surface.

1.2 This guide applies to any liquid-applied product that relies primarily on adhesion for attachment to the surface and is designed to reduce human exposure to lead in paint.

1.3 This guide is not intended for use as a training manual. The information contained herein is not all-inclusive and does not provide comprehensive instructions for the selection, application, or maintenance of specific liquid coating encapsulation products. This guide is intended to supplement information supplied by encapsulation product manufacturers and safety requirements established by law. The user of this guide shall refer to the encapsulation product manufacturer's instructions for encapsulation product application and maintenance.

1.4 This guide does not cover minimum material performance requirements for liquid coating encapsulation products. Performance specifications for non-reinforced liquid coating encapsulation products are provided in Specification E1795.

1.5 Encapsulation products for use on industrial steel structures are not covered in this guide. Industrial steel structures include, but are not limited to, bridges, water towers, and tanks.

1.6 Limited documentation is available on evaluating the field performance of liquid coating encapsulation products. A conservative approach to assessing the selection and use of liquid coating encapsulation products is thus adopted in this guide. As appropriate, the guidance provided within will be revised as additional knowledge regarding how these products perform over time is gained.

1.7 The user of this guide should follow all regulations promulgated by authorities having jurisdiction regarding the use of encapsulation products.

1.8 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.

1.9 *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.*

1.10 *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

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

D1356 Terminology Relating to Sampling and Analysis of Atmospheres

D3359 Test Methods for Rating Adhesion by Tape Test

D4214 Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films

D5064 Practice for Conducting a Patch Test to Assess Coating Compatibility

[1] This guide 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.

E1605 Terminology Relating to Lead in Buildings
E1795 Specification for Non-Reinforced Liquid Coating Encapsulation Products for Leaded Paint in Buildings

3. Terminology

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

4. Significance and Use

4.1 This standard primarily addresses encapsulant products for residential and child-care facilities. It may also be appropriate for some commercial buildings.

4.2 Encapsulation provides a means of protecting occupants from exposure to lead in paint in buildings that are likely to remain standing for a long period of time. This nondestructive abatement strategy is useful in situations in which the primary structure needs to remain intact for either historical or economic reasons. Encapsulation offers an abatement strategy that may be more cost effective than abatement by removal of the paint.

4.3 There are many environmental and use conditions that affect leaded paint liquid coating encapsulation products, and different types of liquid coating encapsulation products have been developed specifically to meet the requirements of the various conditions. Product types include non-reinforced liquid coatings, as well as products for interior or exterior use. These products may be applied over many different surfaces coated with one or more layers of leaded paint and possibly other coatings. Encapsulation products in service are subjected to many kinds of wear. Various colors and finishes are also available. This guide is intended to assist the purchaser in determining which product is most appropriate for the specific conditions under which the product will be used.

4.4 As described in this guide, an encapsulation product must be compatible with the surface to which it is applied. An encapsulation product must bond to the surface coating, and not cause the subsurface layers to separate or deteriorate.

5. Determining the Suitability of a Painted Component for Encapsulation

5.1 Prior to selecting a liquid coating encapsulation product, the substrate, subsurface coating layers, and surface to be encapsulated should be assessed to determine whether they are suitable for encapsulation and to provide information to be used when selecting an encapsulation product type. The assessment should include evaluating both the condition of the substrate and the integrity of the existing subsurface layers, and determining the surface use conditions, such as the degree of impact, abrasion, or weathering that the surface receives.

5.2 *Painted Components*—When assessing surfaces to be encapsulated, all painted components to be encapsulated should be identified and assessed individually since these components may experience different use and environmental conditions. Different painted components within a room often have distinct painting histories, which can affect their suitability for encapsulation. Examples of painted components include walls, doors, door jambs, window sills, window casings, and chair rails.

5.3 *Assessment of Substrates*—The substrate may be composed of wood, metal, plaster, masonry, or other building material(s). The substrate should be sound and intact, or made so, before application of a liquid coating encapsulation product. Encapsulating a surface that exhibits large-scale, systemic damage to the substrate would likely not be effective since the damaged substrate may not have the structural integrity needed to support a liquid coating encapsulation product. The overall condition of the substrate should be evaluated first for evidence of structural integrity and systemic damage, such as moisture or water damage, that might cause the surface to be unsuitable for encapsulation until it is repaired. Next, the surface should be evaluated for localized damage such as cracks, holes, or other signs of deterioration. Spot repairs to correct localized damage may be necessary in order to provide a surface that can be encapsulated successfully.

