



## Standard Test Method for Peel Adhesion of Pressure-Sensitive Label Stocks at a 90° Angle<sup>1</sup>

This standard is issued under the fixed designation D6252/D6252M; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This test method covers the measurement of the peel adhesion of pressure-sensitive label stocks. This test method gives a measure of the adherence to a standard steel substrate or to other surfaces of interest for a pressure-sensitive label stock.

1.2 This test method provides a means of assessing the uniformity of the adhesion of a given type of pressure-sensitive label stock. The assessment may be within a sheet or roll, between sheets or rolls, or between production lots.

1.3 Variations in the label stock facestock and adhesive can affect the response; therefore, this test method cannot be used to pinpoint the specific cause(s) of nonuniformity.

1.4 This test method may not be appropriate to test label stocks having either stiff backings or backings showing a high stretch at low forces. These characteristics could result in a high variability of the test response, which is not a true indication of the real nature of the adhesive bond.

1.5 The values stated in either SI or inch-pound units are to be regarded separately as the standard. The values stated in each system may not be exact equivalents; therefore, each system must be used independently, without combining values in any way.

1.6 *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:<sup>2</sup>

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee D10 on Packaging and is the direct responsibility of Subcommittee D10.14 on Tape and Labels.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

A666 Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

D996 Terminology of Packaging and Distribution Environments

D3715/D3715M Practice for Quality Assurance of Pressure-Sensitive Tapes

D4332 Practice for Conditioning Containers, Packages, or Packaging Components for Testing

E122 Practice for Calculating Sample Size to Estimate, With Specified Precision, the Average for a Characteristic of a Lot or Process

### 3. Terminology

3.1 *Definitions*—Definitions of terms used in this test method are in accordance with Terminology D996.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *pressure-sensitive label stock, n*—the combination of facestock (face material), pressure-sensitive adhesive, and release liner.

### 4. Summary of Test Method

4.1 A strip of label stock is applied to a standard test panel, or other surface of interest, with controlled pressure. The label stock is peeled from the panel at 90° angle at a specified rate, during which time the force required to effect peeling is measured.

NOTE 1—The pressure-sensitive adhesive (psa) is permanently tacky and instantly adheres to the surface for which the label stock is designed. A psa label stock also can be defined as a self-adhering label stock.

### 5. Significance and Use

5.1 This test method is a tool for quality assurance use. Given a pressure-sensitive label stock and a requirement in terms of the minimum or maximum peel adhesion value expected for this label stock, the data from the test can be used in conjunction with acceptance criteria.

5.2 This test method can show the relative bond strength of a given label stock to one or more surfaces of varied material and texture as compared to the standard stainless steel panel. Substitution of panels representative of the proposed substrates for the standard stainless steel panel would be acceptable for this procedure.



## 6. Apparatus

6.1 *Specimen Cutter*<sup>3</sup>—The specimen cutter shall hold two single-edged razor blades in parallel planes, a precise distance apart, to form a cutter of exact specimen width.

NOTE 2—A 25.4-mm or 1-in. cutter shall consist of a 25.4-mm or 1-in. thick by 200-mm or 8-in. length of aluminum bar stock 25.4 mm or 1 in. wide. The edges for about 125 mm or 5 in. from one end shall be slightly rounded to form a handle. The width of the bar for 75 mm or 3 in. from the opposite end shall be narrowed to exactly 25.4 mm or 1 in. minus the thickness of a single-edged razor blade (one of two used as cutting edges). The razor blades shall be held in position using side plates. The end of the cutter shall be cut away at 0.74 Rad or 45° angle to expose the cutting edge at one end of the blades.

6.2 *Dispensing System for Solvents*—Use plastic wash bottles.

6.3 *Panel*<sup>3</sup>—A 50 by 125-mm no less than 1.1-mm thickness or a 2 by 5-in. panel no less than 0.043-in. thickness stainless steel 302 or 304 in accordance with Specification A666 having a bright-annealed finish. The surface roughness height shall be  $50 \pm 5$ -nm or  $2.0 \pm 0.2$ -uin. arithmetical average deviation from the mean line. Panels showing stains, discoloration, or numerous scratches are not acceptable.

