



Designation: D 6944 – 03

Standard Test Method for Resistance of Cured Coatings to Thermal Cycling¹

This standard is issued under the fixed designation D 6944; 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 test method 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:*

D 660 Test Method for Evaluating Degree of Checking of Exterior Paints²

D 661 Test Method for Evaluating Degree of Cracking of Exterior Paints²

D 714 Test Method for Evaluating Degree of Blistering of Paints²

D 3359 Test Methods for Measuring Adhesion by Tape Test²

D 4541 Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers³

D 6677 Test Method for Evaluating Adhesion by Knife³

G 147 Practice of Conditioning and Handling of Nonmetallic Materials for Natural and Artificial Weathering Tests⁴

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 test method 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 *Annual Book of ASTM Standards*, Vol 06.01.

³ *Annual Book of ASTM Standards*, Vol 06.02.

⁴ *Annual Book of ASTM Standards*, Vol 14.04.

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.