5.4 *Assessment of Surface and Subsurface Coating Layers:*

5.4.1 A comprehensive assessment of the condition of the existing surface and subsurface coating layers should be performed in order to determine whether the painted component can be encapsulated successfully. The condition of the existing surface and subsurface coating layers should be examined visually for signs of deterioration. The type and extent of the deterioration and whether the areas of deterioration are systemic, random, or localized should be evaluated. The surface should be assessed visually for cleanliness since food, oil, grease, and dirt can affect the adhesion of an encapsulant to the surface. The amount of abrasion that the surface experiences should be evaluated and repairs made to building components reduce abrasion, if necessary. The surface should be examined for signs of chalking. Adhesion tests should be performed to evaluate the cohesive strength of the subsurface coating layers. The procedures for performing the entire assessment are explained below.

5.4.2 *Types of Surface and Subsurface Coating Layer Deterioration*—The surface should be evaluated for evidence of chalking, chipping, flaking, peeling, cracking, checking, blistering, or broken paint. Small, localized areas of deteriorated paint that are not caused by an ongoing, underlying source can be repaired by priming, patching, bridging, smoothing, wet-sanding, or other methods. The painted component to be encapsulated should be evaluated for the amount of abrasion and repeated impact it experiences during use. Painted components that experience extreme abrasion or repeated impact are generally not suitable for encapsulation. These painted components include, but are not limited to, window headers, stops, mullions, sashes and parting beads, inside door jambs, floors, and stair treads. Painted components having surfaces that rub together, such as drawers or cabinet doors, might also be ineligible for encapsulation. A surface may be suitable for encapsulation if the source of abrasion can be eliminated by such steps as scaling windows or planeing doors.

5.4.3 *Extent of Coating Deterioration*—The painted component should be evaluated to determine what portion is deteriorated. If the deterioration is limited to relatively small, localized areas then repairs can be considered. If large areas exhibit deterioration, other abatement methods should be considered

since extensive surface preparation will be required. Large areas of deterioration can be indicative of underlying, ongoing sources of the deterioration including, but not limited to water leaks, thermal changes, incompatible paints, or excessive sublayer coating thickness.

5.4.4 *Localized, Random, or Systemic Deterioration*—The surface should be examined for evidence of persistent, underlying sources of deteriorated existing paint. Sources of deterioration include excessive moisture, sudden or dramatic temperature changes, high humidity conditions, incompatible paints, or excessive sublayer coating thickness. Areas of random deterioration or areas of deterioration that are widely dispersed over the entire surface can be evidence of an ongoing, underlying problem. The source of the deterioration should be identified and corrected before the encapsulation process begins. Smaller, localized areas of deterioration that have an external source, such as previous wear or abuse, can be repaired by patching, smoothing, bridging, wet-sanding, or other methods after the source has been eliminated.

5.4.5 *Assessment of Painted Surfaces for Chalk*—An assessment of the amount of chalk on the surface should be conducted in accordance with Test Methods D4214. This can be accomplished by running one or more gloved fingers on the painted or coated surface. (A contrasting colored glove provides a more visible surface to evaluate for chalking.) Chalk visible on the glove is evidence that the paint surface has degraded. This residue is different from household dust. If chalk is visible on the glove, the chalk should be removed or the surface should be treated with a suitable sealant or primer prior to the application of a liquid coating encapsulation product.

5.4.6 *Tape Test for Adhesion*—An initial tape test should be performed on each painted component to be encapsulated in order to quickly evaluate the adhesion between the layers of the existing paint. The test results for a particular painted component might vary since the amount of deterioration between paint layers is often not uniform over the entire painted component. To perform the pull-off adhesion tape test, place a piece of pressure-sensitive tape,[3] 125 to 150 mm (5 to 6 in.) long by 50 mm (2 in.) wide, over the surface to be tested. The surface to be tested should be clean and dry. Press the tape firmly against the surface. Smooth the tape into place, and rub firmly with the eraser end of a pencil. Within 90 s of application, remove the tape smoothly and rapidly, at an angle as close to 180° as possible. Examine the tape. There should be no paint or any other material from the surface being tested on the back of the tape. The surface is generally not suitable for encapsulation, if any coating material comes off the surface onto the tape.

