



# Standard Test Method for Tack of Pressure-Sensitive Adhesives by Rolling Ball<sup>1</sup>

This standard is issued under the fixed designation D 3121; 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 measurement of the comparative tack of pressure-sensitive adhesives by a rolling ball and is most appropriate for low-tack adhesives. This test method is only one of several available for the measurement of tack.

1.1.1 This test method is not recommended for the specification of end use products.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values in the parentheses are given for information only.

1.3 *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 907 Terminology of Adhesives<sup>2</sup>

E 171 Specification for Standard Atmospheres for Conditioning and Testing Flexible Barrier Materials<sup>3</sup>

## 3. Terminology

3.1 *Definitions*—Several terms in this test method are defined in accordance with Terminology D 907.

3.2 *Description of Term Specific to This Standard:*

3.2.1 *tack*—the property of an adhesive that enables it to form a bond of measurable strength immediately after adhesive and adherend are brought into contact under low pressure.

## 4. Summary of Test Method

4.1 In the determination of tack by the rolling-ball method, a steel ball is released at the top of an incline, allowed to accelerate down the incline and roll on to a horizontal surface covered with a pressure-sensitive adhesive. Tack is determined by measuring the distance that the ball travels across the adhesive before stopping. There are two major retarding forces

applied by the adhesive to the ball: (1) the adhesion between the ball and the adhesive, often called “grab,” and (2) the “plowing effect” or energy required to push the adhesive out of the ball’s path.

4.2 Test results are influenced by (1) adhesive film thickness, (2) bond of adhesive to backing, and (3) backing rigidity, so these factors must be carefully controlled for satisfactory comparisons.

## 5. Significance and Use

5.1 The rolling-ball tack test is fast, easy to run, and requires little investment in equipment and little operator training. This test is intended primarily for quality control use since it demonstrates good reproducibility within a single laboratory and ability to detect batch-to-batch variations accurately if adhesive film thickness is held constant. Rolling ball tack is not intended as an investigative tool since for most pressure sensitive adhesive applications rolling ball tack results do not correlate well with application tack requirements.

## 6. Apparatus (Fig. 1 and Fig. 2)

6.1 *Inclined Trough* equipped with a release lever at the top<sup>4</sup> through which the ball gains downhill momentum. The ball is a  $\frac{7}{16}$ -in. (11.1-mm) diameter steel ball unless otherwise specified.

## 7. Test Specimen

7.1 The test specimen is a substrate coated with a pressure-sensitive adhesive. It is generally about 2 in. (51 mm) wide and approximately 15 in. (381 mm) long. Specific sample dimensions can be selected for the adhesive to be tested since the length need only be sufficient to allow the adhesive to stop the ball, and the width need be only wide enough to encompass the ball track.

## 8. Conditioning

8.1 Before test, store the pressure-sensitive adhesive-coated substrate at the selected test conditions for 24 h. If other conditions are not specified the storage and test conditions shall

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 15.06.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 15.09.

<sup>4</sup> A suitable apparatus is available through the Pressure Sensitive Tape Council, The Breen Co., 104 Wilmot Rd., Suite 201, Deerfield, IL 60015.



**FIG. 1 Adhesion Test Apparatus and Specimen Showing Distance of Roll That is Measured**

be  $73 \pm 4^\circ\text{F}$  ( $23 \pm 2^\circ\text{C}$ ) and  $50 \pm 5\%$  relative humidity. Details of these and other conditions are more fully described in Specification E 171.

## 9. Procedure

9.1 Select a hard, horizontal surface of sufficient size to conduct the test. Metal or glass plates have been satisfactorily used.

9.2 Prior to the tests of each lot of adhesive, clean the inclined trough thoroughly with a suitable solvent. Heptane, methyl ethyl ketone, isopropanol, toluene, or methanol are usually satisfactory.

9.3 Arrange the specimen to be tested, adhesive side up, in line with the inclined trough. The specimen must be free of any wrinkles, creases, or splices. The end of the specimen opposite the incline shall be held to the table with tape or a weight. Only one test shall be run on each specimen.

9.4 Prior to each roll of the ball, thoroughly clean the ball with a suitable solvent chosen to remove any possible adhesive residue. Wipe with a lint-free, bleached, absorbent material to remove any remaining residue. After cleaning do not touch the ball or raceway. Use clean, dry tongs to place the ball on the upper side of the release.

9.5 Release the ball and allow it to roll to a stop on the adhesive.

9.6 Measure the distance from the point where the ball initially contacts the adhesive to where the ball is in contact when it stops.

