



Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete¹

This standard is issued under the fixed designation C 1315; 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 specification provides requirements for membrane-forming liquids suitable for use as curing compounds and sealers on freshly placed concrete and as sealers on hardened concrete. These membranes have special properties, such as, alkali resistance, acid resistance, adhesion-promoting qualities, and resistance to degradation by UV light.

1.2 The values stated in SI units are to be regarded as the standard. (Inch pound units are shown in parentheses).

1.3 The following precautionary caveat pertains only to the test methods portion, Section 8, of this specification. *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:

C 156 Test Method for Water Retention by Concrete Curing Materials²

D 56 Test Method for Flash Point by Tag Closed Tester³

D 869 Test Method for Evaluating Degree of Settling of Paint⁴

D 1308 Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes⁴

D 1309 Test Method for Settling Properties of Traffic Paints During Storage⁴

D 1544 Test Method for Color of Transparent Liquids (Gardner Color Scale)⁵

D 1734 Practice for Making Cementitious Panels for Testing Coatings⁴

- D 2369 Test Method for Volatile Content of Coatings⁵
D 2371 Test Method for Pigment Content of Solvent Reducible Paints⁵
D 3723 Test Method for Pigment Content of Water-Emulsion Paints by Low-Temperature Ashing⁵
D 4541 Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers⁴
E 1347 Test Method for Color and Color-Difference Measurement by Tristimulus (Filter) Colorimetry⁵
G 53 Practice for Operating Light- and Water-Exposure Apparatus (Fluorescent UV-Condensation Type) for Exposure of Nonmetallic Materials⁶

2.2 Other Standard:

ANSI A136.1–1992 Type I Organic Adhesives for Installation of Ceramic Tile⁷

3. Classification

3.1 The following types of liquid membrane-forming compounds are included:

3.1.1 *Type I*—Clear or translucent, and

3.1.2 *Type II*—White pigmented.

3.2 The curing compound shall conform to one of the following classes:

3.2.1 *Class A* curing compounds conform to the requirements of 6.4.1, and are essentially non-yellowing,

3.2.2 *Class B* curing compounds conform to the requirements of 6.4.2, where moderate yellowing is not prohibited, and

3.2.3 *Class C* curing compounds are not restricted with regard to yellowing or darkening, and are for use where the color changes are acceptable.

NOTE 1—Polymer materials known to satisfy the durability requirements of this document include, but are not limited to, chlorinated rubbers, styrene-acrylate and styrene-butadiene copolymers. These polymers have demonstrated their durability by their ability to adhere to concrete and not be affected by the alkalies from cement.

NOTE 2—Pigmented colors other than white, or other special attributes, are beyond the scope of this specification and are subject to negotiation

¹ This specification is under the jurisdiction of ASTM Committee C09 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.22 on Materials Applied to New Concrete Surfaces.

Current edition approved Jan. 10, 2003. Published April 2003. Originally approved in 1995. Last previous edition approved in 2000 as C 1315-00.

² Annual Book of ASTM Standards, Vol 04.02.

³ Annual Book of ASTM Standards, Vol 05.01.

⁴ Annual Book of ASTM Standards, Vol 06.02.

⁵ Annual Book of ASTM Standards, Vol 06.01.

⁶ Discontinued; see 1999 Annual Book of ASTM Standards, Vol 14.02.

⁷ American National Standard Specifications for the Installation of Ceramic Tile, 1992, Tile Council of America, P.O. Box 1787, Clemson, SC 29633-1787.

between the purchaser and the supplier.

4. Ordering Information

4.1 The purchaser shall include the following information in the purchase order when applicable:

4.1.1 Type and class of liquid membrane-forming compound to be furnished,

4.1.2 Rate of application to be used to determine conformance to this specification,

4.1.2.1 For Type I compounds if not specified, the liquid membrane-forming material shall be applied by uniform spraying at a rate of 7.4 m²/L (300 ft²/gal) for testing purposes.