5.4.7 *Assessment of Painted Surfaces for Adhesion*—For painted components passing the initial tape adhesion test, conduct the "X" cut adhesion test in accordance with Test Methods D3359, Test Method A. The minimum performance rating should be 3A to ensure that the existing paint has adequate adhesive and cohesive strength to support additional stresses caused by the application of an encapsulation product.

[3] Adhesive tape, such as Permacel 99 or 3M No. 710 tape, has been found suitable for this purpose.

5.4.7.1 *Causes of Poor Adhesion Test Results*—An incompatibility between existing subsurface coating layers can cause one or more of the layers to pull away from the substrate easily. Examples of incompatible existing layers include, but are not limited to the following: a layer of flat latex paint over an improperly prepared, glossy, oil-based enamel paint; a poor-quality paint layer that is not adhering well to the underlying substrate; and multiple layers of paint that have begun to pull away from the substrate or other existing subsurface layers. Extremely thick existing paint layers can also result in poor adhesion.

6. Selection of a Liquid Coating Encapsulation Product

6.1 This section provides guidance for selecting a liquid coating encapsulation product after the surfaces to be encapsulated have been assessed for suitability, as directed in Section 5. Encapsulation products have been developed for specific uses and should be used only in those areas recommended by the manufacturer. Contact the manufacturer or refer to product data sheets for information regarding appropriate use situations for the product. It is recommended that patch tests to assess the adhesion of the liquid coating encapsulation product be performed for all candidate products before starting the encapsulation project.

6.2 *Primers*—Some liquid coating encapsulation product manufacturers require special surface treatment such as the use of special commercial primers not supplied with their standard encapsulation products. Contact the encapsulation product manufacturer or refer to product data sheets for information regarding any specialty primers that should be used with the product.

6.3 *Thickness*—Extremely thick encapsulation products might obscure architectural details of the surface. The manufacturer's recommendations should be obtained when the product thickness might be of concern.

6.4 *Exterior Conditions*—Encapsulation products used on exterior surfaces should resist degradation due to weather and local environmental conditions such as ultraviolet light, moisture, variations in temperature, oxidants, mildew, and acidic precipitation. The manufacturer should be consulted for recommendations regarding exterior use of a particular encapsulation product.

6.5 *Alkalinity*—Excessively alkaline surfaces may cause deterioration of some encapsulation products. If surfaces are alkaline (for example, concrete, fresh plaster, and mortar), an alkaline-resistant product should be chosen. Patch tests should be allowed to remain in place for as long a period of time as possible so that signs of incompatibility can be detected. If the alkalinity causes an encapsulation product to blister or deteriorate during the patch test, the alkaline conditions should be corrected before application, or another liquid coating encapsulation product should be tested.

6.6 *Surface Imperfections*—Some surface imperfections can be hidden by certain encapsulation products. Manufacturer's recommendations regarding the selection and application of a particular product with the intent to hide surface imperfections should be obtained.

6.7 *Deterioration*—Certain encapsulation products can often span localized areas of deterioration on a surface and may add additional surface support by remaining intact even though the base substrate may otherwise crack or move. Manufacturer's recommendations regarding the selection and application of a particular product with the intent to span localized areas of deterioration should be obtained.

6.8 *Aesthetic Properties*—Factors such as a smooth or textured appearance, flat or glossy finish, the ability to maintain architectural details, and the availability of special colors and the ability to retain color over time may be of concern when selecting an encapsulation product.

6.9 *Application Considerations*—Several factors regarding application of the encapsulation product can influence product selection. These include, but are not limited to, the degree of skill and amount of time required for installation, the method of application for the product, product's cure time, and any requirements for worker or occupant protection while the product is being applied. These items are discussed further in Section 10.

6.10 *Performance History*—It is recommended that information concerning the past performance of the encapsulation product be obtained. Sources of this type of information include the manufacturer, consumer publications, and state or local consumer agencies.

6.11 *Product Warranty*—The manufacturer should provide a clear understanding of the product warranty and conditions that surround it.

6.12 *Repair and Maintenance*—The manufacturer should provide instructions on how to monitor, maintain, and clean the encapsulated surface. (See Section 12.)

