



Standard Test Method for Composition of Plumage¹

This standard is issued under the fixed designation D 4524; 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 quantitative determination of the components found in plumage. The test method is applicable for plumage found in bulk form or in finished consumer products.

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.*

2. Referenced Documents

2.1 ASTM Standards:

- D 123 Terminology Relating to Textiles²
- D 1776 Practice for Conditioning Textiles for Testing²
- D 2905 Practice for Statements on Number of Specimens for Textiles²
- D 2906 Practice for Statements on Precision and Bias for Textiles²
- D 4523 Terminology Relating to Feather-Filled and Down-Filled Products³

2.2 Other Documents:

- Fed Std. No. 148a–1964 Method 2: Determination of Composition Feather Filling Materials⁴
- ABFLO: Quantitative Determination of Feather and Down in Plumage⁵
- FTC Guides for the Feather and Down Products Industry, 1971⁶

3. Terminology

3.1 Definitions:

3.1.1 *plumage, n*—the outgrowth of fowl, consisting of feathers and down (waterfowl) or feathers only (nonwaterfowl).

3.2 For the definitions of terms used in this standard, refer to

Terminology D 123 and Terminology D 4523.

4. Summary of Test Method

4.1 A representative sample of plumage is selected from the product being tested. The contents of the sample are identified and separated into component parts. Those component parts are measured and reported as a percentage of the whole.

5. Significance and Use

5.1 This test method may be used for acceptance testing of commercial shipments of bulk plumage. Acceptance tolerances of content must be established between the purchaser and seller of bulk shipments of plumage, which also must comply with state and federal agency regulations, as appropriate.

5.1.1 In case of a dispute arising from differences in reported test results when using Test Method D 4524 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 from a lot of material of the type in question. The test specimens should then 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 a bias is found, either its cause must be found and corrected or the purchaser and the supplier must agree to interpret test results in the light of the known bias.

5.2 This test method may also be applicable to the acceptance of consumer products that use plumage as a filling material. Such consumer products include pillows, comforters, sleeping bags, garments, furniture, and mattresses. Acceptance tolerances of content are established by distributors, importers, state or federal regulatory agencies. See 5.1.1.

6. Apparatus

6.1 *Separating Cabinet*—A box or cabinet for separating and identifying the components of plumage. The box should have the following approximate dimensions:

- Base—450 by 300 mm (18 by 12 in.) wide
- Front—150 mm (6 in.) high
- Back—300 mm (12 in.) high

¹ This test method is under the jurisdiction of ASTM Committee D13 on Textiles and is the direct responsibility of Subcommittee D 13.61 on Apparel.

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

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

⁴ Available from the General Services Administration Business Service Center, Washington, DC 20407.

⁵ Available from Association of Bedding and Law Officials, Texas Dept. of Health, 1100 W. 49th St., Austin, TX 78756.

⁶ Available from the Federal Trade Commission, 6th St. and Pennsylvania Ave. N.W., Washington, DC 20580.

The top of the box will be glass to permit the separation to be observed visually. The front of the box will have an open section that will permit the operator's hands to enter the cabinet. Sufficient freedom of movement must be allowed so that the components can be examined and segregated. The cabinet should be equipped with a light to provide sufficient illumination of its interior. The interior cabinet color must be of dark color to provide contrast with the plumage. See Fig. 1.

6.2 *Weighing Containers*—Ten tared weighing bottles or beakers to segregate the components and contain them during weighing.

6.3 *Forceps*, suitable for picking up components of the plumage.

6.4 *Balance*, having a capability adequate for weighing specimens and containers with a sensitivity of 0.0001 g.

6.5 *Mixing Containers*—One large box or container approximately 500 by 500 by 500 mm that is used to hold the sample plumage to be analyzed. Another smaller mixing container approximately 300 by 300 by 150 mm. The interior of the mixing boxes shall be smooth to avoid plumage entrapment.

