



Designation: D6944 – 09

Standard Practice for Resistance of Cured Coatings to Thermal Cycling¹

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1. Scope

1.1 This practice determines the resistance of cured coatings to repeated thermal cycles. This procedure is designed to assess the influence of thermal cycling on adhesion and other properties of coatings. This procedure is not intended to provide a quantitative measure of the service life that can be expected from a specific coating system on a given substrate.

1.2 *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:*²

D660 Test Method for Evaluating Degree of Checking of Exterior Paints

D661 Test Method for Evaluating Degree of Cracking of Exterior Paints

D714 Test Method for Evaluating Degree of Blistering of Paints

D3359 Test Methods for Measuring Adhesion by Tape Test

D4541 Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

D6677 Test Method for Evaluating Adhesion by Knife

G147 Practice for Conditioning and Handling of Nonmetallic Materials for Natural and Artificial Weathering Tests

3. Summary of Test Methods

3.1 *Test Method A*—Cured test specimens are subjected to 30 thermal cycles of immersion, freezing and heating.

3.2 *Test Method B*—Cured test specimens are subjected to 30 thermal cycles of freezing and heating.

¹ This practice is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.46 on Industrial Protective Coatings.

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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.

4. Significance and Use

4.1 The purpose of this test is to obtain information on the ability of a coating system to adhere to substrates under thermal stress. It is assumed that the coating systems used are applied and cured according to the given specifications of the coating manufacturer.

TEST METHOD A—FREEZE/THAW/IMMERSION

5. Apparatus

5.1 *Thermal Cycling Apparatus:*

5.1.1 The thermal cycling apparatus shall consist of a suitable chamber or chambers in which the test specimens may undergo the specified cycle. Ideally, a chamber which contains heating and refrigeration equipment and immersion capabilities in the same unit should be used. This chamber shall have the ability to maintain continuous reproducible cycles within the specified temperature requirements. In the event that an apparatus having freezing, heating, and immersion capabilities is not available, separate equipment for freezing, heating and immersion may be used.

5.1.2 The chamber or chambers shall have the ability to maintain a constant temperature during each of the respective temperature intervals as specified by the procedure.

5.1.3 The samples shall be arranged to minimize contact with the chamber surfaces or any mounting racks, and to maximize air flow.

5.1.4 The temperature of the thermal cycling apparatus shall give uniform readings at various locations within the chamber, within 3°C (5°F) at any given time, except during the transition between heating and freezing cycles. A two hour temperature ramping period is permitted for the equipment to reach the next temperature setting.

6. Test Specimens

6.1 Apply each coating onto the substrate as agreed upon. Minimum film thicknesses should take substrate profile into account when applied.

6.2 Apply each coating or coating system to a minimum of two specimens to determine repeatability. If the substrate of choice is concrete, then suitable encapsulation of the substrate must occur as agreed upon between purchaser and supplier.

6.2.1 When destructive tests are run, it is recommended that a sufficient number of reference specimens be retained so that

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