6.13 *Material Performance Requirements*—All liquid coating encapsulation products shall conform to the applicable minimum material performance requirements (for liquid coating encapsulation products) set forth by ASTM. The product selected should provide labeling and documentation stating that it has been tested independently by an accredited laboratory. The laboratory personnel should be qualified through training and experience and should have a working knowledge of the procedures and test methods to be used. The product selected should also meet all relevant regulations and ordinances promulgated by authorities having jurisdiction.

6.14 *Special Use Situations*—While Specification E1795 establishes minimum performance values for liquid coating encapsulation products, surfaces experience different use, and environmental conditions. No single encapsulation product can service every surface and use situation. The material performance properties of the encapsulation product and the intended use of the surface should be considered when selecting an encapsulation product. In certain use situations, it may be desirable that the encapsulation product perform beyond the Specification E1795 minimums.

6.14.1 *Flexibility*—Encapsulation products that are very flexible may be more likely to resist cracking when the substrate moves due to vibration, sudden or dramatic temperature changes, changes in moisture content, or settling. Encapsulation products that are less flexible can be suitable for those surfaces that are not likely to receive much movement. If an encapsulation product is selected for wall surfaces, it should be able to receive a nail or screw without cracking or shattering.

6.14.2 *Abrasion Resistance*—For painted components such as hand railings, moldings around doors, and window openings where abrasive action typically occurs, an encapsulation product that has enhanced abrasion resistance might be more appropriate.

6.14.3 *Impact Resistance*—Painted components that receive repeated impact require an encapsulation product that has strong impact resistance characteristics. These areas include, but are not limited to, surfaces adjacent to door openings, walls of recreation rooms, and entryways.

6.14.3.1 Impact resistance is generally a function of both the flexibility and tensile strength of the coating. Hard, inflexible liquid coating encapsulation products can be improved by using a reinforcement material as the material's tensile strength, and its ability to hold the coating together under impact provides the needed resistance to maintain the integrity of the surface.

6.14.3.2 Repeated impact can weaken the substrate causing failure of the encapsulation product through either loss of adhesion or structural failure of the substrate. Coatings with high impact resistance may improve the ability of a weak base substrate material to withstand repeated impact.

6.14.4 *Chemical Resistance*—Encapsulation products that demonstrate strong chemical resistance are appropriate for painted components that are touched frequently, such as handrails and surfaces around door knobs. Encapsulation products that display strong chemical resistance and scrub resistance should be chosen for areas that receive regular exposure to household chemicals, such as cleaning materials, dirt, grease, and oil. These areas are typically found in kitchens, bathrooms, and recreation rooms.

6.14.5 *Water Vapor Transmission*—The water vapor transmission of an encapsulation product should be selected based on the amount, type, and duration of moisture the surface to be encapsulated typically receives and the duration of expected moisture movements through the building component and the building. Encapsulation products that display high water vapor permeability should be chosen for surfaces that are likely to become wet or moist, for example, exterior surfaces, when the expected moisture movement is compatible with such a product. Encapsulation products that display low water vapor transmission are generally suitable for most other interior surfaces.

6.14.6 *Tensile Properties*—The temperature expansion and contraction that the surface is likely to undergo due to temperature changes should be considered when choosing an encapsulation product. In general, coatings, including encapsulants, tend to have a thermal coefficient of expansion that is greater than the coefficient of expansion for most building materials. Nevertheless, in order to maintain the integrity of the encapsulated surface, an encapsulation product that demonstrates superior performance for tensile properties should be chosen to encapsulate surfaces that are likely to experience significant temperature changes.

7. Performance of the Patch Test for Selecting Candidate Products

7.1 *Patch Test for Selecting Liquid Coating Encapsulation Product*—Once an encapsulation product is proposed for use on a particular surface, field patch tests should be conducted before the encapsulation process begins. This is to help ensure that the liquid coating encapsulation product will perform under the specific combinations of surface conditions and use situations found throughout the encapsulation project. Multiple patch tests are recommended for surfaces that vary with respect to existing use, surface, and environmental conditions. It may be necessary to test multiple products since no single encapsulation product can generally service every surface and use situation. The results of patch tests should be evaluated thoroughly before selecting an encapsulation product. Surfaces may be retested with the same product if it is determined that the surface was not prepared properly before conducting the patch test. (See Practice D5064 for guidance on conducting patch tests.)

