



Designation: D3121 – 17

Standard Test Method for Tack of Pressure-Sensitive Adhesives by Rolling Ball¹

This standard is issued under the fixed designation D3121; 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 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 Values stated in either SI or inch-pound units are to be regarded separately as 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.

1.3 *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.*

1.4 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*²

[D907 Terminology of Adhesives](#)

[E171 Practice for Conditioning and Testing Flexible Barrier Packaging](#)

[D5750/D5750M Guide for Width and Length of Pressure-Sensitive Tape](#)

¹ 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.

Current edition approved May 1, 2017. Published July 2017. Originally approved in 1973. Last previous edition approved in 2006 as D3121–06 which was withdrawn January 2015 and reinstated in May 2017. DOI: 10.1520/D3121-17.

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. Terminology

3.1 *Definitions*—Many of the terms found in this test method are defined in Terminology [D907](#).

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 through which the ball gains downhill momentum. The ball is a 11 mm ($\frac{7}{16}$ in.) diameter steel ball unless otherwise specified.

7. Reagents

7.1 *Purity of Reagents*—Reagent grade chemicals should be used in all tests. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening accuracy of the determination.

7.2 *Solvents:*

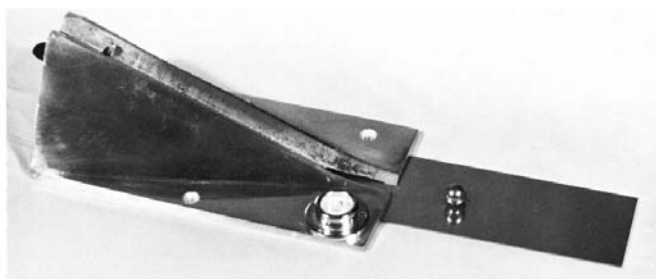


FIG. 1 Adhesion Test Apparatus and Specimen Showing Distance of Roll That is Measured

7.2.1 Any of the following solvents may be used for cleaning:

7.2.1.1 Diactone alcohol non-residual, technical grade or better,

7.2.1.2 Methanol (95 %),

7.2.1.3 Methyl ethyl ketone (MEK),

7.2.1.4 n-Heptane, or

7.2.1.5 Acetone.

7.2.2 Before selecting or using these solvents be sure to read and follow all precautions on the chemical Material Safety Data Sheets (MSDS) and consult with Environment, Health, and Safety (EHS) professionals.

7.3 *Cleaning Material*—Absorbent, surgical gauze, cotton wool or tissue may be used. 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 made exclusively from virgin materials.

8. Test Specimen

8.1 The test specimen is a substrate coated with a pressure-sensitive adhesive. It is generally about 48 mm (2 in.)³ wide and approximately 380 mm (15 in.) 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.

9. Conditioning

9.1 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 be $23 \pm 2^\circ\text{C}$ ($73 \pm 4^\circ\text{F}$) and $50 \pm 5\%$ relative humidity. Details of these and other conditions are more fully described in Specification E171.

10. Procedure

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

³ This width corresponds to the primary metric (SI) units described in Guide D5750/D5750M. These so-called “modular metric” units generally are used throughout the world. If it is desirable to test slightly different widths, this should be noted in accordance with 6.2 and calculations in accordance with 10.1 must account for the difference.

10.2 Prior to the tests of each lot of adhesive, dispense one of the solvents listed in 7.2.1 onto the trough, wiping to dryness with fresh absorbent cleaning material (see 7.3). Repeat for a total of three washes. The final cleaning shall be with an alternate solvent, either MEK or acetone. Do not touch cleaned surfaces with fingers. The cleaned surface should be allowed to dry at standard conditions for at least 10 min. If cleaned apparatus is not used within 10 h, it should be recleaned.

NOTE 1—All operations with solvents should be conducted in a well-ventilated hood.

10.3 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.

10.4 Prior to each roll of the ball, thoroughly clean the ball in the same manner as the inclined trough, see 10.2, to remove any possible adhesive residue. Allow to dry at standard conditions for at least 10 min. After cleaning do not touch the ball or raceway. Use clean, dry tongs to place the ball on the upper side of the release.

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

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

10.7 Repeat procedure 10.4 – 10.6 at least four additional times for each lot of adhesive to be tested (for a minimum of five replicates.) Use a fresh specimen for each test.

