



# Standard Test Method for Unwind Force of Pressure-Sensitive Tapes<sup>1</sup>

This standard is issued under the fixed designation D 3811/D 3811M; 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 Department of Defense.*

## 1. Scope

1.1 This test method provides one procedure for determining the force required to unwind a roll of pressure-sensitive tape.

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 Environments<sup>2</sup>

D 3715/D 3715M Practice for Quality Assurance of Pressure-Sensitive Tapes<sup>2</sup>

D 4332 Practice for Conditioning Containers, Packages, or Packaging Components for Testing<sup>2</sup>

E 122 Practice for Calculating Sample Size to Estimate, With a Specified Tolerable Error, the Average for a Characteristic of a Lot or Process<sup>3</sup>

## 3. Terminology

3.1 *Definitions:* General terms 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 held in a CRE (constant-rate-of-extension) tension tester. While the crosshead is moved at a specified rate, the maximum force measured during unwinding of approximately 150 mm [6 in.] of tape is taken as the unwind force.

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

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 14.02.

## 5. Significance and Use

5.1 This procedure simulates hand and machine unwinding of tape at low rates. The force required for unwinding at low rates is a function of rate. At some rate (expected to be different for each construction type and manufacturer) there occurs an inversion of the response. The rate for this test method does not allow for comparisons of different tapes that will be unwound at high rates.

5.2 This procedure can be used to indicate satisfaction where a specification for unwind, either maximum or minimum, is established and when the responses referred to in 5.1 are taken into consideration.

## 6. Apparatus

6.1 *Unwind Force Tester*—A CRE tension tester shall be used. The tester shall have two clamps with centers in the same plane, parallel with the direction of motion of the stressing clamp, and so aligned that they will hold the specimen wholly in the same plane; a means of moving the stressing clamp at a uniform rate of  $5 \pm 0.2$  mm/s [ $12.0 \pm 0.5$  in./min]; and an autographic device for recording load. The instrument shall be calibrated to an accuracy of 0.5 % full scale. The scale range used for any test shall be such that the mean test level falls within 20 to 50 % of full scale.

6.2 *Free-Turning Spindle*<sup>4</sup>, sized to fit snugly inside the sample tape core, with its axis horizontally supported in a frame that can be held in the clamp on the crosshead of the unwind tester that is not supporting the load cell.

## 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 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 wherever possible, among several production runs of tape. Strong conclusions about a specific property of a tape cannot be based on test results of a single unit (roll) of a product.

<sup>4</sup> Available from Chemsultants International, 9349 Hamilton Dr., Mentor, OH 44061-1118.

## 8. Test Specimens

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

8.2 Unwind and discard at least three, but no more than six, outer wraps of tape from the sample roll before unwinding specimens for test.

## 9. Conditioning

9.1 Condition the sample rolls in the standard conditioning atmosphere as described in Practice D 4332 for a period of not less than 24 h. Test at these conditions.

## 10. Procedure

10.1 Place the free-turning spindle into the clamp not associated with the load cell.

10.2 Place the sample roll on the spindle.

10.3 Unwind sufficient tape by hand to allow folding the end over to form a tab and insertion of the tab into the opposite clamp.

10.4 Unwind approximately 150 mm [6 in.] mechanically at 5 mm/s [12 in./min].

10.5 Observe the autographic record to find the maximum force to the nearest N/100 mm [0.1 lbf/in.] during the unwinding in 10.4. Examine the roll and the unwound strip for evidence of transfer of adhesive and tearing, or delamination of the backing.

## 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 Report the results found in 10.5 to the nearest N/100 mm [lbf/in.] by the average and the standard deviation. Report the number of samples.

11.1.4 The occurrence of adhesive transfer and tearing, or delamination of backing found in 10.5.

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

### 12.1 Precision:

12.1.1 An interlaboratory evaluation of four types of pressure-sensitive tape by five laboratories has been conducted. The following summary presents the standard deviations as percentages of the mean. These may be larger or smaller for any particular tape type or any particular manufacturer.

|  |        |
|--|--------|
| Residual (within roll and replication error) | 7.6 %  |
| Between rolls (of one tape type)             | 15.4 % |
| Between people (testers in one laboratory)   | 4.0 %  |
| Between laboratories                         | 18.5 % |

12.1.2 These may be combined in several ways to obtain the desired estimate of precision. Since the repeatability (within-laboratory replication error) can be determined by a laboratory for a particular tape, this information can be used with the reported information to obtain more meaningful estimates of precision.

12.2 *Bias*—No measure of bias is possible with this test method because an accepted reference or referee value is not available.

## 13. Keywords

13.1 pressure-sensitive tape; unwind force

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

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