6.4 *Roller*<sup>3</sup>, mechanically-operated.

6.4.1 A steel roller  $85 \pm 2.5$  mm or  $3.25 \pm 0.1$  in. in diameter and  $45 \pm 1.5$  mm or  $1.75 \pm 0.05$  in. in width, covered by rubber approximately 6.5 mm or 0.25 in. in thickness, having a Shore Scale A durometer hardness of  $80 \pm 5$ . The surface shall be a true cylinder void of any convex or concave deviations. The mass of the roller shall be  $2040 \pm 45$  g or 4.5  $\pm 0.1$  lb.

6.4.2 No part of the apparatus shall increase the mass of the roller during use. The roller shall move mechanically at the rate of  $5.0 \pm 0.2$  mm/s or  $12.0 \pm 0.5$  in./min.

NOTE 3—A simple check to determine if the rubber surface is a true cylinder is to wrap the roller in a very thin paper (onion skin) and drag it across a flat glass surface on which is placed a carbon paper face up. The carbon rubs off onto the thin paper wrapper to reveal high spots or hollows on the rubber surface.

6.5 *Adhesion Tester*—A constant-rate-of-extension (CRE) tension-type instrument shall be used. The instrument shall have a means for rigidly holding a test panel or a test panel fixture and another means for holding one end of the label stock specimen both having centers on one line. The instrument shall produce movement between the two points described above such that a 90° angle is maintained between label stock specimen and the test panel throughout the test. The extension shall be at a uniform rate of  $5.0 \pm 0.2$  mm/s or  $12 \pm 0.5$  in./min. The force measuring system shall be calibrated to an accuracy of 0.5 % of full scale. The lowest required full scale range is 0–550 g or 0–20 oz. Above the 0–20 oz range, full scale for any test shall be such that the mean test value falls within 20 % of the scale maximum. An autographic device for recording peel force shall be provided. Capability of intergrating areas under the peel force recordings shall be optional.

## 7. Reagents and Materials

7.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available.<sup>4</sup> Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

7.2 *Solvents*:

7.2.1 *Diacetone Alcohol*, non-residual, technical grade or better.

7.2.2 One of the following:

7.2.2.1 *Acetone*.

7.2.2.2 *Ethyl Acetate*.

7.2.2.3 *Isopropyl Alcohol (IPA)*.

7.2.2.4 *Methyl Alcohol, (95 %)*.

7.2.2.5 *Methyl Ethyl Ketone (MEK)*.

7.2.2.6 *Methyl Isobutyl Ketone (MIBK)*.

7.2.2.7 *n-Heptane*.

7.2.3 Where toxicity and flammability requirements are paramount, a mixture of n-heptane and a fluorinated hydrocarbon, such as refrigerant, may meet the requirements. Normally, cleaning procedures, including use of the solvents in 7.2, cannot be used on porous or solvent-sensitive materials.

7.3 *Cleaning Material*, absorbent, either surgical gauze or tissue. To be suitable, materials must be lint-free during use, absorbent, contain no additives that are soluble in the solvents listed in 7.2, and be made without contaminants.

## 8. Sampling

8.1 Sampling for rolls shall be in accordance with Practice D3715/D3715M and for sheet stock in accordance with Practice E122.

## 9. Test Specimen

9.1 The specimens shall be no greater than 25.4 mm or 1 in. in width nor less than 12.7 mm or ½ in. wide. A tolerance of  $\pm 0.4$  mm or  $\pm 1/64$  in. shall be allowed. The length shall be approximately 150 mm or 6 in.

9.2 If samples are in roll form, discard, at least three but not more than six, outer wraps of label stock from the sample roll before taking the specimen for testing.

9.3 Remove one specimen, minimum length 150 mm or 6 in./sample roll or sample sheet.

9.4 When the label stock is wider than 25.4 mm or 1 in., specimens of the widest specified width (9.1) are to be cut from the center of a strip removed from the roll or sheet.

NOTE 4—Discard cleaned panels showing stains, discoloration, or numerous scratches. Avoid contacting panel surfaces with fingers. During storage, panels should be protected by covering with protective tape.

