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DEPARTMENT OF COMMERCE

BUREAU OF STANDARDS

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UNITED STATES GOVERNMENT GENERAL SPECIFICATION FOR TEXTILE MATERIALS (METHODS OF PHYSICAL AND CHEMICAL TESTS)

FEDERAL SPECIFICATIONS BOARD SPECIFICATION No. 345

This specification was officially promulgated by the Federal Specifications Board on October 28, 1925, for the use of the Departments and Independent Establishments of the Government in the purchase of textile materials.

[The latest date on which the technical requirements of this specification shall become mandatory for all Departments and Independent Establishments of the Government is January 28, 1926. They may be put into effect, however, at any earlier date after promulgation]

CONTENTS

I. GENERAL STATEMENT

These methods were prepared for use in making determinations on the requirements specified in textile specifications promulgated by the Federal Specifications Board, so that variations introduced by different test methods may be eliminated. They are not intended

66163°—25†

to include all the textile-test methods in use in the textile industry. Additions and revisions will be made as the necessity arises.

II. ATMOSPHERIC CONDITIONS

Physical tests may be made under prevailing atmospheric conditions except in the settlement of disputes where moisture is an influencing factor in tests for breaking strength, thread count, weight, width, length, etc. Such tests shall then be made upon material having normal moisture content, obtained by exposure for at least four hours to an atmospheric condition of 65 per cent relative humidity at 70° F.

The effect of humidity is a decided variable in these tests, depending on the construction, finishing, sizing, etc. In general, a high relative humidity will increase all weight results, and in breaking-strength results will show an increase for vegetable fibers and a decrease for animal fibers. The manufacturer should note the humidity on a sling psychrometer at the time tests are made to establish whether his material conforms to these specifications and take into consideration the above facts.

III. FIBER IDENTIFICATION AND QUANTITATIVE DETERMINATIONS

1. Cotton.—In specifications calling for cotton fibers no further test is needed than the visual examination of the fibers as pulled from the specimen.

2. Wool.—In specifications calling for all-wool fibers chemical tests shall be made to dissolve all of the wool fibers, leaving the impurities and vegetable fibers as indications of any variations from the all-wool requirements. Place the specimen of about 5 g in a beaker or vessel containing at least 100 times its weight of 5 per cent solution of sodium or potassium hydroxide and boil slowly until the wool fibers become gelatinous and dissolve. If, after 10 minutes of boiling, there appear to be present any loose fibers or yarns when stirring with a glass rod, the contents shall be filtered through a fine-mesh wire cloth and the residue washed with warm water. Allow the residue to dry in air, then examine it for its nature and amount. The presence of fibers and of foreign matter in excess of 1 per cent in weight shall be cause for rejection.

3. Wool and Cotton Mixtures.—In specifications calling for wool and cotton mixtures chemical tests shall be made according to the following classification:

(*a*) With a cotton warp and with no limit as to the proportion of cotton allowed, based on the weight of the material as a whole, the

filling shall be separated from the material until a weight of about 5 g is obtained. The test shall be given as for wool (III, 2).

(*b*) With a cotton warp and with a limit as to the proportion of cotton allowed, a specimen of about 5 g shall be weighed and placed in a beaker or vessel containing at least 100 times its weight of 5 per cent solution of sodium potassium hydroxide and boiled slowly until the wool fibers become gelatinous and dissolve. After a period of 10 minutes of boiling filter residue through a fine-mesh wire cloth and wash residue with warm water, then dry in air and weigh. The per cent of cotton present shall be calculated by adding 5 per cent of the residue dry weight, as expressed:

$$\frac{\text{Residue weight}}{95} \times 100 = \text{weight of cotton}$$

$$\frac{\text{Weight of cotton}}{\text{Original weight of specimen}} \times 100 = \text{per cent of cotton.}$$

(*c*) With no mention of where the cotton is to be found and with a limit as to the proportion of cotton allowed, the test shall be carried out as in (*b*).

4. Umpire Method for Wool and for Wool and Cotton Mixtures.—In the event of a dispute, the following procedure shall be used: All weighings shall be made after the specimen has been conditioned at 65 per cent relative humidity and 70° F. Weighings shall be made to the nearest milligram or equivalent accuracy. Boil at least a 5 g specimen in at least 100 times its weight of a 5 per cent solution of sodium or potassium hydroxide contained in an assay flask fitted with a reflux condenser for a period of one hour. Filter the residue on a fine-mesh wire cloth, wash first with warm water, then with a solution of 3 per cent acetic acid, and finally with hot water.

The per cent of cotton present shall be calculated by adding 5 per cent to the residue dry weight, as expressed:

$$\frac{\text{Residue weight}}{95} \times 100 = \text{weight of cotton}$$

$$\frac{\text{Weight of cotton}}{\text{Original weight of specimen}} \times 100 = \text{per cent of cotton.}$$

IV. BREAKING STRENGTH, GRAB METHOD (1 by 1 by 3 inches)

Six test specimens 6 inches long by 4 inches wide shall be cut, three in the direction of the warp and three in the direction of the filling, respectively, as shown in Figure 1. Care shall be taken that no two test specimens include the same threads, except for retest as specified

below. No specimen for testing should be taken at less than 8 inches from either selvage.

