



Designation: ~~D7005-03 (Reapproved 2008)~~ D7005/D7005M-15

Standard Test Method for Determining the Bond Strength (Ply Adhesion) of Geocomposites¹

This standard is issued under the fixed designation ~~D7005~~; D7005/D7005M; 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 It has been widely discussed in the literature that bond strength of flexible multi-ply materials is difficult to measure with current technology. The above is recognized and accepted, since all known methods of measurement include the force required to bend the separated layers, in addition to that required to separate them. However, useful information can be obtained when one realizes that the bending force is included and that direct comparison between different materials, or even between the same materials of different thickness, cannot be made. Also, conditioning that affects the moduli of the plies will be reflected in the bond strength measurement.

1.2 This index test method defines a procedure for comparing the bond strength or ply adhesion of geocomposites. The focus is on geotextiles bonded to geonets or other types of drainage cores; for example, geomats, geospacers, etc. Other possible uses are geotextiles adhered or bonded to themselves, geomembranes, geogrids, or other dissimilar materials. Various processes can make such laminates: adhesives, thermal bonding, stitch bonding, needling, spread coating, etc.

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as the standard. ~~The values given in parentheses are provided for information purposes only; stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.~~

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.* Specific precautionary statements are given in 11.1.1.

2. Referenced Documents

2.1 ASTM Standards:²

~~D76~~D76/D76M Specification for Tensile Testing Machines for Textiles

~~D2905~~ Practice for Statements on Number of Specimens for Textiles (Withdrawn 2008)³

~~D4354~~ Practice for Sampling of Geosynthetics and Rolled Erosion Control Products (RECPs) for Testing

~~D4439~~ Terminology for Geosynthetics

~~D5321~~D5321/D5321M Test Method for Determining the Shear Strength of Soil-Geosynthetic and Geosynthetic-Geosynthetic Interfaces by Direct Shear

3. Terminology

3.1 Definitions:

3.1.1 atmosphere for testing geosynthetics—air maintained at a relative humidity between 50 to 70 % and a temperature of $21 \pm 2^\circ\text{C}$ [$70 \pm 4^\circ\text{F}$].

3.1.2 bond strength (ply adhesion)—amount of force required (per unit width) to separate plies of material or materials in peeling mode plus the force to bend the plies.

3.1.2 necking—localized reduction in cross section, which may occur in a material under tensile stress.

3.1.3 geocomposite—a product composed of two or more materials, at least one of which is a geosynthetic.

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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 The last approved version of this historical standard is referenced on www.astm.org.



3.1.4 ~~geosynthetic—geomat/geospacer—a planar product manufactured from any three dimensional, polymeric material used with soil, rock, earth, or other geotechnical engineering related material as an integral part of a man-made project, structure, or system.~~

3.1.5 ~~geotextile—a permeable geosynthetic comprised solely of textiles.~~

3.1.5 ~~geonet—a geosynthetic consisting of integrally connected parallel sets of ribs overlying similar sets at various angles for planar drainage of liquids or gases.~~

3.1.6 ~~geomat/geospacer—geosynthetic—any three dimensional, a planar product manufactured from polymeric material used with soil, rock, earth, or other geotechnical engineering related material as an integral part of a man-made project, project structure, or system.~~

3.1.7 ~~geotextile—a permeable geosynthetic comprised solely of textiles.~~

3.1.8 ~~index test—a test procedure, which may contain a known bias but may be used to establish an order for a set of specimens with respect to the property of interest.~~

3.1.9 ~~machine direction—the direction in the plane of the fabric parallel to the direction of manufacture.~~

3.1.10 ~~atmosphere for testing geosynthetics—necking—air maintained at a relative humidity between 50 to 70 % and a temperature of $21 \pm 2^{\circ}\text{C}$ ($70 \pm 4^{\circ}\text{F}$), localized reduction in cross section, which may occur in a material under tensile stress.~~

3.2 For definitions of other terms refer to Terminology D4439.

4. Summary of Test Method

4.1 Initially the geotextile is separated from its associated material with care. The separated plies of the test specimen are placed into the grips of a tensile testing machine. The grips are then separated and the force required to further separate the plies is defined as bond strength.

NOTE 1—The force to bend the separated plies is included in the measured force.

5. Significance and Use

5.1 This test method is to be used as a quality control or quality assurance test. As a manufacturing quality control (MQC) test, it would generally be used by the geocomposite product manufacturer or fabricator. As a construction quality assurance (CQA) test, it would be used by certification or inspection organizations.

5.2 This test method can also be used to verify if the adhesion or bond strength varies after exposure to various incubation media in durability ~~and/or~~ or chemical resistance ~~testing—testing, or both.~~

5.3 Whatever use is to be associated with the test, it should be understood that this is an index test.

NOTE 2—There have been numerous attempts to relate the results of this test to the interface shearing resistance of the respective materials determined per Test Method ~~D5321/D5321M~~. To date, no relationships have been established between the two properties.

5.4 Test Method ~~D7005/D7005M~~ for determining the bond strength (ply adhesion) strength may be used as an acceptance test of commercial shipments of geocomposites, but caution is advised since information about between-laboratory precision is incomplete. Comparative tests as directed in 5.4.1 are advisable.

5.4.1 In the case of a dispute arising from differences in reported test results when using the procedure in Test Method ~~D7005/D7005M~~ for acceptance of commercial shipments, the purchaser and the supplier should first confirm that the tests were conducted using comparable test parameters including specimen conditioning, grip faces, grip size, etc. Comparative tests should then be conducted to determine if there is a statistical bias between their laboratories. Competent statistical assistance is recommended for the investigation of bias. As a minimum, the two parties should take a group of test specimens that are as homogeneous as possible and that are from a lot of the material in question. The test specimens should be randomly assigned to each laboratory for testing. The average results from the two laboratories should be compared to the Student's t-test for unpaired data and an acceptable probability level chosen by the two parties before the testing is begun. If a bias is found, either its cause must be found and corrected or the purchaser and supplier must agree to interpret future test results in the light of the known bias. Refer to Practice D2905, Table 1.

6. Apparatus

6.1 *Grips*—A gripping system that minimizes both slippage and uneven stress distribution is required. Grips lined with thin rubber, crocus clothe or pressure sensitive tape, as well as file-faced or serrated grips has been successfully used for many materials. Air-actuated grips have been found advantageous, particularly in the case of materials that tend to “neck” in the grips, since pressure is maintained at all times. Grip faces shall measure not less than 50.8 mm (~~2.0 in.~~) [2.0 in.] wide by no less than 100 mm (~~4 in.~~) [4 in.] long, with the longer dimension perpendicular to the direction of the applied load.

6.2 *Testing Machine*—A tensile testing machine with computer acquisition capabilities conforming to the requirements for Specification ~~D76/D76M~~.

6.3 *Specimen Cutter*—A die 101.6 \pm 2 mm (~~4~~) [4 \pm 0.08 in.] wide by at least 200 mm (~~8 in.~~) [8 in.] long.