



Designation: D3813/D3813M – 98 (Reapproved 2020)

# Standard Test Method for Curling, Twisting, and Tubing on Unwind of Pressure-Sensitive Tapes<sup>1</sup>

This standard is issued under the fixed designation D3813/D3813M; 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.

*This standard has been approved for use by agencies of the U.S. 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, health, and environmental 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:*<sup>2</sup>

[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](#)

<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.

[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*—General terms used in this test method are defined in Terminology [D996](#).

## 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*,<sup>3</sup> 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.

<sup>3</sup> The sole source of supply of the apparatus known to the committee at this time is Chemsultants International, 9349 Hamilton Dr., Mentor, OH 44061-1118. 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,<sup>1</sup> which you may attend.

## 7. Sampling

7.1 *Acceptance Sampling*—Sampling shall be in accordance with Practice **D3715/D3715M**.

7.2 *Sampling for Other Purposes*—The sampling and the number of test specimens depends on the purpose of the testing. Practice **E122** 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.

## 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 **D4332** 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  $900 \pm 3$  mm or  $36 \pm 0.125$  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  $5^\circ$  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 $90^\circ$	$A = B$
91 to $180^\circ$	$180 - A = B$
181 to $270^\circ$	$180 + A = B$
271 to $360^\circ$	$360 - A = B$
361 to $450^\circ$	$360 + A = B$
451 to $540^\circ$	$540 - A = B$
541 to $630^\circ$	$540 + A = B$
631 to $720^\circ$	$720 - A = B$
721 to $810^\circ$	$720 + A = B$

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  $5^\circ$  arc, and

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

## 12. Precision and Bias<sup>4</sup>

12.1 Limited information is presented about the precision and bias of this test method since the test produces pass/fail results.

## 13. Keywords

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

<sup>4</sup> Supporting data are available from ASTM Headquarters. Request RR:D10-1002, Report 2. Contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org).