



Designation: B905 – 00 (Reapproved 2021)

Standard Test Methods for Assessing the Adhesion of Metallic and Inorganic Coatings by the Mechanized Tape Test¹

This standard is issued under the fixed designation B905; 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 These test methods describe procedures for assessing the adhesion of metallic and inorganic coatings and other thin films to metallic and nonmetallic substrates. Assessment is made by applying pressure-sensitive tape to a coated surface and then utilizing a mechanical device to remove the tape at a regulated, uniform rate and constant angle while simultaneously recording the removal force.

1.2 Four methods are described. Methods A1 and A2 are intended primarily for use on parts. Methods B1 and B2 are intended primarily for use in laboratory evaluations. Methods B1 and B2 are not recommended for testing coatings and films on polymer substrates.

1.3 These test methods may be used to establish whether the adhesion of a coating to a substrate is within a required range (between a quantified low and a quantified high level). Determination of actual adhesive forces requires more sophisticated methods of measurement. In multilayer systems adhesion failure may occur between intermediate coating layers so that the adhesion of the total coating system to the substrate may not necessarily be determined.

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.5 *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.*

1.6 *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.*

¹ These test methods are under the jurisdiction of ASTM Committee B08 on Metallic and Inorganic Coatings and are the direct responsibility of Subcommittee B08.10 on Test Methods.

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2. Referenced Documents

2.1 ASTM Standards:²

- B183 Practice for Preparation of Low-Carbon Steel for Electroplating
- B242 Guide for Preparation of High-Carbon Steel for Electroplating
- B252 Guide for Preparation of Zinc Alloy Die Castings for Electroplating and Conversion Coatings
- B253 Guide for Preparation of Aluminum Alloys for Electroplating
- B254 Practice for Preparation of and Electroplating on Stainless Steel
- B281 Practice for Preparation of Copper and Copper-Base Alloys for Electroplating and Conversion Coatings
- B320 Practice for Preparation of Iron Castings for Electroplating
- B343 Practice for Preparation of Nickel for Electroplating with Nickel
- B480 Guide for Preparation of Magnesium and Magnesium Alloys for Electroplating
- B481 Practice for Preparation of Titanium and Titanium Alloys for Electroplating
- B482 Practice for Preparation of Tungsten and Tungsten Alloys for Electroplating
- B537 Practice for Rating of Electroplated Panels Subjected to Atmospheric Exposure
- B538 Method of FACT (Ford Anodized Aluminum Corrosion Test) (Withdrawn 1986)³
- B629 Practice for Preparation of Molybdenum and Molybdenum Alloys for Electroplating
- B630 Practice for Preparation of Chromium for Electroplating with Chromium
- B727 Practice for Preparation of Plastics Materials for Electroplating
- D1730 Practices for Preparation of Aluminum and Aluminum-Alloy Surfaces for Painting

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.

³ The last approved version of this historical standard is referenced on www.astm.org.

- D1731** Practices for Preparation of Hot-Dip Aluminum Surfaces for Painting
- D1732** Practices for Preparation of Magnesium Alloy Surfaces for Painting
- D2370** Test Method for Tensile Properties of Organic Coatings
- D3330/D3330M** Test Method for Peel Adhesion of Pressure-Sensitive Tape
- D3359** Test Methods for Rating Adhesion by Tape Test

3. Summary of Test Method

3.1 Pressure-sensitive tape is adhered to the surface of the coating and then removed utilizing a motorized mechanical device that peels the tape at a constantly maintained angle and controlled rate of peel. A digital recording force gage is used to record the maximum peel force.

NOTE 1—All due care must be taken to ensure that test specimens are handled and stored such that they are not subjected to conditions that will cause deleterious effects. These conditions include but are not limited to handling without the use of gloves, storing in areas that accumulate dust, areas of high humidity or where the sample may be subjected to fumes or vapors that might condense on the sample.

3.2 Methods A1 and A2:

3.2.1 In these methods, which are nondestructive, the measurement area used is the unbroken coating surface with peel angles of 90 and 180° respectively.

