INTERNATIONAL STANDARD 3801

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Textiles — Woven fabrics — Determination of mass per unit length and mass per unit area

Textiles — Tissus — Détermination de la masse par unité de longueur et de la masse par unité de surface

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 3801 was developed by Technical Committee ISO/TC 38, *Textiles*, and was circulated to the member bodies in September 1976.

It has been approved by the member bodies of the following countries :

Australia	Germany	Norway
Belgium	Hungary	Poland
Bulgaria	India	Romania
Canada	Iran	South Africa, Rep. of
Chile	Ireland	Spain
Czechoslovakia	Italy	Sweden
Denmark	Korea, Rep. of	Switzerland
Egypt, Arab Rep. of	Mexico	United Kingdom
Finland	Netherlands	U.S.S.R.
France	New Zealand	Yugoslavia

No member body expressed disapproval of the document.

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Textiles — Woven fabrics — Determination of mass per unit length and mass per unit area

0 INTRODUCTION

The mass per unit length and per unit area of a fabric may be determined in more than one way. For some fabrics, mass per unit length and mass per unit area are related simply by the width of the fabric, but for other fabrics variations in structure (whether in the selvedges or in the body of the fabric) may introduce an important distinction between mass per unit length and mass per unit area. It is important, therefore, to consider all the possible methods and to choose one appropriate to the fabric, and particular attention is drawn to the fact that the size of specimens used in method 5 may not be sufficient when fabrics with large patterns are being tested. In these instances, this method would not be suitable in cases of dispute. A choice must also be made between test methods suitable for samples or specimens of cloth (i.e. short lengths or cuttings) and those suitable for application to fabric in bulk, i.e. in the piece (the normal unit of production). If a cutting has been taken as a representative sample of a batch of pieces, it may be advisable to use the results of the tests on the sample to correct measurements and masses of the unconditioned pieces. Circumstances may well call for the use of any of these methods of determining fabric mass; none of them is so much more accurate than the others as to justify its being set up as the sole standard method. Specific circumstances should, therefore, govern choices between mass per unit length and mass per unit area and between a method applicable to samples and a method applicable to pieces.

1 SCOPE AND FIELD OF APPLICATION

1.1 This International Standard specifies methods for the determination of

a) the mass per unit length, and

b) the mass per unit area

of woven fabrics that have been conditioned in the standard atmosphere for testing.

1.2 The methods are applicable to woven fabrics (including those of the "stretch" type) made up full width or folded down the middle, and apply to the determination of the fabric mass of complete pieces as well as of sample lengths.

2 REFERENCES

ISO 139, *Textiles — Standard atmospheres for conditioning and testing.*

ISO 3932, *Textiles — Woven fabrics — Determination of length.*

ISO 3933, *Textiles — Woven fabrics — Determination of width.*

3 PRINCIPLE

3.1 Methods 1 and 3

When the piece or the sample length can be conditioned in the standard atmosphere for testing, the length and the mass of the fabric are determined and the mass per unit length calculated, or the length, width, and mass of the fabric are determined and the mass per unit area calculated, as relevant.

3.2 Methods 2 and 4

When it is impracticable to condition the whole piece in the standard atmosphere for testing, the length (and width) and the mass of the piece are determined after relaxation in the prevailing atmosphere, and the mass per unit length (mass per unit area) is calculated and corrected by application of a correction factor, determined by comparison of the length (and width) and the mass of a specific portion cut from the piece after relaxation, and measured firstly in the ambient atmosphere and then in the standard atmosphere for testing.

3.3 Method 5

When it is required to test a small sample, the mass per unit area is determined by exposing the small samples taken from this sample, to the standard atmosphere for testing textiles until they are in equilibrium with that atmosphere. Specimens of known dimensions are then taken and weighed and the mass per unit area is calculated.

4 APPARATUS

4.1 Calibrated steel rule, of length 3 m (or failing this, at least 2 m), graduated in centimetres and millimetres, for methods 1, 2, 3 and 4.

