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Standard Test Methods for
Mass Per Unit Area (Weight) of Fabric[1]

This standard is issued under the fixed designation D 3776; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 These test methods cover the measurement of fabric mass per unit area (weight) and is applicable to most fabrics.

1.2 There are four approved options:

1.2.1 *Option A*—Full Piece, Roll, Bolt or Cut (Section 7).

1.2.2 *Option B*—Full Width Sample (Section 8).

1.2.3 *Option C*—Small Swatch of Fabric (Section 9).

1.2.4 *Option D*—Narrow Fabrics (Section 10).

1.3 The values either in SI units or U.S. customary units are regarded as standard. U.S. customary units may be approximate.

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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D 123 Terminology Relating to Textiles

D 1776 Practice for Conditioning and Testing Textiles

D 3773 Test Methods for Length of Woven Fabric

D 3774 ~~Test Method for Width of Textile Fabric~~

~~D4850~~ ~~Terminology Relating to Fabrics and Fabric Test Methods~~ Test Method for Width of Textile Fabric

2.2 *Other Standard:*

ANSI/ASQC Z1.4 Inspection by Attributes[3]

3. Terminology

~~3.1For all terminology relating to D13.60, Fabric Test Methods, Specific refer to Terminology D4850.~~

~~3.1.1The following terms are relevant to this standard: weight, as used with fabric~~

~~3.2For definitions of other textile terms used in this test method, refer to Terminology D123~~

3.1 *Definitions:*

3.1.1 *weight, n—as used with fabrics*, mass per unit area.

3.1.1.1 *Discussion*—Fabric mass per unit area is expressed either as grams per square metre (ounces per square yard), or grams per linear metre (ounces per linear yard). Fabric mass is also sometimes expressed inversely as linear metres per kilograms (yards per pound) with the fabric width stated.

3.2 For definitions of other textile terms used in these test methods, refer to Terminology D 123.

4. Summary of Test Methods

4.1 Fabric mass is calculated from the mass of a specimen the length and width of which have been measured as directed in one of the procedures in Test Method D 3773 and D 3774 ~~and D3774~~.

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5. Apparatus

5.1 *Scale*, with a capacity and sensitivity sufficient to weigh the full piece, roll, bolt, or cut units to within ±0.1 % of their gross mass. The accuracy of the scale should be certified by a recognized authority.

5.2 *Balance*, having a capacity and sensitivity to weigh within ±0.1 % of the mass of the specimens being tested.

5.3 *Cutting Die*, either square or round with an area of at least 13 cm^2 or 4 in.^{2}

6. Conditioning

6.1 Condition test specimens as directed in Practice D 1776.

6.2 All weighing tests should be made in the standard atmosphere for testing textiles (20 ± 1°C (70 ± 2°F), 65 ± 2 % RH), after the specimens have been conditioned in the same atmosphere. It may be impractical to condition the specimens in Option A or nonconditioned testing may be agreed upon by the purchaser and supplier. When the full rolls or bolts of fabric cannot be properly conditioned in a reasonable time with available facilities, perform the tests without conditioning and report the actual conditions prevailing at the time of the test. Such results may not correspond with the results obtained after testing adequately conditioned specimens in the standard atmosphere for testing textiles.

7. Option A—Full Piece, Roll, Bolt, or Cut

7.1 *Significance and Use*

7.1.1 Option A for the determination of mass per unit area of woven fabrics may be used for acceptance testing of commercial shipments since it has been used extensively in the trade.

7.1.2 In case of a dispute arising from differences in reported test values when using Test Methods D 3776 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 which are as homogeneous as possible and which 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 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 in the light of the known bias.

7.2 *Sampling*—As a lot sample for acceptance testing, take at random the number of rolls of fabric as directed in an applicable material specification or other agreement between the purchaser and the supplier. Consider rolls of fabric to be the primary sampling units. Consider the rolls of fabric in the lot sample as the laboratory sample and as the test specimens.