<sup>3</sup> Available from Chemsultants International, 9349 Hamilton Drive, Haisley Commercial Park, Mentor, OH 44061–1118.

<sup>4</sup> “Reagent Chemicals, American Chemical Society Specifications,” American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see “Reagent Chemicals and Standards,” by J. Rosin, D. Van Nostrand Co., Inc., New York, NY, and the “United States Pharmacopoeia”.



## 10. Conditioning

10.1 Condition the sample rolls or sheets in the standard conditioning atmosphere as described in Practice D4332 for a period of not less than 24 h. Test at these conditions.

## 11. Procedure

11.1 Dispense diacetone alcohol onto the panel. Scrub the panel with a clean piece of absorbent cleaning material. Dry the panel with fresh absorbent cleaning material. Dispense one of the solvents listed in 7.2.2 onto the panel, wiping it to dryness with fresh absorbent cleaning material. Repeat for a total of three washes with this solvent.

11.2 Place the specimen, release liner side up, and remove 125 to 150 mm or 5 to 6 in. of the release liner by pulling the release liner away from the adhesive and cutting to the appropriate length.

11.3 Touch one end of the specimen with exposed adhesive to an end of the test panel. Hold the outer end of the specimen so that it does not make contact with the panel but is positioned loosely above it. Roll the label stock mechanically once in each direction, causing the roller to apply the label stock to the panel. This action prevents entrapment of air between the adhesive and the panel. Should such entrapment of air occur, discard the specimen.

NOTE 5—Use only the weight of the roller to press the samples onto the test panel. Do not push down on the roller.

11.4 Individually prepare each specimen and test immediately (within 60 s).

NOTE 6—Longer dwell time will give different results. Peel adhesion increases with dwell time at different rates for various label stocks. A longer dwell time may be chosen purposely. Within a set of tests, one specified dwell time should be used. Sets of data should be compared only if a common dwell time has been used.

11.5 Place the panel into the panel holder on the lower fixture. Clamp the free end of the specimen into the upper clamp. Operate the separation speed at  $5.0 \pm 0.2$  mm/s or  $12 \pm 0.5$  in./min.

11.6 After the jaw is started in motion, disregard the values obtained while the first and last 25 mm or 1 in. is mechanically peeled.

11.6.1 Record an instrument integrated value obtained from the peeling of the next 50 mm or 2 in. after the first 25 mm or 1 in. for the peel-adhesion value, or

11.6.2 For the next 50 mm or 2 in. of peel after the first 25 mm or 1 in., average all chart recorded high peaks and an equal number of low peaks. Record the average value for the peel-adhesion value.

11.7 If the sample breaks before an average pull value is obtained, the sample can be reinforced with transparent tape approximately 1 mil thickness. If transparent tape is used, it should be noted in the report.

## 12. Calculation

12.1 If recorded peel adhesion is not in newtons per 100 mm or ounces per inch of width, convert to newtons or ounces. Calculate peel adhesion in newtons per 100 mm or ounces per inch of width.

## 13. Report

13.1 The report shall include the following information:

13.1.1 Statement that this practice was used and indicate any deviations from the practice as written.

13.1.2 Complete identification of each specimen tested, including label source, manufacturer's code number, and form.

13.1.3 Anomalous behavior observed during the test, that is, adhesive transfer, splitting, etc.

13.1.4 Peel adhesion value in newtons per 100 mm or ounces per inch of width to the nearest 0.1 N/100 mm or 0.1 oz/1 in. of width.

13.1.5 Dwell time.

13.1.6 Transparent tape reinforcement, if used and transparent tape thickness.

## 14. Precision and Bias

14.1 Based on data from a single laboratory, the typical repeatable standard deviation is approximately 0.8 N/100 mm or 0.7 oz/1 in. The actual standard deviation will depend on the specific pressure-sensitive product that is being tested. An interlaboratory test program will be conducted to determine the between laboratory reproducibility.

14.2 *Bias*—No information can be presented on the bias of the procedure in this test method because no acceptable reference value is available.

## 15. Keywords

15.1 label stock; peel adhesion at 90° angle; pressure-sensitive label stock

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