4.2 Device, to enable a specimen of full width to be cut at right angles to the selvedge, for methods 1, 2, 3 and 4.

4.3 Balance, capable of determining the mass of pieces or sample lengths (as relevant) to an accuracy of ± 0,2 % of the determined mass. For method 5, an accuracy of 0,001 g is required.

4.4 Table, having a smooth flat surface, a width greater than that of the woven fabric to be measured and a length of at least 4 m.

4.5 Device, accurate to 1 %, to enable a specimen 10 cm × 10 cm to be cut, or a **circular cutter** of area 100 cm^2, for method 5.

4.6 Metal plate, approximately 9 cm square (or 80 cm^2 if a circular plate is used) × 1 cm thick, for method 5.

5 STANDARD ATMOSPHERE FOR CONDITIONING AND TESTING

The atmosphere for conditioning and testing textiles is that defined in ISO 139. This atmosphere has a relative humidity of 65 ± 2 % and a temperature of 20 ± 2° C. In tropical regions, a temperature of 27 ± 2 °C may be used, subject to the agreement of the interested parties.

6 PROCEDURE

6.1 Pre-conditioning

Equilibrium shall be approached from the dry side. When the fabric as received is in such a condition that this is not immediately possible, the fabric may be pre-conditioned by exposing it to an atmosphere having a relative humidity not exceeding 10 % at a temperature not higher than 50 °C. Consider equilibrium with the pre-conditioning atmosphere to have been reached when the difference between successive weighings, made at intervals of at least 2 h, does not exceed 0,5 % of the final mass of the fabric when conditioned in this atmosphere.

6.2 Selvedges

If the mass per unit length (or area) of the selvedge differs appreciably from the mass per unit length (or area) of the fabric, the mass per unit area shall be determined on a sample from which the selvedges have been removed along the outermost warp threads of the body and calculation(s) shall be based on the mass of the trimmed sample and its length and width.

6.3 Method 1 : Determination of mass per unit length of pieces and of sample lengths that can be conditioned in the standard atmosphere for testing

6.3.1 *Pieces*

Determine the conditioned length of the piece in accordance with ISO 3932 and then (without removing it from the standard atmosphere) weigh it. Alternatively, if it is neither possible nor necessary to determine the full length of the piece, use the procedure given in 6.3.2 on a sample having a length of at least 0,5 m but preferably of 3 to 4 m, taken preferably from the middle of the piece.

6.3.2 *Sample lengths*

6.3.2.1 Ensure that the fabric is cut across the full width of the piece along parallel lines at right angles to the selvedge and that the length of the sample is at least 0,5 m but preferably 3 to 4 m.

6.3.2.2 Determinate the conditioned length of the sample in accordance with ISO 3932 and then (without removing it from the standard atmosphere) weigh it.

6.4 Method 2 : Determination of mass per unit length of pieces when it is impracticable to condition them in the standard atmosphere for testing

Determine, in accordance with ISO 3932, the length of the piece after relaxation in the prevailing atmosphere, and then weigh it in the prevailing atmosphere. From, preferably, the middle of the piece, cut a full-width sample of length at least 1 m but preferably 3 to 4 m and determine its length and the mass in the prevailing atmosphere. Determine the mass of the piece and the mass of the sample length in the prevailing atmosphere at the same time in order to minimize the effect of any sudden changes in the temperature and/or humidity of that atmosphere. Then proceed as described in 6.3.2.2.

6.5 Method 3 : Determination of the mass per unit area of pieces and of sample lengths that can be conditioned in the standard atmosphere for testing

6.5.1 *Pieces*

Use the procedure given in 6.3.1 and determine the conditioned width in accordance with ISO 3933.

6.5.2 *Sample lengths*

Use the procedure given in 6.3.2 and determine the conditioned width in accordance with ISO 3933.

6.6 Method 4 : Determination of mass per unit area of pieces when it is impracticable to condition them in the standard atmosphere for testing

Use method 2 and in addition determine, in accordance with ISO 3933, the width of the piece after relaxation in the prevailing atmosphere and the width of the sample both after relaxation and after conditioning in the standard atmosphere for testing.

