



Standard Test Method for Mass Unit Area of Nonwoven Fabrics¹

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1. Scope

1.1 This test method covers the determination of mass/unit area of all nonwoven fabrics.

1.2 The values stated in SI units or inch-pound units shall be regarded separately as the standard. The values stated in each system may not be exact equivalents; therefore, each system must be used independently of the other, 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:*²

D 123 Terminology Relating to Textiles

D 1776 Practice for Conditioning Textiles for Testing

E 177 Practice for Use of the Terms Precisions and Bias in ASTM Test Methods

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

3. Terminology

3.1 *Definitions:* For definitions of other textile terms used in this test method, refer to Terminology D 123.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *nonwoven fabric, n*—a textile structure produced by bonding or interlocking of fibers, or both, accomplished by mechanical, chemical, thermal, or solvent means or by a combination thereof.

4. Summary of Test Method

4.1 A specimen of specified area is weighed and the mass/unit area calculated.

5. Significance and Use

5.1 This test method determines the ratio of mass/unit area of any nonwoven fabric. Many properties of nonwovens, including strength, thickness, porosity, tearing strength, and others are influenced by changes in mass/unit area. For this reason, many nonwovens specifications include targets and limits for this property, which may be verified using this procedure. Also, it is a useful procedure to use in controlling production of nonwovens and verifying the property of the material being delivered to the customer.

5.2 The procedure in this test method may be used for acceptance testing of commercial shipments, but caution is advised since information about between-laboratory precision is incomplete. Comparative tests in accordance with 5.2.1 are advisable.

5.2.1 In case of a dispute arising from differences in reported test results when using the procedures in this test method for acceptance testing of commercial shipments, the purchaser and the manufacturer 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 which are from a lot of material of the type in question. The test specimen then should be randomly assigned in equal numbers to each laboratory for testing. The average results from the two laboratories should be compared using the appropriate Student's *t*-test and an acceptable probability level chosen by the two parties before testing is begun. If a bias is found, either its cause must be found and corrected or the purchaser and the manufacturer must agree to interpret future test results with consideration to the known bias.

6. Apparatus

6.1 *Balance*, having a weighing accuracy of ± 0.0002 g.

6.2 *Steel Rule*, at least 30 cm (12 in.) in length, with subdivisions of 0.5 mm (0.02 in.).

NOTE 1—The use of cutting dies of known dimensions is recommended for cutting the test specimens required in 7.3.

¹ This test method is under the jurisdiction of ASTM Committee D 13 on Textiles and is the direct responsibility of Subcommittee D13.64 on Non-Woven Fabric. Current edition approved April 10, 1998. Published September 1998.

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.

7. Sampling

7.1 *Lot Sample*—As a lot sample for acceptance testing, take at random the number of rolls, or pieces, of nonwoven fabric directed in an applicable material specification or other agreement between the purchaser and the supplies. Consider the rolls, or pieces, of nonwoven fabric to be the primary sampling units. In the absence of such an agreement, take the number of nonwoven fabric rolls specified in Table 1.

NOTE 2—An adequate specification or other agreement between the purchaser and supplier requires taking into account the variability between rolls or pieces of fabric and between specimens from a swatch from a roll or pieces of fabric to provide a sampling plan with a meaningful producer's risk, consumer's risk, acceptable quality level, and limiting quality level.

7.2 *Laboratory Sample*—For the laboratory sample, take a full width swatch of sufficient length along the selvage so that the requirements of 7.3 can be met.

7.2.1 The laboratory sample should be free from imperfections or other areas not representative of the material sampled.

7.3 *Test Specimens*—The number of test specimens shall be a minimum of five, cut such that they are representative of the entire roll width except as specified in 7.3.1, and with a combined total minimum area of 100000 mm²(160 in.²). All test specimens shall be approximately equal in area, but none shall be less than 10000 mm²(16 in.²). Determine the exact area of each specimen accurately to ± 0.5 %.

7.3.1 Cut the test specimen at least one tenth of the width of the nonwoven fabric from any selvage, unless otherwise specified.

7.3.2 If the structure of the nonwoven fabric is such that the specified test specimen size is not representative of the laboratory sample, a larger size shall be agreed upon between the purchaser and the supplier.