7. Sampling

7.1 *Lot Sample*—As a lot sample for acceptance testing, select at random the number of bales, bags, or other shipping containers as directed in an applicable material specification or other agreement between the purchaser and the supplier. In the

absence of such an agreement, randomly select 30 % of the shipping containers. From each of the shipping containers selected, remove a sample sufficient in mass to obtain a total lot sample of 300 g. Consider the shipping containers to be the primary sampling units.

NOTE 1—An adequate specification or other agreement between the purchaser and the supplier requires taking into account the variability between and within shipping containers 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*—As a laboratory sample for acceptance testing, randomly take portions of plumage from each lot sample submitted weighing at least 10 g each from the upper, middle, and lower portion of the sample submitted, drawing each sample from the middle of the submitted sample. Combine the three portions from the lot sample into a composite sample and use it as a test specimen for that sample submitted.

8. Procedure

8.1 *Specimen Reduction:*

8.1.1 Place the sample plumage in the larger mixing container and mix well by turning the plumage with the hands. Do not stir the sample with a stick.

8.1.2 Draw the specimen to be analyzed from three sections of the mixing container (top, middle, and bottom) to weigh approximately 4 g.

8.2 *Preliminary Separation:*

8.2.1 Place the test specimen in the separating cabinet and begin the separation into plumage components.

8.2.2 With the forceps, remove all feathers from the plumage. Brush the feathers between the thumb and index fingers of one hand to remove any down, fiber, or residue caught therein.

8.2.3 Separate the feathers into whole waterfowl feathers (Container A), damaged waterfowl feathers (Container C), and landfowl feathers (Container B) and place each into an individual tared weighing container.

8.2.4 Place the down cluster, plumules, down fiber, and feather fiber that are all combined in the fourth tared weighing container (Container E).

8.2.5 Place the quill feathers in a fifth tared weighing container (Container Q).

8.2.6 Place the residue in a sixth weighing container (Container D).

8.2.7 Weigh the contents of the six containers to the nearest 0.0001 g.

8.3 *Down and Fiber Separation:*

8.3.1 Place the contents of the container in 8.2.4 in the smaller mixing container. Mix the contents by turning with the hands.

8.3.2 Draw a sub-specimen to be analyzed that weighs a minimum of 0.200 g. Draw the plumage to be separated from three sections of the mixing container.

8.3.3 Place the 0.200-g sub-specimen in the separating cabinet. Separate the components as follows:

8.3.3.1 With forceps remove a down cluster or plumule and shake five times from an up position to a down position and up again. Slightly flick the cluster as you go down and up again.