11. Report

11.1 Report the following information:

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

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

11.1.3 Conditioning procedure used,

11.1.4 Conditions of testing area,

11.1.5 Number of specimens tested (five are recommended),

11.1.6 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

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

12. Precision and Bias⁴

12.1 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).

⁴ Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:D14-1000.

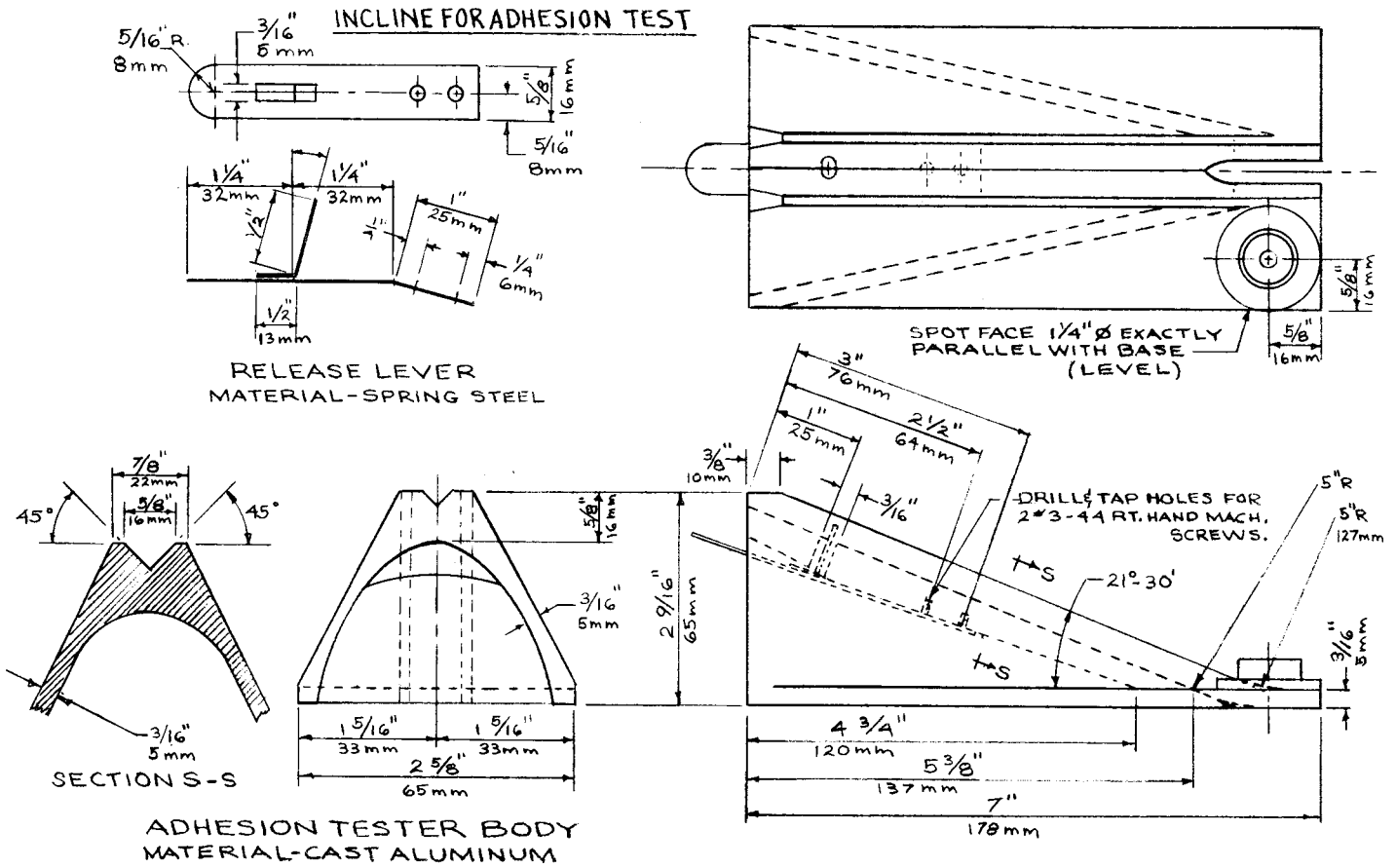


FIG. 2 Incline for Adhesion Test

13. Keywords

13.1 pressure-sensitive adhesives; rolling ball; tack

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org). Permission rights to photocopy the standard may also be secured from the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, Tel: (978) 646-2600; http://www.copyright.com/