Designation: D6525/D6525M – 17

Standard Test Method for Measuring Nominal Thickness of Rolled Erosion Control Products[1]

This standard is issued under the fixed designation D6525/D6525M; 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 covers the measurement of the nominal thickness of rolled erosion control products.

1.2 This test method does not provide thickness values for rolled erosion control products under variable compressive stresses. This test method determines nominal thickness, not necessarily minimum thickness.

1.3 The values stated in either SI units 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 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.*

1.5 *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:*[2]

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

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

3. Terminology

3.1 *Definitions:*

3.1.1 *pressure, n*—the force or load per unit area.

3.1.2 *thickness—(1)* the distance between one planar surface and its opposite parallel and planar surface; *(2) in rolled erosion control products,* the distance between the upper and lower surfaces of the material, measured under a specified pressure and time.

4. Summary of Test Method

4.1 The nominal thickness of rolled erosion control products is determined by observing the perpendicular distance that a movable plane is displaced from a parallel surface by the rolled erosion control product while under a specified pressure of 0.2 kPa [0.029 psi] for 5 s.

5. Significance and Use

5.1 Thickness is one of the basic physical properties used to control the quality of rolled erosion control products. Thickness values may aid in the calculation of other rolled erosion control product parameters. Thickness however is not generally an indication of field performance and generally should not be used in specifications. This test method is developed to aid manufacturers, designers, and end users in comparing the thickness of rolled erosion control products through the use of an accepted ASTM standard.

5.2 The thickness of rolled erosion control products may vary considerably depending on the pressure applied to the specimen during measurement. Where observed changes occur, thickness decreases when applied pressure is increased. To minimize variation, specific sample size and applied pressure are indicated in this test method to ensure all results are comparable.

5.3 This test method may be used for acceptance testing of commercial shipments of rolled erosion control products, but caution is advised since information on between-laboratory precision is incomplete. Comparative tests in accordance with 5.3.1 may be advised.

[1] This test method is under the jurisdiction of ASTM Committee D35 on Geosynthetics and is the direct responsibility of Subcommittee D35.05 on Geosynthetic Erosion Control.

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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.

5.3.1 In case of a dispute arising from differences in reported test results when using this test method for acceptance testing of commercial shipments, the purchaser and the supplier should conduct comparative tests 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 formed from a lot of material of the type in question. The test specimens should be randomly assigned in equal numbers to each laboratory for testing. The average results from the two laboratories should be compared using Student's *t*-test for unpaired data and an acceptable probability level chosen by the two parties before the testing is begun. If bias is found, either its cause must be found and corrected or the purchaser and supplier must agree to interpret future tests in light of the known bias.

NOTE 1—The user should be aware that the compressibility of the materials, their rebound characteristics, and the like will also affect the thickness of the rolled erosion control products following the time they are rolled up on rolls, shipped, and stored.

6. Apparatus

6.1 *Thickness Testing Instrument*—The thickness gauge shall have a base (or anvil) and a free-moving presser foot plate whose planar faces are parallel to each other to <0.1 mm. A gauge with a 150.0-mm [6.00-in.] diameter presser foot, the base shall extend at least 10 mm in all directions further than the edge of the approximately 17 500-mm^2 circular presser foot, shall be used for measurements of rolled erosion control products. The instrument must be capable of measuring a maximum thickness of at least 25 mm [1 in.] to an accuracy of ±0.025 mm [0.001 in.]. The gauge shall be constructed to permit gradual application of pressure to a specific force of 0.2 ± 0.02 kPa [0.029 ± 0.003 psi] for rolled erosion control products. Dead weight loading may be used.

6.2 *Cutting Dies*—Dies to cut specimens should have dimensions at least as large as a circle 200.0 mm [8.00 in.] in diameter.

NOTE 2—Due to compressibility of many rolled erosion control products, the cutting and handling preparation may change the thickness. Care should be exercised to minimize these effects.

6.3 *Scissors*—A sharp pair of scissors may be used in place of cutting dies.

7. Sampling

7.1 *Lot Sample*—In the absence of other guidelines, divide the product into lots and take lot samples in accordance with Practice D4354.

7.2 *Laboratory Sample*—For the laboratory sample, take a full-width sample of sufficient length in the machine direction so that the required size and number of specimens can be obtained. Exclude the inner and outer layers or wraps of the roll or any material containing folds, crushed areas, or other distortions not representative of the sampled lot.

7.3 Remove test specimens from the laboratory sample so that each specimen will contain different machine and cross-machine elements with no specimen taken nearer than 100 mm [4 in.] from the roll sides or ends, unless otherwise specified.

7.4 *Test Specimens*—Specimen size shall be sufficient to assure that the edge of the specimen will extend beyond the edge of the presser foot by 10 mm [0.39 in.] in all directions.

7.5 *Number of Specimens*—Unless otherwise agreed upon, as when provided in an applicable material specification, take the number of test specimens per laboratory sample as follows:

7.5.1 *Reliable Estimate of* v—When there is a reliable estimate of *v* based upon extensive part records for similar materials tested in the user's laboratory as directed in this test method, calculate the required number of specimens as follows so that the user may expect at the 95 % probability level that the test result is not more than 5.0 % of the average above or below the average of the sample:

$$n = (t\ v / A)^2 \quad (1)$$

where:

n = number of test specimens (rounded upward to a whole number),
v = the coefficient of variation of individual observations on similar materials in the user's laboratory under conditions of single operation precision, %,
t = value of Student's t for one-sided limits, a 95 % probability level, and the degrees of freedom associated with the estimate of v (see Table 1), and
A = 5.0 % of the average, the value of the allowable variation.