## 10. Report

10.1 Report the following information:

10.1.1 Complete identification of the adhesive tested and the substrate on which it is coated including type, source, manufacturers' code numbers, form, etc.,

10.1.2 Method of preparing test specimens, especially the resultant thickness of adhesive and substrate,

10.1.3 Conditioning procedure used,

10.1.4 Conditions of testing area,

10.1.5 Number of specimens tested (five are recommended),

10.1.6 Maximum, minimum, and average value of rolling ball distance. Optionally, either all values or a standard deviation for the value may also be included, and

10.1.7 Pertinent additional comments based on visual inspection such as noticeable residue on ball, lift of adhesive from substrate, etc.

## 11. Precision and Bias <sup>5</sup>

11.1 In tests of an identical series of pressure-sensitive tapes in various laboratories this rolling-ball test has reproducibly arranged the samples from least to most tacky. Numerical results on the same tape tested by different operators or in different laboratories could vary by as much as 50 % (95 % confidence limits).

## 12. Keywords

12.1 pressure-sensitive adhesives; rolling ball; tack

<sup>5</sup> ASTM Research Report No. D-14-1000. A copy is available from ASTM Headquarters, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

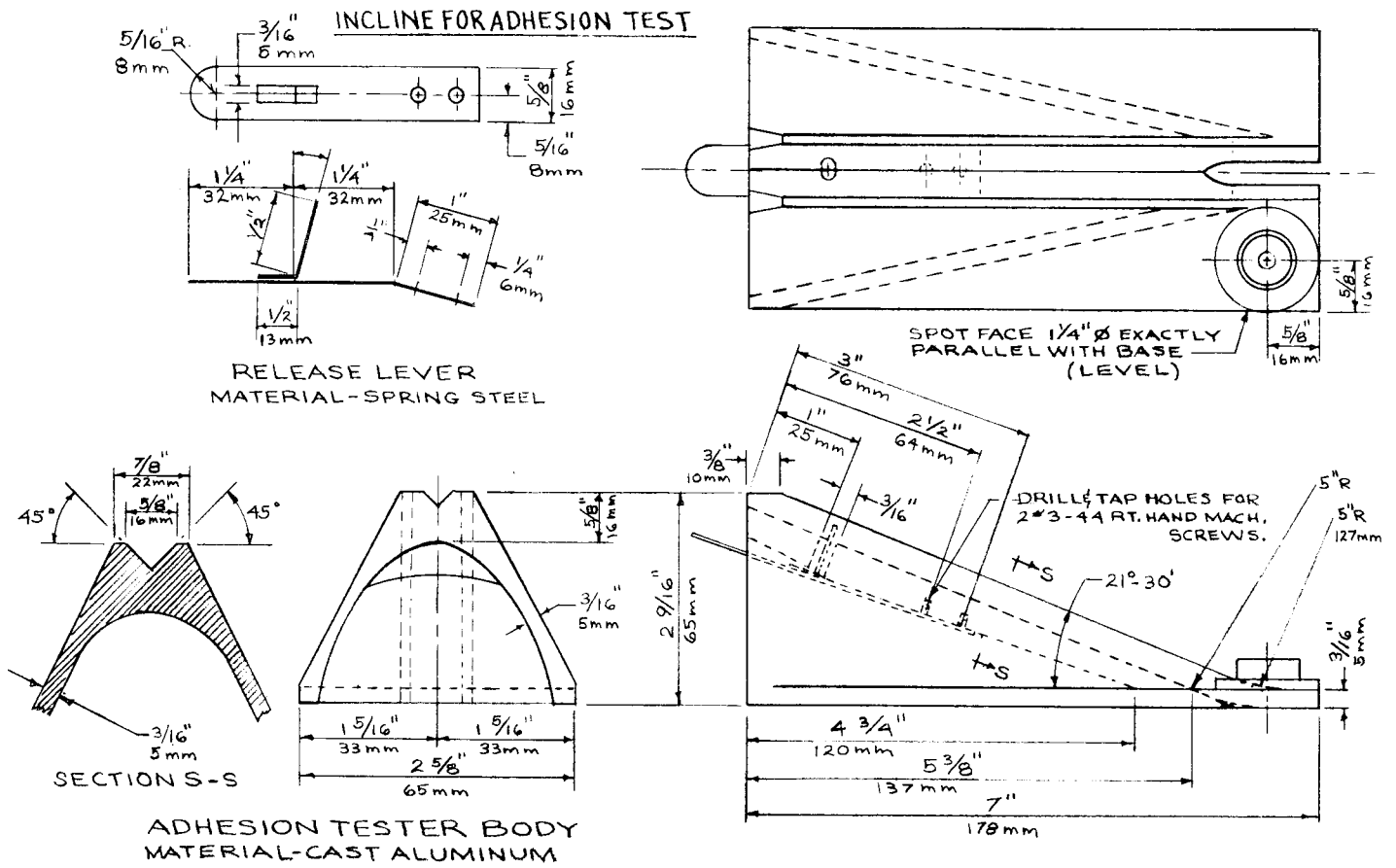


FIG. 2 Incline for Adhesion Test

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