4.1.2.2 For Type II compounds, if not specified, the liquid membrane-forming material shall be applied by uniform spraying at a rate of 5.0 m²/L (200 ft²/gal) for testing purposes.

NOTE 3—The application rate used for testing may or may not be the same as the rate used for field application. Many agencies use the same rate for field application on relatively smooth surfaces as the rate used for testing, while requiring a substantially greater application rate on deeply textured surfaces.

4.1.3 The intended method of application (for example: spraying, brushing, or by roller). If not specified, materials shall be of a sprayable consistency.

5. General Requirements

5.1 Type I liquid membrane-forming compound shall be clear or translucent and have a minimum of 25 % solids by mass when tested in accordance with 8.5.

5.2 Type II liquid membrane-forming compound shall consist of finely divided white pigment and vehicle integrally ready mixed for immediate use as is and have a minimum of 25 % vehicle solids by mass when tested in accordance with 8.6. The membrane-forming compound shall present a uniform white appearance when applied uniformly to a new concrete surface at the specified rate of application.

NOTE 4—Although this is a performance specification, a minimum vehicle solids content is specified in order to provide an approximately 0.025 mm (1 mil) thick dry film at the specified rate of application. This film thickness is considered necessary to achieve the desired characteristics.

5.3 Liquid membrane-forming compounds shall be of such a consistency that they can be readily applied by spraying, or by brushing or rolling, to form a uniform coating at temperatures above 4°C (40°F).

NOTE 5—For uniform application in the field on vertical concrete surfaces, the specified rate of application may be achieved by two coats, each applied at one half the normal rate with approximately 1 h drying time between coats or in accordance with manufacturer's recommendations.

5.4 Liquid membrane-forming compounds shall adhere to freshly-placed concrete that has stiffened or set sufficiently to resist marring during application. Liquid membrane-forming compounds shall also adhere to damp or dry, hardened concrete surfaces. In every case, the compound shall form a continuous film after application at the specified rate.

5.5 Liquid membrane-forming compounds shall not react deleteriously with concrete. Deleterious reactions are detected by scratching the surface of a mortar specimen used for the

water-retention test with a knife or screwdriver, not less than 72 h after application, and comparing with the surface hardness similarly determined on a similar specimen that has been moist cured for one half the time. Any softening of the treated surface shall be considered sufficient cause for rejection of the compound.

5.5.1 Testing for deleterious reactions is not needed on a routine basis. However, it must be done when testing compounds of a new or unknown composition.

5.6 Liquid membrane-forming compounds shall be storable for at least 6 months without deterioration. Compounds of the water emulsion type shall not be exposed to freezing. Type II liquid membrane-forming compounds shall be capable of being mixed to a uniform consistency by stirring or agitation. When tested for long term settling, as is stated in 8.4, the compound shall have a rating of not less than 4.

5.7 The volatile portion of liquid membrane-forming compounds shall be of materials that are neither toxic⁸ nor have flash points of less than 38°C (100°F) when tested in accordance with 8.7. In all cases the volatile material shall meet applicable air-pollution control requirements.

6. Specific Characteristics

6.1 Liquid membrane-forming compounds, when tested in accordance with 8.1 shall restrict the loss of water to not more than 0.40 kg/m² in 72 h.

6.2 *Reflectance Properties*—Type II liquid membrane-forming compounds, when tested in accordance with 8.2 shall exhibit a daylight reflectance of not less than 65 %. Reflectance properties are only for white pigmented materials.

6.3 *Drying Time*—Liquid membrane-forming compounds, when tested in accordance with 8.3 shall dry to touch in not more than 4 h.

6.4 *Ultraviolet Light (UV) Degradation-Yellowing*—When tested in accordance with 8.8.6, compounds shall be durable and remain as a complete film, free of blisters, peeling, or flaking on the surface of the mortar panel.

6.4.1 Class A Type I or Type II compounds shall have a color equal to or lighter than Gardner Color Standard No. 1 when tested in accordance with 8.8.6.

6.4.2 Class B Type I or Type II compounds shall have a color equal to or lighter than Gardner Color Standard No. 3 when tested in accordance with 8.8.6.

