



# Standard Test Method for Peel or Stripping Strength of Adhesive Bonds<sup>1</sup>

This standard is issued under the fixed designation D 903; 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 reappraisal. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reappraisal.

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

## 1. Scope

1.1 This test method covers the determination of the comparative peel or stripping characteristics of adhesive bonds when tested on standard-sized specimens and under defined conditions of pretreatment, temperature, and testing machine speed.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are 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>

## 3. Terminology

3.1 *Definitions*—Many terms used in this test method are defined in Terminology D 907.

### 3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *flexible*—*in this test method*, indicates a material of the proper flexural strength and thickness to permit a turn back at an approximate 180° angle in the expected loading range of the test without failure. In order to fulfill all terms of the definition, at least one of the adhered materials must be flexible.

3.2.2 *peel or stripping strength*—the average load per unit width of bond line required to separate progressively one member from the other over the adhered surfaces at a separation angle of approximately 180° and at a separation rate of 152 mm (6 in.)/min. It is expressed in kilograms per millimetre (pounds per inch) of width.

## 4. Apparatus

4.1 *Testing Machine*— A power-driven machine, with a

constant rate-of-jaw separation or of the inclination balance or pendulum type, which fulfills the following requirements:

4.1.1 The applied tension as measured and recorded is accurate within  $\pm 1\%$ .

4.1.2 Hold specimens in the testing machine by grips which clamp firmly and prevent slipping at all times.

4.1.3 The rate of travel of the power-actuated grip is 305 mm (12 in.)/min. This rate which provides a separation of 152 mm (6 in.)/min is to be uniform throughout the tests.

4.1.4 Operate the machine without any device for maintaining maximum load indication. In pendulum-type machines, the weight lever swings as a free pendulum without engagement of pawls.

4.1.5 The machine is autographic giving a chart having the inches of separation as one axis and applied tension as the other axis of coordinates.

4.1.6 The capacity of the machine is such that the maximum applied tension during test does not exceed 85 % nor be less than 15 % of the rated capacity.

4.2 *Conditioning Room or Desiccators*—A conditioning room capable of maintaining a relative humidity of  $50 \pm 2\%$  at  $23 \pm 1^\circ\text{C}$  ( $73.4 \pm 2^\circ\text{F}$ ), or desiccators filled with a saturated salt solution (Note 1) to give a relative humidity of  $50 \pm 2\%$  at  $23 \pm 1^\circ\text{C}$  are required for the conditioning of some specimens.

NOTE 1—A saturated salt solution of calcium nitrate gives approximately 51 % relative humidity at the testing temperature.

## 5. Test Specimen

5.1 The test specimen, shown in Fig. 1(a), consists of one piece of flexible material, 25 by 304.8 mm (1 by 12 in.), bonded for 152.4 mm (6 in.) at one end to one piece of flexible or rigid material, 25 by 203.2 mm (1 by 8 in.), with the unbonded portions of each member being face to face.

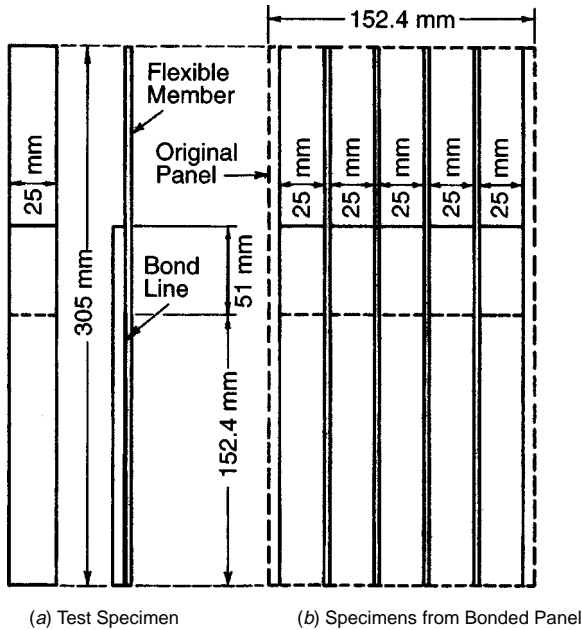
5.2 In order to maintain a separation rate of 152.4 mm (6 in.)/min the specimen is to be relatively nonextensible in the expected loading range. Where a material is sufficiently extensible to lessen radically the separation rate, back it up with a suitable nonextensible material. In reporting such a test, completely identify the backing material and method.