The machine used shall be of the inclination balance type, as shown in Figure 2. The maximum capacity of the machine shall be such that no break shall occur beyond the limits as shown in Figure 3. The lower or pulling jaw shall travel at a uniform rate of 12 inches per minute under no load. The distance between jaws shall be 3 inches per minute at start of test. (See fig. 4.) The inside or back half of each jaw shall be 2 inches or more in width; the other half shall be 1 inch in width. Jaws shall have a smooth and flat surface with edges slightly rounded to prevent cutting. The results of the test of each direction shall be averaged. If a specimen slips in the jaw, breaks in the jaw, breaks at the edge of the jaw, or for any reason due to faulty operation, the result falls markedly below the general average, the result shall be disregarded, another specimen taken from the same threads, and the result of this break included in the average.

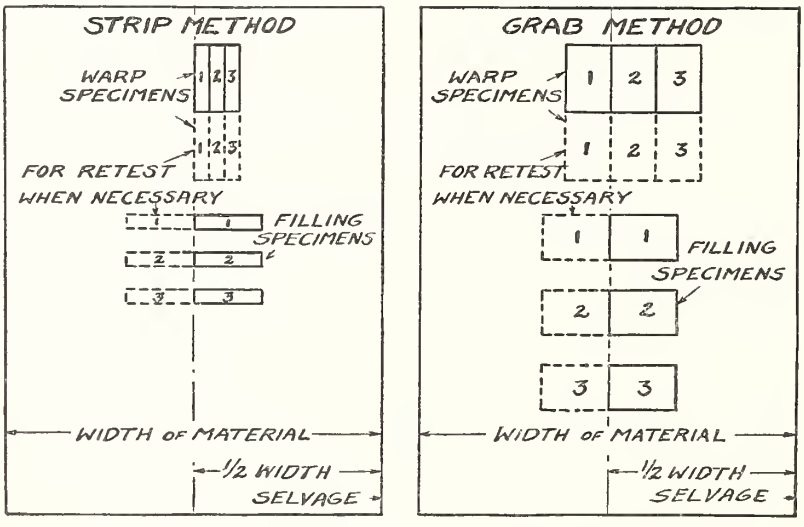

FIG. 1.—*Layout of sample to obtain specimens for breaking strength*

V. BREAKING STRENGTH, STRIP METHOD

Six test specimens approximately "*a*" inches (see Table 1) long by "*c*" inches (see Table 2) wide shall be cut, three in the direction

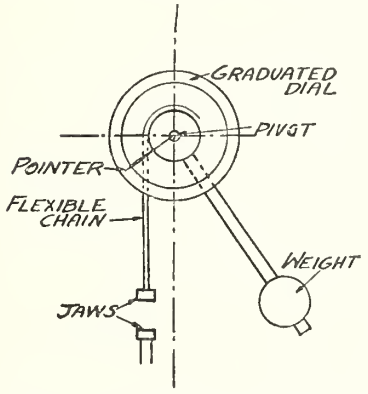

FIG. 2.—*Essential features of the inclination balance type of breaking-strength machine*

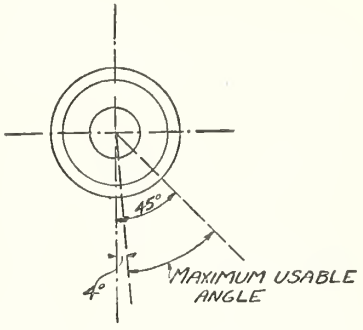

FIG. 3.—*The limits of capacity which may be used in testing in accordance with these methods. Minimum angle, 4°; maximum angle, 45°*

of the warp and three in the direction of the filling, respectively, as shown in Figure 1.

TABLE 1.—*Length of test specimen and distance between jaws for different kinds of materials (strip method)*

Material	Length of test specimen "*a*"	Distance between jaws "*b*"
	Inches	*Inches*
Cotton	6	3
Spun silk	6	3
Wool	9	6
Linen	9	6
Silk	9	6
Jute	9	6
Ramie	9	6

TABLE 2.—*Width of specimen before raveling (strip method)*

Threads per inch	Width "*c*"
	Inches
Over 80	1⅛
50 to 80	1¼
Under 50	1½

Each specimen shall be raveled to exactly 1 inch by taking from each side approximately the same number of threads. (See fig. 5.) Care shall be taken that no two test specimens include the same threads, except for retest, as specified below. No specimen for testing should be taken at less than 8 inches from either selvage.