7.5.2 *No Reliable Estimate of* v—When there is no reliable estimate of *v* for the user's laboratory, measurements shall be made on a minimum of ten (10) specimens per laboratory sample.

8. Conditioning

8.1 Bring the specimens to the moisture and temperature equilibrium in the atmosphere for testing rolled erosion control products, that is, a temperature of 21 ± 2 °C [70 ± 4 °F] and a relative humidity of 60 ± 10 %.

9. Procedure

9.1 Test the conditioned specimens in the standard atmosphere specified in 8.1.

9.2 Handle the test specimens carefully to avoid altering the natural state of the material.

TABLE 1 Values of Student's *t* for One-Sided Limits and the 95 % Probability

df	One-Sided	df	One-Sided	df	One-Sided
1	6.314	11	1.796	22	1.717
2	2.920	12	1.782	24	1.711
3	2.353	13	1.771	26	1.706
4	2.132	14	1.761	28	1.701
5	2.015	15	1.753	30	1.697
6	1.943	16	1.746	40	1.684
7	1.895	17	1.740	50	1.676
8	1.860	18	1.734	60	1.671
9	1.833	19	1.729	120	1.658
10	1.812	20	1.725	∞	1.645

9.3 With force applied to the presser foot on the base (no test specimen present), zero the measuring scale or record the base reading. Lift the presser foot, center the test specimen on the base under the presser foot, and bring the presser foot into the contact with the material. Gradually increase the pressure to 0.2 kPa [0.029 psi]. After the full force has been applied to the presser foot for 5 s against the specimen, record the thickness to the nearest 0.025 mm [0.001 in.] and remove the specimen from the test device.

9.4 Repeat the method for each of the remaining specimens.

10. Calculation

10.1 Calculate the average of the thickness for all test results as read directly from the test instrument.

11. Report

11.1 Report the following information for the nominal thickness:

11.1.1 Project, type of rolled erosion control product tested, and method of sampling,

11.1.2 Name or description of thickness apparatus used for testing,

11.1.3 Dimensions of the presser foot and of the specimen to the accuracy recorded in 6.1 and 6.2,

11.1.4 Loading time interval,

11.1.5 Number of tests,

11.1.6 Average nominal thickness to the accuracy recorded in 9.3,

11.1.7 Coefficient of variation of thickness in the sample, in percent (optional), and

11.1.8 Any unusual or out-of-standard conditions or observations made during the tests.

12. Precision and Bias[3]

12.1 *Precision*—The precision of this test method is based on an interlaboratory study of Test Method D6525, conducted in 2013. Eight laboratories participated in this study. Each of the labs reported three replicate test results for two different types of mats and a double net blanket. Every "test result" reported represents the average of ten measurements taken from a sample. Practice E691 was followed for the design and analysis of the data; the details are given in ASTM Research Report No. RR:D35-1020.

12.1.1 *Repeatability (*r*)*—The difference between repetitive results obtained by the same operator in a given laboratory applying the same test method with the same apparatus under constant operating conditions on identical test material within short intervals of time would in the long run, in the normal and correct operation of the test method, exceed the following values only in one case in 20.

12.1.1.1 Repeatability can be interpreted as the maximum difference between two results, obtained under repeatability conditions, that is accepted as plausible due to random causes under normal and correct operation of the test method.

12.1.1.2 Repeatability limits are listed in Table 2.

12.1.2 *Reproducibility (*R*)*—The difference between two single and independent results obtained by different operators applying the same test method in different laboratories using different apparatus on identical test material would, in the long run, in the normal and correct operation of the test method, exceed the following values only in one case in 20.

12.1.2.1 Reproducibility can be interpreted as the maximum difference between two results, obtained under reproducibility conditions, that is accepted as plausible due to random causes under normal and correct operation of the test method.

12.1.2.2 Reproducibility limits are listed in Table 2.

12.1.3 The above terms (repeatability limit and reproducibility limit) are used as specified in Practice E177.

12.1.4 Any judgment in accordance with statements 12.1.1 and 12.1.2 will have an approximate 95 % probability of being correct. The precision statistics obtained in this ILS must not be treated as exact mathematical quantities which are applicable to all circumstances and uses. The limited number of materials tested may lead to times when differences greater than predicted by the ILS results will arise, sometimes with considerably greater or smaller frequency than the 95 % probability limit would imply.

12.2 *Bias*—At the time of the study, there was no accepted reference material suitable for determining the bias for this test method, therefore no statement on bias is being made.

12.3 The precision statement was determined through statistical examination of 72 results, from eight laboratories, on three materials.

12.3.1 To judge the equivalency of two test results, it is recommended to choose the material closest in characteristics to the test material.

[3] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:D35-1020. Contact ASTM Customer Service at service@astm.org.

TABLE 2 Thickness (mils)

Material	Average[A]	Repeatability Standard Deviation	Reproducibility Standard Deviation	Repeatability Limit	Reproducibility Limit
	$\bar{x}$	S_r	S_R	r	R
Double Net Blanket	267.06	17.86	40.40	50.00	113.13
Double Net TRM #1	370.64	52.67	82.60	147.49	231.27
Double Net TRM #2	351.92	44.49	54.24	124.57	151.86

[A] The average of the laboratories' calculated averages.