



Standard Test Method for Determination of Compression Resistance and Recovery Properties of Highloft Nonwoven Fabric Using Static Force Loading¹

This standard is issued under the fixed designation D 6571; 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 compression resistance and recovery properties of any type of highloft nonwoven fabric using a simplistic and economical applied static weight loading technique.

1.2 *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.*

1.3 The values stated in SI units are to be regarded as the standard. The values stated in parentheses are for information only.

1.4 This test method offers two options for the measurement of compression resistance and recovery properties. Option 1 contains fewer steps and is, therefore, simpler. Option 2 makes more measurements and provides more details about the behavior of a fabric under these test conditions.

2. Referenced Documents

2.1 ASTM Standards:

D 123 Terminology Relating to Textiles²

D 5796 Test Method for Thickness of Highloft Nonwoven Fabrics³

2.2 ASTM Adjuncts:

D 2904 Practice for Interlaboratory Testing of a Textile Test Method that Produces Normally Distributed Data²

D 2906 Practice for Statements on Precision and Bias for Textiles²

Adjunct TEX-PAC

3. Terminology

3.1 Definitions:

3.1.1 *applied static force, n*—in testing, the application of a fixed force by action of gravity on a fixed mass.

3.1.2 *batting, n*—a textile filling material consisting of a continuous web of fibers formed by carding, garnetting, air

laying, or other means.

3.1.3 *compression force, n*—the perpendicular force applied to surface (s) of a material in compaction.

3.1.4 *compression recovery, n*—the property of a material to regain its original dimensions after release from compaction.

3.1.5 *compression resistance, n*—the property of a material to oppose its change in dimension under compaction.

3.1.6 *dead-weight loading, n*—in testing, a method of loading in which a mass is supported solely by the specimen and has no other mechanical connection to the test machine. Static loading may be considered a synonym of dead-weight loading.

3.1.7 *elastic loss, n*—the permanent loss of dimensions following a release from an applied load either in compression or extension.

3.1.8 *highloft nonwoven fabric, n*—a low-density fiber network structure characterized by a high ratio of thickness to mass per unit area.

3.2 For definitions of other textile terms, refer to Terminology D 123.

4. Summary of Test Method

4.1 A specimen (one piece of or a stack of pieces) is placed between two plates and the height of the stack measured. A weight of specified mass is placed on the top plate for a specified period of time. The height of the specimen with the mass in place is measured at specified time intervals. The mass is removed and the height of the stack is measured at specified time intervals. Compression resistance and recovery properties are calculated using the height measurements.

5. Significance and Use

5.1 The ability of a highloft nonwoven fabric to resist compression and recovery and elastic loss after compression are two basic physical properties that are measured to set specifications for certain end-use applications. This test method provides an inexpensive alternative for highloft producers, their suppliers and customers to determine compression resistance, and recovery properties thus better predicting their performance in the finished product.

5.2 Compression resistance and recovery performance requirements of highloft nonwovens will vary according to the end-use application. Furniture, bedding apparel, and industrial

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² *Annual Book of ASTM Standards*, Vol 07.01.

³ *Annual Book of ASTM Standards*, Vol 07.02.

applications do not require the same property values to satisfy their individual consumers. They will require resistance to compression and the ability to recover to some degree.

5.3 Option 1 of this test method is used in the trade for the acceptance testing of commercial shipments. Compression recovery graphs from Option 2 can be helpful in comparing performance of different highloft nonwoven fabrics.

5.3.1 In case of a dispute arising from differences in reported test results when using this test method, the purchaser and the supplier should conduct comparative tests to determine if there is a significant 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 samples that are as homogeneous as possible and that are from a lot of material of the type in question. The test samples should be randomly assigned in equal numbers to each laboratory for testing. The average results from the two laboratories should be compared using an appropriate statistical test for unpaired samples and an acceptance 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 the supplier must agree to interpret future test results with consideration of the known bias.

NOTE 1—An adequate specification or the agreement between the purchaser and the supplier requires taking into account the variability between rolls and within rolls to provide a meaningful producer's risk, consumer's risk, acceptance quality level, and limiting quality level.

6. Apparatus

6.1 *Steel Rule*, graduated in at least 1-mm (0.05-in.) increments at least 150 mm (6 in.) long or suitable length to measure specimens' heights for the material of interest.

6.2 *Timer*, such as a clock, capable of indicating the total time interval of the test method (see 8.2) and graduated in hours and minutes.

6.3 Plates:

6.3.1 *Base or Bottom Plate*, 230 by 230 by 6.35-mm (9 by 9 by ¼-in.) plywood plate covered with aluminum foil, or a piece of aluminum sheet.

6.3.2 *Cover or Top Plate*, 230 by 230 by 6.35-mm (9 by 9 by ¼-in.) plywood plate covered with aluminum foil weighing 187 ± 2 g (0.41 ± 0.005 lb).

6.4 *Weight*, pieces of metal, liquid-filled containers, or other appropriate substitute of a specific mass to equal 7.26 kg (16 lb) used to compress highloft battings.

7. Sampling and Test Specimens

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

7.2 *Laboratory Sample*—For the laboratory sample, take a swatch extending the width of the fabric and approximately 1 m (1 yd) along the machine direction from each roll, or piece, in the lot sample. If the thickness of the sample is such that this

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

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

length is not adequate to supply enough fabric for the testing, use a swatch that is twice this length. For rolls of fabric, take a sample that will exclude the outer wrap of the roll or the inner wrap around the core.

7.3 *Test Specimens*—Specimens should be taken randomly from areas of the laboratory sample that are free of folds and wrinkles and any distortions that make these specimens abnormal from the rest of the test material. Unless otherwise specified, take specimens randomly no nearer to the edges of the sample than one tenth of the width of the sample. Test one specimen from each sampling unit, or test three specimens representing the right, the center, and the left of each sampling unit, if the width exceeds 1 m.

7.3.1 A specimen consists of sufficient 200 by 200-mm (8 by 8-in.) pieces of highloft nonwoven fabric which, when stacked, measures at least 100 mm (4 in.) in height, or one piece of finished product that measures at least 100 mm in height.

NOTE 2—For highloft nonwoven fabrics, typically, four to six pieces are stacked to make a specimen.

7.3.2 *Cutting Test Specimens*—If making one test per unit, cut the pieces for each specimen at random across and along each laboratory sampling unit, preferably along the diagonal. If testing right, center, and left areas, cut the pieces needed for each specimen from the appropriate section of each laboratory sampling unit.

8. Conditioning

8.1 No preconditioning is needed.

8.2 Control the temperature for conditioning and testing between 20 and 24°C (68 and 75°F). No control of relative humidity is required.

9. Procedure

9.1 Height Measurements:

9.1.1 For each height determination, make four measurements of distance from the top of the base plate to the bottom of the cover plate, with a measurement at the midpoint of each side of the cover plate. Make the four measurements in rapid succession and read to the nearest mm (0.05 in.).

9.2 Option 1: Acceptance Testing:

9.2.1 Place a specimen (one piece or stack of pieces as needed) on the base plate and add the cover plate. Measure the specimen height. Record the values, average the values in calculations in all sections, as the initial height, *A*. Once the cover plate is put on the specimen, do not remove the cover plate until the test is completed.

9.2.2 Immediately after measuring the initial height, place the mass (6.4) centrally and uniformly and start the timer. After