7.1.1 *Location of Test Patches*—Patch tests should be performed on each type of painted component found in the entire encapsulation project. Patch tests should be performed on the following surfaces within each painted component:

7.1.1.1 Surfaces that require extensive surface preparation due to peeling, chipping, or flaking paint, water, or weather damage;

7.1.1.2 Surfaces that experience daily exposure to moisture, dirt, oil, grease, household chemicals, or exposure to extreme environmental conditions, such as variations in temperature, that may affect patch test results;

7.1.1.3 Surfaces that experience extreme use conditions, such as interior and exterior door frames and casings, window sills and casings, baseboards, stairways, hallways, handrails, and chair rails;

7.1.1.4 Surfaces with variations in painting history which can be identified by changes in the appearance of the surface with respect to gloss, color, or texture; and

7.1.1.5 Smooth, glossy surfaces that could prevent some liquid coating encapsulation products from adhering adequately.

7.1.2 *Surface Preparation*—The surface preparation methods used when conducting the patch test should be the same as those that will be used in the actual encapsulation project. The encapsulation product manufacturer should be consulted for specific instructions for surface preparation for each product being tested.

7.1.3 *Cure Time*—Since the cure time of various liquid coating encapsulation products can range from 24 h to a period of months for a complete cure, the manufacturer of each encapsulation product should be consulted to determine a suitable cure time for each product used for patch testing procedures. The patch tests can be done on partially cured patches in some cases. The longer the patch is in place prior to testing, the better the results will be able to predict long-term service.

7.1.4 *Adhesion Testing*—All liquid coating encapsulation products should be tested for adhesion to the surface to be encapsulated in accordance with Test Methods D3359, Test Method A, when possible. The test may not be possible for some products because of the difficulty in cutting through them with a knife. Use the patch-edge method for these products. The minimum performance rating for Test Methods D3359, Test Method A, should be 5A to ensure that the encapsulated system has adequate adhesive and cohesive strength. The size of the patch test area depends on the size and shape of the surface and the type of liquid coating encapsulation product being tested. For normal flat surfaces, a square patch with dimensions of 150 mm by 150 mm (6 in. by 6 in.) should be tested. A narrow test patch with the same area should be used for narrow surfaces such as door frames, baseboards, and window casings.

7.1.5 *Patch Edge Method*—This test is used to evaluate whether the liquid coating encapsulation product can be peeled away from the surface. The test is performed as follows: make a cut along the edge of the patch through to the substrate. Probe under the encapsulant at the cut with the point of a knife, attempting to peel or lift the patch from the topcoat or other delaminated layers within the existing paint layers. A small portion of the encapsulation product may be lifted; however, the surface is not suitable for encapsulation if a large portion of the encapsulation product can be easily lifted. If a failure occurs and it is determined that the surface has been prepared properly and the encapsulation product has been applied according to the manufacturer's directions, the encapsulation product is not appropriate for the surface and another product or system should be tested.

7.2 *Interpreting the Results of Patch Tests*—Several types of failure can occur with patch tests performed as part of liquid coating encapsulation product selection. Below are possible causes of failure and appropriate remedies. Patch tests may fail in some cases due to inadequate surface preparation or other conditions that can be corrected. It may be necessary in these instances to repeat failed patch tests after additional appropriate surface preparation or other steps to remedy the situation have been taken.

7.2.1 *Loss of Adhesion Between Subsurface Coating Layers*—Loss of adhesion between subsurface coating layers may cause the test to fail. In this situation, insufficient adhesion between subsurface coating layers is the result of a weak bond in the history of the coated surface. This could have been caused by inadequate deglossing, poor quality paint, or incompatible coatings. Loss of adhesion could also be caused by moisture. It is likely that the loss of adhesion was caused by moisture if the back of the patch is damp. These surfaces are not appropriate for encapsulation using liquid coating encapsulation products.

7.2.2 *Loss of Adhesion Between a Coating and Substrate*—A failed patch test could be due to loss of adhesion between the inner-moist coating layer and the substrate. Evidence of bare substrate and paint adhering to the back of the delaminated portion of the patch indicates that the test failed for this reason. These surfaces are not appropriate for encapsulation using liquid coating encapsulation products.

7.2.3 *Loss of Adhesion Due to System Stress*—Loss of adhesion can be caused by excessive weight or internal stress of both the multiple layers of coating and the liquid coating