



Standard Test Method for Curling, Twisting, and Tubing on Unwind of Pressure- Sensitive Tapes¹

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This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This test method provides one procedure for determining the extent of curling, the degree of twisting, and tendency to form a tube resulting from unwinding of the tape from its roll.

1.2 The 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.*

2. Referenced Documents

2.1 ASTM Standards:

D 996 Terminology of Packaging and Distribution Environments²

D 3715/D 3715M Practice for Quality Assurance of Pressure-Sensitive Tapes²

D 4332 Practice for Conditioning Containers, Packages, or Packaging Components for Testing²

E 122 Practice for Choice of Sample Size to Estimate a Measure of Quality for a Lot or Process³

3. Terminology

3.1 *Definitions*—General terms used in this test method are defined in Terminology D 996.

4. Summary of Test Method

4.1 The sample roll of tape is placed on a free-turning spindle a specified distance above a horizontal plane. A strip of

tape is drawn from the roll the distance to the plane at a specified rate and released. Any subsequent curling, twisting, or tubing of the strip is observed and measured.

5. Significance and Use

5.1 This test method will provide information on the relative tendency of tapes to curl, twist, or form into a tube with touching edges. The amount of each is a predictor of the difficulty one might experience in handling strips of tape of any length during their application.

5.2 There are several causes for variation in the extent or degree of these characteristics and may vary themselves within a production lot of tape. Therefore, it is essential to use an accepted sampling plan (see Section 7) when it is desired to use this test method to compare two types of tape for acceptance sampling purposes.

6. Apparatus

6.1 *Free-Turning Spindle*,⁴ sized to fit snugly inside the sample tape core, with its axis firmly supported horizontally and adjustable in height directly above a horizontal platform. There should be no obstructions in the path between the platform and the spindle.

NOTE 1—The horizontal platform can be a bench top or the floor.

7. Sampling

7.1 *Acceptance Sampling*—Sampling shall be in accordance with Practice D 3715/D 3715M.

7.2 *Sampling for Other Purposes*—The sampling and the number of test specimens depends on the purpose of the testing. Practice E 122 is recommended. It is common to test at least five specimens of a particular tape. Test specimens should be taken from several rolls of tape and whenever possible, among several production runs of tape. Strong conclusions about a specific property of a tape cannot be based on test results on a single unit (roll) of a product.

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.

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² *Annual Book of ASTM Standards*, Vol 15.09.

³ *Annual Book of ASTM Standards*, Vol 14.02.

⁴ Available from Chemsultants International, 9349 Hamilton Dr., Mentor, OH 44061-1118.

8. Test Specimens

8.1 The test specimen shall be the strip of tape unwound from the originally wound sample roll during performance in accordance with Section 10.

8.1.1 No restrictions in the width of the sample (or the specimen) are made except a practical limitation due to the high unwind that might result from wide tape rolls.

NOTE 2—This test method calls for a specific unwind rate which could be difficult to meet with high levels of unwind.

9. Conditioning

9.1 Condition the sample rolls in the standard atmosphere as described in Practice D 4332 for a period of at least 24 h. Test at these conditions.

NOTE 3—For plastic backed tapes when testing for tubing, conditioning may be 4 h and the standard humidity is not necessary. For referee purposes the standard humidity conditions shall be used.

10. Procedure

10.1 Place the sample roll on the spindle and adjust its height so that the lowest point of the roll is 900 ± 3 mm or 36 ± 0.125 in. above the horizontal platform.

10.2 Unwind 50 mm or 2 in. of tape from the roll and fold it over adhesive to adhesive to form a 25-mm or 1-in. tab.

10.3 Firmly grasp the tab and pull the tape vertically downward at a uniform rate of 125 to 175 mm/s or 5 to 7 in./s until the end of the tab touches the horizontal platform. Immediately release the tab.

10.4 Approximately 30 s after release of the tab make the following determinations:

10.4.1 *Measure the Curl of the Tape*—This is the distance between the platform and the lowest portion of the tape. Measure to the nearest 1 mm or $\frac{1}{32}$ in.

10.4.2 *Measure the Twist of the Tape*—Project an imaginary line representing the end of the tab onto the horizontal platform. This is done by sighting past the tab end from above it and lining up a pencil on the platform with the end of the tab. Measure the angle between the pencil and a line at right angles to the edge face of the roll to the nearest 5° of arc. This is Angle

A. Untwist the tape determining the quadrant of rotation needed to straighten it.

10.4.2.1 To find Angle *B*, the actual twist, use the following table:

When Rotation Is	Then
0 to 90°	$A = B$
91 to 180°	$180 - A = B$
181 to 270°	$180 + A = B$
271 to 360°	$360 - A = B$
361 to 450°	$360 + A = B$
451 to 540°	$540 - A = B$
541 to 630°	$540 + A = B$
631 to 720°	$720 - A = B$
721 to 810°	$720 + A = B$

10.4.3 If the tape outer edges touch to form a roll/tube, it shall be a cause for rejection.

11. Report

11.1 The report shall include the following:

11.1.1 Statement that this test method was used. Indicate any deviations from this test method as written,

11.1.2 Manufacturer's name and designation for the tape,

11.1.3 The curling found in 10.4.1 in millimetres or inches to the nearest 1 mm or $\frac{1}{32}$ in.,

11.1.4 The twisting found in 10.4.2 to the nearest 5° arc, and

11.1.5 Whether the tape, when tested as described in 10.4.3, formed a tube.

12. Precision and Bias ⁵

12.1 No statement is made about either the precision or bias of this test method since the results merely state whether there is conformance to the criteria for success specified by the user of this test method.

13. Keywords

13.1 curling; pressure-sensitive tape; tubing; twisting; unwinding

⁵ Supporting data are available from ASTM Headquarters. Request RR: D-10-1002, Report 2.

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