6.4.3 Class C shall not be tested for yellowing.

6.5 *Acid and Alkali Resistance*:

6.5.1 The cured membrane, when tested in accordance with 8.8.7 for 48 h, shall not pin-hole, blister or disintegrate.

⁸ Toxicity is dependent on the type of material, duration of exposure, and concentrations. Concentrations will depend on conditions under which the membrane-forming compound is used, that is, in an enclosed space, outside without wind, or outside with wind. Relative toxicity of some materials may be determined from the current edition of "Threshold Limit Values of Airborne Contaminants Adopted by ACGIH" available from the American Conference of Governmental Industrial Hygienists, P.O. Box 1937, Cincinnati, OH 45201. OSHA standards should be consulted.



6.6 Adhesion —This requirement is to assure that the product being specified does not reduce the bonding effectiveness of adhesives commonly used to adhere flooring materials such as ceramic tile, resilient tile, wood flooring and carpet to concrete.

6.6.1 When tested in accordance with 8.9, surfaces coated with the membrane-forming compound shall pass the performance requirement of 8.9.5.

7. Sampling

7.1 Samples shall be taken either at the plant or warehouse prior to delivery, or at the point of delivery, at the option of the purchaser. If sampling is done prior to shipment, the inspector representing the purchaser shall have free access to the materials being sampled and shall be afforded all reasonable facilities for inspection and sampling.

7.2 Thoroughly shake or stir liquid membrane-forming compounds before taking a sample. Take one sample for each lot, batch, or other unit of production in a shipment. If the liquid membrane-forming compound is in mixing tanks or vats, one third of the sample shall represent the material coming from the tank at the beginning of the filling operation, one third shall represent the material coming at the middle of the filling operation, and one third shall represent the material coming at the end of the filling operation. If the liquid membrane-forming compound to be sampled is in containers, obtain a sample by taking a portion out of a number of containers equal in number to the next integer larger than the cube root of the total number of containers in the lot.

7.3 Seal all of the filled containers represented by the sample to prevent leakage, substitution or dilution. The sampling agency shall mark each container represented by the sample with a suitable identification mark for later identification and correlation.

8. Test Methods

8.1 Water Retention Test—Using Test Method C 156 at an application rate of $7.4 \text{ m}^2/\text{L}$ ($300 \text{ ft}^2/\text{gal}$) for Type I compounds and $5.0 \text{ m}^2/\text{L}$ ($200 \text{ ft}^2/\text{gal}$) for Type II compounds, test for water retention.

8.2 Reflectance Test—Using Test Method E 1347, determine the daylight reflectance of Type II membrane-forming compound on a mortar specimen after completion of the water retention test.

8.3 Drying Time Test:

8.3.1 Scope—This test method is used to determine the length of time for a liquid membrane-forming curing compound to dry to the touch.

8.3.2 Significance and Use—The ability of a liquid membrane-forming compound to dry in a suitable length of time enables the user the ability to perform other tasks on the concrete, such as sawing joints, and the like without lifting the membrane from the concrete by tracking.

8.3.3 Procedure—Apply the membrane-forming compound to a fresh mortar specimen at the specified rate of application and expose it to air at $23 \pm 2^\circ\text{C}$ ($73 \pm 4^\circ\text{F}$), $50 \pm 10\%$ relative humidity and at an air velocity of approximately 180 m/min (600 ft/min) horizontally across the surface of the test specimen. Test the film with a finger using moderate pressure.

Consider the film to be dry when the soft tacky condition no longer exists and the film feels firm.

8.3.4 Precision and Bias—The precision of the procedure for measuring the drying time of liquid membrane-forming compounds is being determined. The test method has no bias because there is not any acceptable reference material.

8.4 Long Term Settling Test—Use Test Method D 1309 for routine testing. In the case of dispute, use Test Method D 869.

8.5 Solids Test (Type I)—Test in accordance with Test Method D 2369.

8.6 Vehicle Solids Test (Type II)—Determine total nonvolatile content in accordance with Test Method D 2369, and pigment solids in accordance with Test Method D 2371 for solvent-borne products or Test Method D 3723 for water-borne products. Calculate percent vehicle solids as percent total solids minus percent pigment solids.