7.3.3 Specimens prepared for other test also may be used, provided that the minimum specimen area requirements for this test method are met and that the specimens are weighed prior to any other activity. The precise area of each specimen must be determined.

8. Conditioning

8.1 Precondition the specimens by bringing them to approximate moisture equilibrium in the standard atmosphere for preconditioning textiles as directed in Practice D 1776.

8.2 After preconditioning, bring the test specimens to moisture equilibrium for testing in the standard atmosphere for testing textiles as directed in Practice D 1776 or, if applicable, in the specified atmosphere in which the testing is to be performed.

8.3 Upon written agreement between parties involved in the testing, such as a material specification, contract or similar document, the conditioning specified in 8.1 and 8.2 may be omitted.

9. Procedure

9.1 Determine the length and width of each of the specimens to ± 0.5 mm (± 0.02 in.).

9.2 Weigh each of the conditioned specimens separately on a calibrated balance to the nearest 0.1 %.

10. Calculation

10.1 Calculate the area of each specimen using the following equation:

$$A = L \times W \quad (1)$$

where:

A = area of specimen, mm²(in.²),

L = length, mm (in.), and

W = width, mm (in.).

10.2 Calculate the mass/unit area of each of the specimens to the nearest 0.1 g/m²(oz/yd²) using the following equation:

$$M = \frac{S}{A \times C} \quad (2)$$

where:

M = mass/unit area, g/m²(g/in.²),

S = mass of the specimen, g,

C = 0.000001 (constant for converting mm² to m²), or 45.714 (constant for converting g/in.² to oz/yd²), and

A = area of specimen, mm²(in.²), obtained from the equation in 10.1

10.3 Calculate the average mass/unit area and standard deviation for each laboratory sampling unit and for the lot.

11. Report

11.1 State that the specimens were tested as directed in this test method. Describe the material or product sampled and the method of sampling used.

11.2 Report the following information:

11.2.1 The average mass/unit area for each laboratory sampling unit and for the lot.

11.2.2 The standard deviation for each laboratory sampling unit and for the lot.

11.2.3 The number of specimens tested.

11.2.4 A statement of any departures from the suggested testing procedures so that the results can be evaluated and used.

12. Precision and Bias

12.1 An interlaboratory study involving six laboratories and four different nonwoven materials using the procedure in this test method was completed in 1996. The data was analyzed using Practice E 691 and is adjunct. The results showed significantly different repeatability and reproducibility limits for the four materials tested. The terms *repeatability limit* and *reproducibility limit* have the meanings specified in Practice E 177, meaning that approximately 95 % of all pairs of test results obtained within a laboratory (repeatability) or in two different laboratories (reproducibility) can be expected to differ

TABLE 1 Number of Rolls, or Pieces, of Nonwoven Fabric in the Lot Sample

Number of Rolls, Pieces in Lot, Inclusive	Number of Rolls or Pieces in Lot Sample
1 to 3	all
4 to 24	4
25 to 50	5
over 50	10 % to a max. of 10 rolls or pieces

in absolute value by less than the limits shown in Table 2 for each of the materials tested. The respective standard deviations among test results may be obtained by dividing the above limits by 2.8.

TABLE 2 Precision Information for Determining Mass/Unit Area of Nonwovens

Method of Manufacture	Average Test Value	95 % Repeatability Limit	95 % Reproducibility Limit
Thermally bonded	19.8	2.76	2.97
Spundonded	23.5	1.24	2.77
Spunbonded/meltblown/Spunbonded	48.3	0.87	4.45
Needlepunched	169.9	14.00	14.00

12.2 *Precision*—The precision information in Table 2, expressed in units of measurement of g/m^2 , is for the comparison of two test values of average mass/unit area, each of which is the average of testing done on five test specimens, as required in relevant sections of this test method.

12.3 *Bias*—The procedure in this test method has no known bias as values for mass/unit area are defined in terms of the test method. There are no accepted reference materials for use in determining the bias, if any, of the procedure in this test method for testing nonwovens.

13. Keywords

13.1 fabric; nonwoven; mass; mass/unit area

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