3.2.2 Adhesion is assessed in terms of “passed,” if the coating does not detach, or “failed,” if the coating detaches within the specified range of peel forces as recorded during the test.

3.3 Methods B1 and B2:

3.3.1 In these methods, which are destructive, the measurement area used is a broken coating surface created by scoring a lattice pattern through the coating to the substrate and peeling at angles of 90 and 180°, respectively.

3.3.2 Adhesion is assessed qualitatively on the 0 to 5 scale.

4. Significance and Use

4.1 If a coating is to fulfill its function of protecting or imparting unique properties to the surface of a substrate, it must adhere to the substrate for the expected service life. Because surface preparation (or lack of it) has a drastic effect on adhesion of coatings, a test method for evaluating adhesion to different surface treatments or of different coatings to the same treatment is of considerable use to the industry.

4.2 The limitations of all adhesion methods, and the specific limitation of this test method to lower levels of adhesion (see 1.3) should be recognized before using it. These test methods are mechanized adaptations of Test Methods **D3359**; therefore, the intra- and interlaboratory precision of these test methods are similar to Test Methods **D3359** and to other widely-accepted tests for coated substrates, for example, Test Method **D2370**, but this is partly the result of it being insensitive to all but large differences in adhesion. The pass-fail scale of 0 to 5 for Method B1 and B2 was selected deliberately to avoid a false impression of being sensitive.

5. Apparatus and Materials

5.1 *Peel Test Fixture*—The fixture shall consist of a frame to which the specimen is rigidly clamped, and a moveable beam by which the tape is pulled off under a constant peel angle of 90 (Method A1 and B1) or 180° (Method A2 and B2). The peel rate should be controllable between 20 mm/s and 200 mm/s for Method A1 and B1 and between 14 mm/s and 140 mm/s for Methods A2 and B2. A recording force gage is fitted between the tape grip and the movable beam (see Fig. 1).

5.2 *Pressure-Sensitive Tape*—Unless otherwise specified in the document referencing this test, the tape shall be 25 mm wide, semitransparent, pressure-sensitive tape with an adhesion strength of 43 ± 5.6 g/mm or N/100 mm width when tested in accordance with **D3330/D3330M**. The adhesion shall not change by more than + 6.5 % of its mean value within 12 months. The backing of the tape may consist of fiber-reinforced cellulose acetate, unplasticized poly (vinyl chloride), or polyester film. When results obtained in different laboratories do not agree it is recommended that the test be repeated using tape from the same batch.

5.3 *Roller*—The roller,⁴ which is hand operated, consists of a steel roller 85 ± 2.5 mm in diameter and 45 ± 1.5 mm in width, covered with rubber approximately 6 mm in thickness, having a Shore scale A durometer hardness of 80 ± 5 . The surface of the roller shall be a true cylinder void of any concave or convex deviations. The mass of the roller shall be 2040 ± 45 g.

NOTE 2—A standardized roller is used in place of the pencil eraser of Test Methods **D3359** because of the variety of rubber and abrasives formulations used to make pencil erasers. A further consideration was the extended range of localized pressures that could be exerted by the pencil and eraser.

TEST METHOD A NONDESTRUCTIVE, PARTS TAPE TEST

6. Test Specimen

6.1 *Parts*—This test normally is performed on parts. Any requirements for test specimens will be found in the document specifying their use.

NOTE 3—When specified by the document referencing this test, the coated parts shall be subjected to a preliminary exposure, such as water immersion, salt spray, or humidity, before conducting the tape test.

7. Procedure

7.1 *Test Area*—Select a flat area, on a significant surface, free of blemishes and minor surface imperfections. Ensure that the surface is clean and dry. Extremes in temperature or relative humidity may affect the adhesion of the tape or the coating.

7.2 *Tape Section*—Remove two complete laps of the pressure-sensitive tape from the roll and discard. Remove an

⁴ The sole source of supply of the apparatus known to the committee at this time is Pressure-Sensitive Tape Council (PSTC), 104 Wilmot Rd., Suite 201, Deerfield, IL 60015. 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 committee,¹ which you may attend.