NOTE 6—This procedure is not satisfactory for water-borne products containing organic colorants or filler, or pigments which dehydrate or decompose below 230°C (450°F).

8.7 Flash Point Test—Test in accordance with Test Method D 56 using the liquid membrane-forming compound as supplied.

8.8 UV Degradation, Yellowing, Acid, and Alkali Resistance:

8.8.1 Scope—This procedure is used to evaluate the resistance of the membrane to the effects of UV radiation, acid, and alkali.

8.8.2 Significance and Use—Curing membranes are exposed to water and alkali in concrete and frequently are subjected to ultraviolet light, any or all of which can degrade some polymers. These tests are used to evaluate durable membranes. Polymers used in formulations to comply with these requirements are alkali and acid resistant and adhere well to concrete surfaces. As such, they are suitable for use under many latex and alkyd base paints and do not interfere with the adhesion of most resilient floor coverings, parquet wood floors, carpets or carpet tiles. The compounds are also suitable for sealing and protecting exterior concrete surfaces against the intrusion of water and some chemicals.

8.8.3 Materials—Five mortar panels, prepared as directed in Practice D 1734, 5 % aqueous sodium hydroxide by mass, 10 % aqueous hydrochloric acid by mass, and watch glasses.

8.8.4 Equipment—as described in Practice G 53, with UV-A 340 light source.

8.8.5 Preparation of Specimens—Coat five mortar panels at the rate of $7.4 \text{ m}^2/\text{L}$ ($300 \text{ ft}^2/\text{gal}$) and allow to dry for at least 24 h.

8.8.6 Yellowing Resistance:

8.8.6.1 Expose three of the panels for 336 h (2 weeks) in accordance with Practice G 53 with a test cycle consisting of alternating periods of 8 h UV radiation at 60°C (140°F) and 4 h condensation at 50°C (122°F).

8.8.6.2 Interpretation of Results—Compare the panels after the test period to the color of the Gardner Color Standards of Test Method D 1544. Report the results as lighter, the same, or darker than the designated color. Also report if the membrane was damaged or destroyed during the test.

8.8.7 Alkali and Acid Resistance:

8.8.7.1 Procedure—Test the cured membrane on two panels as directed in Test Method D 1308 using the covered spot test method and 5 % aqueous sodium hydroxide solution on one panel and 10 % aqueous hydrochloric acid solution on the other panel.

8.8.7.2 Interpretation of Results—Report whether the membranes pinhole, disintegrate, blister or discolor.

8.8.7.3 Precision and Bias—No information is presented about the precision or bias of this test method since the result is non-quantitative.

8.9 Adhesion:

8.9.1 Scope—This test is used to determine if the membrane formed by the product being tested is compatible with tile adhesives of the types listed in 8.9.3.3 or other types as agreed upon between supplier and purchaser.

8.9.2 Significance and Use—Durable curing and sealing membranes are used to promote surface strength and prevent dusting of concrete. The subsequent adhesion of topcoats such as tile adhesives is sometimes affected positively or adversely by the membrane. This test method evaluates the bonding between the membrane and an adhesive.

8.9.3 Apparatus:

8.9.3.1 Mortar Panels—Three mortar panels for each adhesive to be tested, prepared according to Practice D 1734⁹ (the test is run in triplicate).

8.9.3.2 Test Apparatus as described in Annex A2 of Test Method D 4541 with a 40-mm (1 $\frac{1}{16}$ -in.) loading fixture (available from the manufacturer). (See Note 7.)

NOTE 7—The usual apparatus employs a 20-mm loading fixture. The 40-mm fixture permits measurements in the low range of forces required.

8.9.3.3 Adhesives—Ceramic tile adhesive shall meet the requirements of ANSI A136.1. Adhesives for other systems shall be of a type recommended for the installation of materials of interest over concrete. No product specifications are currently in force for these other adhesives.