7.3 *Procedure*:

7.3.1 Measure the length of the full piece, roll, bolt, or cut by the hand procedure in Test Method D 3773.

7.3.2 Measure the width by the tension-free alternative of Option A of Test Method D 3774.

7.3.3 Weigh the fabric, with shell and holder, if any, to the nearest 0.1 % of its mass.

7.3.4 Weigh the holder, if any, to the nearest 0.1 % of its mass.

7.4 *Calculations*:

7.4.1 Determine the net weight of the fabric by subtracting the weight of the holder from the total weight.

7.4.2 Dimensions and mass may all be determined in SI units and mass per unit area calculated using Eq 1, Eq 2, or Eq 3, as follows:

$$g/m^2 = 10^3 M/LW \tag{1}$$

$$g/m = 10^3 M/L \tag{2}$$

$$m/kg = L/M \tag{3}$$

where:
M = mass of fabric, in kilograms,
L = length of fabric, in metres, and
W = width of fabric, in metres.

7.4.3 Calculate the mass per unit area, mass per linear yard, or linear yards per pound to three significant figures, unless otherwise specified, using Eq 4, Eq 5, Eq 6, or Eq 6,as7, as follows:

Mass per unit area:

$$oz/yd^2 = 576M/LW \tag{4}$$

Mass per yard:

$$oz/yd = 16M/L \tag{5}$$

Linear yards per pound:

$$yd/lb = L/M \tag{6}$$

$$yd/lb = L/M \qquad (7)$$
$$= 16 \ oz/yd$$

where:

M = mass of fabric, in pounds,
L = length of fabric, in yards, and
W = width of fabric, in inches.

7.4.4 If preferred, convert the U.S. customary units to SI units using Eq 7,8, Eq 8,9, or Eq 9,10, as follows:

$$\text{Mass, } g/m^2 = oz/yd^2 \times 33.906 \qquad (8)$$
$$\text{Mass, } g/m = oz/yd \times 31.000 \qquad (9)$$
$$m/kg = yd/lb \times 2.016 \qquad (10)$$

8. Option B—Full Width Sample

8.1 *Significance and Use*:

8.1.1 This procedure is applicable to a full-width sample cut from a full piece, roll, bolt, or cut. Unless otherwise specified, these results will include selvages and will be on the basis of conditioned fabric.

8.1.2 Option B is not recommended for the acceptance testing of commercial shipments, since Option A is regularly used for that purpose.

8.2 *Sampling*:

8.2.1 *Lot Sample*—As a lot sample for acceptance testing, take at random the number of rolls of fabric as directed in an applicable material specification or other agreement between the purchaser and the supplier. Consider the roll of fabric to be the primary sampling units.

8.2.2 *Laboratory Sample*—From each roll or piece in the lot sample, cut—don't tear—at least one laboratory sample the full width of the fabric and at least 250 mm (10 in.) in length. The cut edges must be a straight line, free of indentations or bulges, unless both edges have been made to trace parallel filling yarns. In this procedure the complete laboratory sample is used as the specimen.

8.3 *Procedure*:

8.3.1 Measure the length of the conditioned specimen by the hand procedure of Test Method D 3773.

8.3.2 Measure the width by the tension-free alternative of Option A of Test Method D 3774.

8.3.3 Weigh the specimen in grams on a scale or balance to the nearest 0.1 % of its mass (weight).

8.4 *Calculations*:

8.4.1 Calculate the mass per unit area, mass per linear yard, or linear yards per pound to three significant figures, unless otherwise specified, using Eq 10,11, Eq 11,12, Eq 12,13, or Eq 13,14, as follows:

Mass per unit area:

$$oz/yd^2 = 45.72 G/L_s W_s \qquad (11)$$

W *Mass per linear yard: oz/yd*

$$oz/yd = 1.27 G/L_s \qquad (12)$$

Linear yards per pound: yd/lb = 16/oz per linear yd

$$yd/lb = 16/oz \text{ per linear yd} \qquad (13)$$
$$yd/lb = 12.6 L_s/G \qquad (14)$$

$\underline{W}$

where:

G = mass of specimen, in grams,
L_s = length of specimen, in inches, and
$W_s \underline{W}$ = width of specimen, in inches.

8.4.2 If preferred, convert the U.S. customary units to SI units using Eq 4, Eq 5, or Eq 6 in 7.4.3.

8.4.3 Alternatively, dimensions and mass may all be determined in SI units and calculated using Eq 14,15, Eq 15,16, or Eq 16,17, as follows:

Mass per unit area:

$$g/m^2 = 10^6 G/L_s W_s \qquad (15)$$

$\underline{W}$
Mass per linear metre:

$$g/m = 10^3 G/L_s \qquad (16)$$

Linear metres per kilogram:

$$m/kg = L_s/G \qquad (17)$$