



Standard Test Method for Determining Adhesive Shear Strength of Carpet Adhesives¹

This standard is issued under the fixed designation D 6004; 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 describes a procedure to measure shear strength development for adhesives used to bond carpet adhesives to selected underlayments.

1.2 This test method provides a quantitative means of measuring and recording shear strength of the adhesive when it is applied to the desired underlayment.

1.3 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.4 *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:²

D 618 Practice for Conditioning Plastics for Testing

D 907 Terminology of Adhesives

E 4 Practices for Force Verification of Testing Materials
E 177

2.2 Voluntary Product Standards³

PS1 Construction and Industrial Plywood

PS2 Structural Use Panels

3. Terminology

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

¹ This test method is under the jurisdiction of ASTM Committee D14 on Adhesives and is the direct responsibility of Subcommittee D14.70 on Construction Adhesives.

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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 Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401.

4. Significance and Use

4.1 In selecting or developing a carpet adhesive, it is critical to have knowledge regarding how well the adhesive will bond to the desired underlayment. Shear loading simulates a common failure mode.

4.2 The test method determines the failure shear load for the test adhesive and specific underlayment combination.

5. Apparatus

5.1 *Applicator trowel*, with a notch pattern of 1/8 in. (3.2 mm) wide, 3/32 in. (2.4 mm) deep, 1/8 in. (3.2 mm) flat.

5.2 Three 10-lb (4.54-kg) weight equivalents.

5.3 Three 2 × 3-in. (51 mm × 76 mm) sections of underlayment for dead weight distribution.

5.4 *Convection Oven*, capable of maintaining a temperature of 122 ± 2°F (50 ± 1°C).

5.5 *Calibrated Universal Testing Machine*, capable of a controlled application of force with a force measurement accuracy of ± 1 % when calibrated in compliance with Practices E 4 requirements.

6. Materials

6.1 *Adhesive*—Any appropriate adhesive for carpet installation.

6.2 *Duck cloth*—natural, untreated, #10, 14.73 oz.

6.3 *Underlayment*—Common wood-based products such as PS2 grade mark stamped oriented strand board underlayment or PS1 grade mark stamped plywood underlayment. Other products, recommended by the adhesive manufacturer may also be used.

7. Conditioning

7.1 Condition the duck cloth, underlayment and adhesive to be tested for 24 h at 73 ± 3°F (23 ± 2°C) and 50 % ± 5 % relative humidity prior to testing.

8. Sample Preparation

8.1 Cut the duck cloth into three 2 × 6-in. (51 × 127-mm) pieces.

8.2 Cut one section of underlayment into a 16 × 5-in. (406 × 127-mm) section.

$$S = \frac{SV}{6} \quad (1)$$

9. Procedure

9.1 Hold the trowel at a 45° angle and spread sufficient adhesive to cover the bonding areas.

9.2 Wait 10 min and place three pieces of duck cloth perpendicular to the trowel pattern, each covering a 6-in.² or 3 × 2-in. (38.7 cm² or 51 × 76 mm) area of the adhesive (Fig. 1).

9.3 Place a 2 × 3-in. (51 × 76 mm) underlayment section on top of each duck cloth piece for dead weight distribution (Fig. 2).

9.4 Place a 10-lb weight on each 2 × 3-in. (51 × 76 mm) dead weight distribution underlayment section.

9.5 Remove the weights and the dead weight underlayment sections from the test panel.

9.6 Allow the test panel to dry 24 h at standard conditions.

9.7 Place the test panel in a 122°F (50°C) oven for 72 h.

9.8 Remove the test panel from the oven and allow it to cool at standard conditions for 3 h.

9.9 Test the specimens in tension shear using a calibrated universal testing machine, aligning the upper and lower jaws as perpendicular as possible. Set the test speed at 1 in. (25.4 mm) /min. The test area will be 6 in.² (38.7 cm²).

9.10 Record the three shear values in pounds-force.

10. Calculation

10.1 Calculate the shear strength (psi) of the individual specimens as follows:

where:

S = shear strength (psi), and

SV = shear value reading from the universal test machine.