8.9.4 Procedure—For each adhesive to be tested, coat three mortar panels with the membrane-forming curing compound under test at the specified application rate and allow to dry 72 h at 23 ± 2°C (73.5 ± 3.5°F) 50 ± 10 % relative humidity. Apply the adhesive on each panel at the rate specified by the manufacturer to a 40-mm (1 $\frac{1}{16}$ -in.) diameter area, affix the loading fixture, allow the adhesive to cure in accordance with the manufacturer's instructions, and determine the pull-off strength in accordance with Test Method D 4541. (See Note 8.)

NOTE 8—Pull-off strength results obtained using devices other than specified in Annex A2 of Test Method D 4541 may be different because the results depend on parameters of the specific test instrument.

8.9.5 Interpretation of Results—This test is a pass/fail determination. If the measured pull-off strength is greater than 0.50 MPa (70 psi) in at least two thirds of the trials, the membrane passes.

8.9.5.1 If the measured pull-off strength is less than 0.50 MPa (70 psi), examine the failure surface to determine if failure occurred in the adhesive/membrane bond or at other interfaces. Estimate the percent of adhesive and cohesive failure in accordance to their respective areas and locations within the test system.

8.9.5.2 The test system is described as consisting of: substrate (A, the mortar specimen); the coating under test (B, a C 1315 liquid membrane-forming curing compound); the adhesive (Y, e.g. tile or carpet adhesive); and the pull-off fixture (Z).

8.9.5.3 Designate cohesive failures by the layers within which they occur as A, B, or Y, and the percent of each.

8.9.5.4 Designate adhesive failures by the interfaces at which they occur as A/B, B/Y, or Y/Z, and the percent of each.

8.9.5.5 A result that is very different from most of the results, caused by a mistake in recording or calculating, or by circumstances involved in preparation of the test specimens, shall be dropped from the analysis of the test. Valid reasons for dropping results include misalignment of the apparatus, improper application of the adhesive, voids or inclusions in the adhesive and sliding or twisting the fixture during the cure of the adhesive.

8.9.5.6 Disregard any test where failure in the adhesive (Y), failure of the bond (Y/Z), or both represents more than 50 % of the area. If all tests result in failure of the adhesive (Y or YZ) at less than 0.50 MPa (70 psi) repeat the evaluation using a different adhesive. (See Note 9.)

NOTE 9—To avoid results of this type, an adhesive can be tested between two pull-off fixtures to establish its inherent pull-off strength prior to running the material evaluation.

8.9.5.7 If more than 20 % of the failure occurs in B, A/B and B/Y at less than 0.50 MPa (70 psi), the membrane is suspect and the trial fails.

8.9.6 Precision and Bias—Precision is being determined. The test method for measuring adhesion has no bias because the value of adhesion is defined only in terms of this test method.

9. Packaging and Package Marking

9.1 The liquid membrane-forming compound shall be delivered in the manufacturer's original, clean, and sealed containers. The manufacturer shall ensure that material in all containers is representative of the compound produced. Each container shall be marked with:

9.1.1 The name of the manufacturer,

9.1.2 The trade name of the compound,

9.1.3 The ASTM designation and type of compound,

9.1.4 The nominal percentage of nonvolatile material (Note 10), and

9.1.5 The manufacturer's lot or batch designation.

NOTE 10—The listing of the nominal percentage of nonvolatile materials by the manufacturer, and the reporting of this information on the identification accompanying the sample, will enable the testing agency to determine whether the compound in the containers was adequately stirred and the sample is reasonably representative of the membrane-forming compound produced. Type II membrane-forming compounds are especially prone to separation due to settling of the pigment.

⁹ The sole commercial source of supply of the mortar panels known to the committee at this time is Masonry Test Block Company, 6389 Lawndale, Saginaw, MI 48004. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee¹, which you may attend.

10. Keywords

sealers; yellowing resistance

10.1 acid resistance; adhesion promoting; alkali resistance; curing compounds; liquid membrane-forming compounds;

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