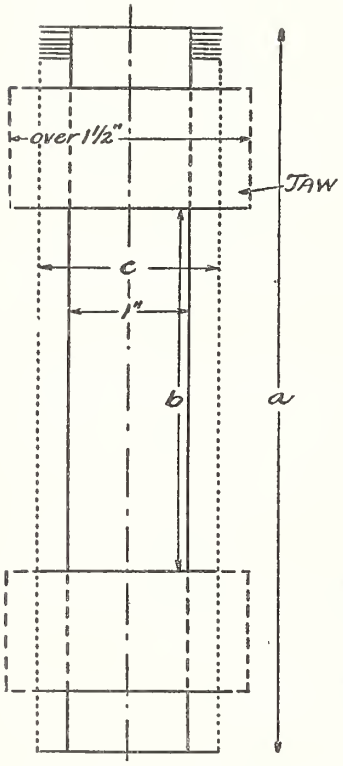

FIG. 4.—*The test specimen for strip method for determining breaking strength, showing dimensions and positions occupied by the jaws when in place. For dimensions a, b, and c, see Tables 1 and 2*

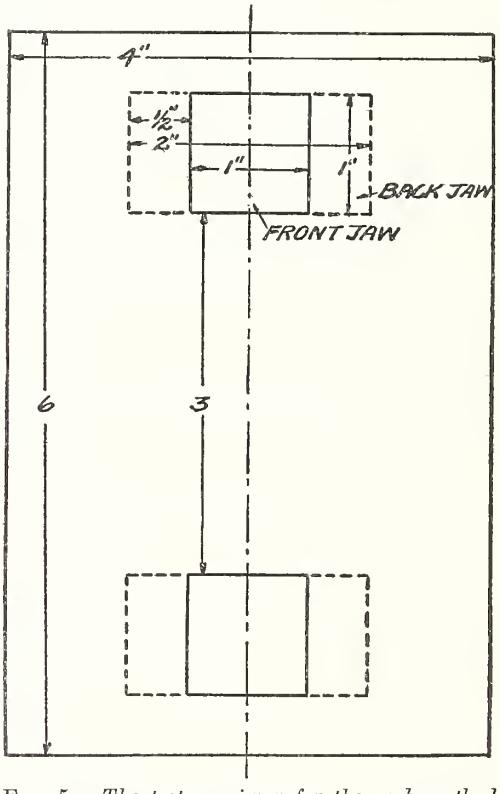

FIG. 5.—*The test specimen for the grab method for determining breaking strength, showing dimensions and positions occupied by the jaws when in place*

The machine used shall be of the inclination balance type, as shown in Figure 2. The maximum capacity of the machine shall be such that no break shall occur beyond the limits, as shown in Figure 3. The lower or pulling jaw shall travel at a uniform rate of 12 inches per minute under no load. The distance between jaws shall be "*b*" inches (see Table 1) at the start of test. The width of the jaws shall be 1½ inches or more. Jaws shall have a smooth and flat surface with edges slightly rounded to prevent cutting. The results of the tests in each direction shall be averaged. If a specimen slips in the

jaw, breaks in the jaw, breaks at the edge of the jaw, or for any reason due to faulty operation the result falls markedly below the general average, the result shall be disregarded, another specimen taken from the same threads, and the result of this break included in the average.

VI. WEIGHT PER SQUARE YARD

The weight per square yard may be determined by any one of the following three methods. In case of dispute, method No. 1 shall be used as an umpire method.

Method No. 1.—Take 1 yard of the sample. Weigh, and if the width is not 1 yard calculate the weight per square yard.

$$\frac{\text{Weight of linear yard}}{\text{Width}} \times 36 = \text{weight per square yard.}$$

Average, 2 tests.

Method No. 2.—Take a measured portion of the material and weigh. Calculate from this area the weight per square yard.

$$\frac{1{,}296 \times \text{weight of known area}}{\text{Area in inches}} = \text{weight per square yard.}$$

Average, 3 tests.

Method No. 3.—Cut from the sample a specimen 2 by 2 inches, using a steel die. No specimen for testing shall be taken less than 8 inches from either selvage. Weigh on a balance adjusted to read the weight of the material in ounces per square yard.

Average, 3 to 5 tests.

VII. WEIGHT PER LINEAR YARD

The weight per linear yard shall be computed from the weight per square yard, as follows:

$$\frac{\text{Weight per square yard} \times \text{width}}{36} = \text{weight per linear yard.}$$

VIII. THREAD COUNT

The actual number of threads in 1 inch of width shall be counted in each direction at three different places in the cloth and the results averaged for each direction. Where the thread count is under 25, the actual number of threads in 3 inches shall be counted for each direction at three different places in the cloth and the results reduced to threads per inch and averaged for each direction. When the size of the sample permits, these counts shall be taken about 6 inches apart. No warp reading should be taken at less than 8 inches from the selvage.

IX. WIDTH

The width shall be determined by laying the material on a flat surface without tension, then measuring the distance perpendicular to the length from edge to edge to an accuracy of one-sixteenth inch. Three measurements shall be taken at different places in the sample and the results averaged.

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