10.2 Calculate the average shear strength of the individual specimens as follows:

$$S_{AVE} = \frac{\sum S}{3} \quad (2)$$

where:

S_{AVE} = the average shear strength (psi) of the three shear strength values.

11. Report

11.1 Report the following information:

11.1.1 The type of carpet adhesive used.

11.1.2 The type of underlayment.

11.1.3 The tension shear strength in psi.

12. Precision and Bias ⁴

12.1 The precision data is based on three tensile shear values determined for one adhesive by five different laboratories. The testing was performed for bonding carpet to plywood and duck cloth to plywood:

⁴ Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR: D14-1011.

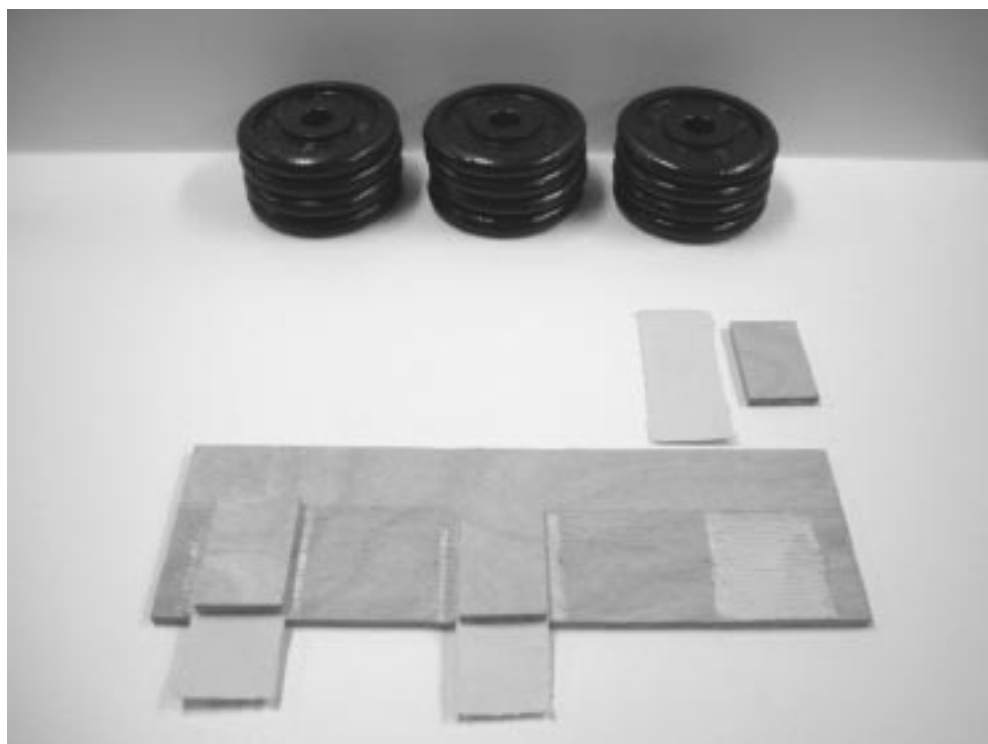


FIG. 1 Shear Strength Carpet Assembly Pattern



NOTE 1—Each weight group weighs 10 lbs (composed of four 2.5 lbs weight discs).

FIG. 2 Shear Strength Carpet Assembly Dead Weight Configuration

	Av	Sr	SrCOV%	SR	SRCOV%	r	R
Carpet to plywood Tensile strength (psi)	11	1.3	11.8	1.7	15.4	3.6	4.8
Duck cloth to plywood Tensile strength (psi)	21	0.8	3.8	1.2	5.7	2.2	3.3

where:

S_r = repeatability standard deviation,

S_R = reproducibility standard deviation,

r = 95 % repeatability limit (within a laboratory), and

R = 95 % reproducibility limit (between laboratories).

12.1.1 The table was calculated using the relationship:

95 % limit = $2.8 \times \text{standard deviation}$.

12.2 The terms repeatability and reproducibility limits are used as specified in Practice E 177.

12.3 *Bias*—No information can be presented in the bias of the procedure in Test Method D 6004 for measuring adhesive shear strength because no material having an accepted reference value is available.

13. Keywords

13.1 adhesion; carpet; tension shear strength

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