6.7 Method 5 : Determination of mass per unit area using small specimens

6.7.1 *Test samples*

Cut five samples (unless otherwise specified) from the fabric, each approximately 15 cm × 15 cm, selected so as to avoid any selvedges or creased areas and so that they represent the fabric as fully as possible. Where the existence of a large pattern involves local areas of appreciably different mass per unit area, select samples containing an integral number of complete repeats of the pattern.

6.7.2 *Procedure*

Pre-condition the samples in accordance with 6.1. Bring the samples into equilibrium with the standard atmosphere for testing by exposing them to this atmosphere in a tension-free condition for at least 24 h. Take each sample in turn and place it on a surface suitable for cutting. Place the metal plate centrally on the sample, position the cutter and cut a square specimen 10 cm × 10 cm (or a circular specimen of area 100 cm^2).

Weigh the specimen to an accuracy of ± 0,001 g, ensuring that no loss of threads occurs.

7 CALCULATION OF RESULTS

7.1 Methods 1 and 3

Calculate the mass per unit length, in grams per metre, and/or the mass per unit area, in grams per square metre, from the following formulae, as appropriate :

$$m_{ul} = \frac{m_c}{l_c}$$

$$m_{ua} = \frac{m_c}{l_c \times w_c}$$

where

m_{ul} is the mass per unit length, in grams per metre, of the piece/sample (with/without selvedges, as relevant), after conditioning in the standard atmosphere for testing;

m_{ua} is the mass per unit area, in grams per square metre, of the piece/sample (with/without selvedges, as relevant), after conditioning in the standard atmosphere for testing;

m_c is the mass, in grams, of the piece/sample (with/without selvedges, as relevant), after conditioning in the standard atmosphere for testing;

l_c is the length, in metres, of the piece/sample after conditioning in the standard atmosphere for testing;

w_c is the width, in metres, of the piece/sample (with/without selvedges, as relevant), after conditioning in the standard atmosphere for testing.

Round off the result to the nearest gram.

7.2 Methods 2 and 4

7.2.1 From the data on the relaxed fabric, the relaxed sample, and the conditioned sample calculate, in accordance with ISO 3932, the conditioned length of the piece.

7.2.2 When mass per unit area is determined, calculate similarly, but in accordance with ISO 3933, the conditioned width of the piece.

7.2.3 Calculate the conditioned mass, in grams, of the piece from the formula

$$m_c = m_r \times \frac{m_{sc}}{m_s}$$

where

m_c is the mass, in grams, of the piece after conditioning in the standard atmosphere for testing;

m_r is the mass, in grams, of the piece after relaxation in the prevailing atmosphere;

m_{sc} is the mass, in grams, of the sample after conditioning in the standard atmosphere for testing;

m_s is the mass, in grams, of the sample after relaxation in the prevailing atmosphere.

7.2.4 Use the value of m_c calculated as in 7.2.3 to calculate, as in 7.1, the mass per unit length or per unit area, as relevant.

7.2.5 Round off the result to the nearest gram.

7.3 Method 5

From the mass of the specimen, calculate the mass per unit area of the fabric from the formula

$$m_{ua} = m \times 100$$

where

m_{ua} is the mass per unit area, in grams per square metre, of the fabric after conditioning in the standard atmosphere for testing;

m is the mass, in grams, of the specimen.

Calculate the mean of the five values so calculated.

Round off the result to the nearest gram.

8 TEST REPORT

The test report shall include the following particulars :

a) a statement that the test was performed in accordance with this International Standard;

b) where more than one specimen is tested, the result for each specimen;

c) the date of the test;

d) the mean mass per unit length, in grams per metre, and/or area, in grams per square metre;

e) the method (1, 2, 3, 4 or 5) by which each result was obtained;

f) whether or not the results include the selvedge;

g) details of any deviation from the specified test procedure.

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