8.3.3.2 Carefully remove the entwined feather fiber from the cluster or plumule with the forceps.

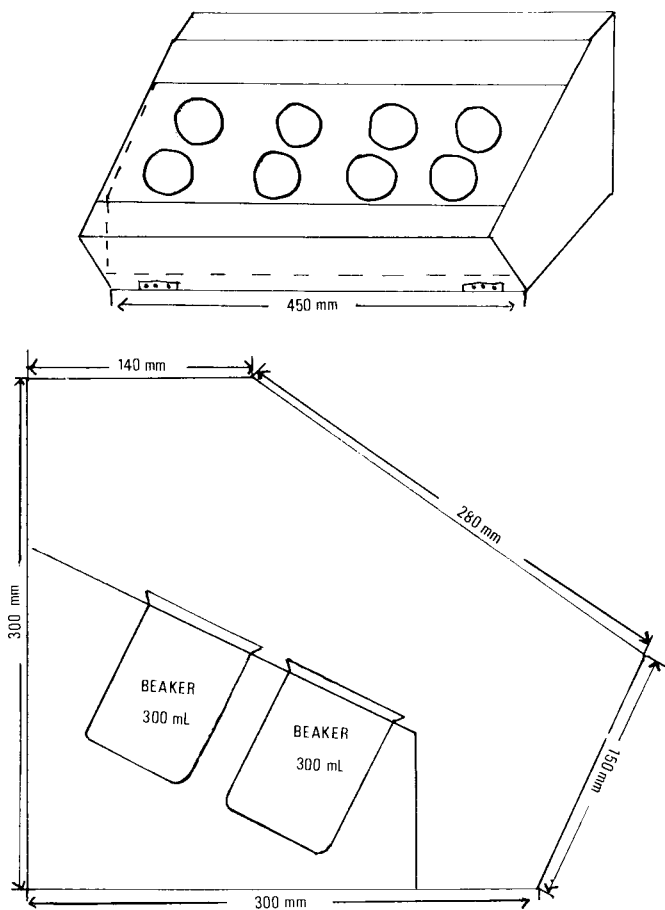


FIG. 1 Down and Feather Separating Cabinet

8.3.3.3 Place the cluster or plumule into a weighing container (Container F). Place the feather fiber into a second container (Container H). Pick up the down fiber with the forceps and place into a third weighing container (Container G).

8.3.3.4 Do not remove entwined down fiber from the clusters. Only remove the down fiber that shakes loose.

8.3.3.5 If landfowl feather, fiber is present, place it in a fourth container (Container J).

8.3.3.6 If residue is found in this portion of the separation, place it in a fifth container (Container K).

8.3.3.7 Weigh the contents of the five containers to the nearest 0.0001 g.

9. Calculations

9.1 Preliminary Separation:

9.1.1 Obtain total contents analyzed by adding together the weight of the waterfowl feathers, landfowl feathers, fiber, damaged feathers, quill feathers, residue, and down and fiber components using Eq 1, as follows:

$$T_1 = A + B + C + D + E + Q \quad (1)$$

where:

- T_1 = contents analyzed, g,
- A = waterfowl feathers, g,
- B = landfowl feathers, fiber, g,
- C = damaged feathers, g,
- Q = quill feathers, g,
- D = residue, g, and
- E = down and fiber, g.

9.1.2 Obtain the total percentage for each component of the preliminary separation using the following equations as examples (Eq 2 or Eq 3):

$$PA = 100 (A/T_1) \quad (2)$$

where:

PA = waterfowl feathers, %.

$$PE = 100 (E/T_1) \quad (3)$$

where:

PE = down and fiber, %.

9.2 Down and Fiber Separation:

9.2.1 Obtain total contents analyzed by adding together the weight of the down cluster and plumules, down fiber, feather fiber, landfowl feather, fiber, and residue using Eq 4.

$$T_2 = F + G + H + J + K \quad (4)$$

where:

- T_2 = contents analyzed in the down and fiber separation, g,
- F = down clusters and plumules, g,
- G = down fiber, g,
- H = feather fiber, g,
- J = landfowl feather, fiber, g, and
- K = residue, g.

9.2.2 Obtain the total percentage for each component (F, G, H, J, K) of the down and fiber separation using the following equations as examples (Eq 5-7):

$$PF = PE \times (F/T_2) \quad (5)$$

where:

PF = down cluster and plumules, %.

$$PJ = PE \times (J/T_2) \quad (6)$$

where:

PJ = landfowl feather, fiber, %.

$$PK = PE \times (K/T_2) \quad (7)$$

where:

PK = residue in down and fiber separation, %.

Add PJ to PB to obtain total landfowl in separation.

Add PK to PD to obtain total residue in separation.

10. Report

10.1 Report that the specimens were tested as directed in Test Method D 4524. Describe the product sampled and the method of sampling.

10.2 Report the percent of each component and list individually.

11. Retest

11.1 If the test specimen from a laboratory sample fails to meet a specified minimum acceptance level, take two additional lot samples as directed in 7.1 and test them. If the average for all three test specimens meet the requirements, the lot sample may be considered as acceptable.

12. Precision and Bias

12.1 *Precision*—The precision of the procedures in Test Method D 4524 is being established.

12.2 *Bias*—The procedures in Test Method D 4524 have no known bias.

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