5.3 Test materials are to be thick enough to withstand the expected tensile pull but not over 3 mm ( $1/8$  in.) in thickness. Wherever possible, the standard thickness of specimens is: metals, 1.6 mm ( $1/16$  in.); plastics,  $1/16$  in.; woods,  $1/8$  in.; rubber

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



English/Metric Equivalents				
in.	1	2	6	12
mm	25	51	152.4	305

FIG. 1 Test Specimen

compounds, 1.9 mm (0.075 in.); and cotton duck, 627.4 gm/m<sup>2</sup> (30 oz/yd<sup>2</sup>). Other special materials, as well as the standard materials, are to be completely identified in the test report as specified in Section 10.

5.4 Test at least ten test specimens for each adhesive.

5.5 Discard any specimen whose test result is out of line due to some obvious flaw and retest.

**6. Preparation of Test Specimen**

6.1 Precondition or prepare the surface of the area to be bonded in accordance with the recommendations of the manufacturer of the adhesive.

6.2 Bond the specimens in accordance with the procedure and recommendations as outlined by the manufacturer of the adhesive.

6.3 While individual specimens may be prepared, it is recommended that specimens be cut from bonded panels approximately 152.4 mm (6 in.) in width as shown in Fig. 1(b), so that five standard 25-mm (1-in.) wide specimens are obtained from each panel.

**7. Conditioning**

7.1 Condition all specimens for 7 days by exposure to a relative humidity of 50 ± 2 % at 23 ± 1°C (73.4 ± 2°F) or until equilibrium is reached, except where the adhesive manufacturer may specify such an aging period to be unnecessary or a shorter period to be adequate.

7.2 Special conditioning procedures may be used by agreement between the purchaser and the manufacturer.

**8. Procedure**

8.1 Conduct the test as soon as possible after removing the test specimens from the conditioning atmosphere and prefer-

ably under the same conditions.

8.2 Separate the free end of the 25-mm (1-in.) wide flexible member by hand from the other member for a distance of about 1 in. Place the specimen in the testing machine by clamping the free end of the 8-in. long member in one grip, turning back the free end of the flexible member and clamping it in the other grip as shown in Fig. 2. Attach the separated end of the specimen, with all separate parts except the one under test securely gripped, to the recording head by means of a clamp using care to adjust it symmetrically in order that the tension is distributed uniformly. Maintain the specimen during the test approximately in the plane of the clamps. This may be done either by attaching the minimum weight required to the free end of the specimen or by holding the specimen against an alignment plate (Fig. 2) attached to the stationary clamp. In either case, take into account the added weight in determining the load causing separation. Grip the 1-in. wide flexible member symmetrically and firmly without twisting in the power-actuated clamp. Adjust the autographic mechanism and chart to zero and start the machine. Strip the separating member from the specimen approximately at an angle of 180° and continue the separation for a sufficient distance to indicate the peel or stripping value. Peel at least one half of the bonded area, even though a peel or stripping value may be indicated before this point.

**9. Calculation**

9.1 Determine the actual peel or stripping strength by drawing on the autographic chart the best average load line that will accommodate the recorded curve. Report the load so indicated, corrected for any tare weight which may have been used with the specimen as described in 8.2 expressed in kilograms per millimetre (pounds per inch) of width for separation at 152.4 mm (6 in.)/min, as the peel or stripping strength for the particular specimen under test.

9.2 For each series of tests, calculate the arithmetic mean of all the values, obtained and report as the "average value."

**10. Report**

10.1 Report the following:

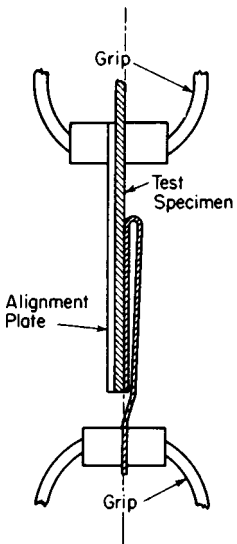


FIG. 2 Specimen Under Test

10.1.1 Complete identification of the adhesive and specimens tested, including types, source, manufacturer's code numbers, form, etc.,

10.1.2 Method of preparing test specimens, including mixing and dispensing of adhesive,

10.1.3 Conditioning procedure used,

10.1.4 Testing room conditions,

10.1.5 Number of specimens tested,

10.1.6 Speed of testing,

10.1.7 Average value of peel or stripping strength,

10.1.8 Maximum and minimum strength values of the series,

10.1.9 Individual test values, individual autographic charts, and other statistical data requested by the purchaser, and

10.1.10 Type of failure.

## **11. Precision and Bias**

11.1 A precision and bias statement does not exist for this test method because resources necessary for round-robin testing have not been forthcoming.

## **12. Keywords**

12.1 adhesive bonding; peel strength; stripping strength

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