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Textile floor coverings — Methods for determination of mass

Revêtements de sols textiles — Méthodes de détermination de la masse

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 8543 was prepared by Technical Committee ISO/TC 38, *Textiles*, Subcommittee SC 12, *Textile floor coverings*.

This second edition cancels and replaces the first edition (ISO 8543:1986) of which it is a minor revision. See particularly 8.1 and 9.1 which have been augmented.

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Textile floor coverings — Methods for determination of mass

1 Scope

This International Standard specifies methods for the determination of the total mass per unit area, total pile mass per unit area, and mass of pile per unit area above the substrate, and for the calculation of measured surface pile density and measured pile fibre volume ratio, of textile floor coverings.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 139:1973, *Textiles — Standard atmospheres for conditioning and testing.*

ISO 1765:1986, *Machine-made textile floor coverings — Determination of thickness.*

ISO 1766:1986, *Carpets — Determination of thickness of pile above the substrate.*

ISO 1957:1986, *Machine-made textile floor coverings — Sampling and cutting specimens for physical tests.*

3 Definitions

For the purpose of this International Standard, the following definitions apply.

3.1 constant mass: The mass attained when successive weighings at hourly intervals over a period of 3 h do not vary by more than 1 %.

3.2 total pile mass per unit area: The mass of the pile yarn in a unit area, including that forming the base of the tufts or held in the substrate but excluding any backing compound adhering to the pile yarn, determined in equilibrium with the standard atmosphere for conditioning and testing described in clause 4.

3.3 measured surface pile density: The ratio of mass to volume of the pile above the substrate measured under a pressure of 2,0 kPa[1)].

3.4 measured pile fibre volume ratio: The proportion of the volume of the pile actually occupied by fibre.

1) 1 kPa = 10^3 N/m^2

4 Atmosphere for conditioning and testing

The specimens shall be conditioned and the test conducted in one of the standard atmospheres for conditioning and testing textiles specified in ISO 139.

5 Number of specimens

The number of specimens for each determination in accordance with clauses 6, 7 and 8 shall be sufficient to give 95 % confidence limits of ± 6 %. Four specimens shall be tested initially and if the coefficient of variation (CV) calculated from these tests is > 4 %, then further specimens shall be tested as follows:

if 4 % < CV ≤ 5,5 %, test a further two specimens (total six);

if 5,5 % < CV ≤ 7 %, test a further four specimens (total eight);

if CV > 7 %, test a further eight specimens (total twelve).

NOTE — Confidence limits $= \pm \frac{t \cdot CV}{\sqrt{n}}$

where

t is the appropriate value for Student's t-test;

n is the number of specimens tested.

6 Determination of total mass per unit area

6.1 Field of application

The method is applicable to textile floor coverings including those with varying pile height or density. It can be used prior to, and in conjunction with, the methods specified in clauses 7 and 8, with which it is compatible.

6.2 Principle

The mass of a measured area of textile floor coverings is determined in its entirety.

6.3 Apparatus

6.3.1 Sharp pointed knife.

6.3.2 Rule, graduated in millimetres.

6.3.3 Balance, accurate to 0,01 g.

6.4 Specimens

Select the specimens according to the standard procedure specified in ISO 1957. Cut out, using the sharp knife, at least four rectangular specimens, each at least 200 mm × 200 mm, with the sides parallel with, and at right angles to, the machine production direction.

NOTE — More than four specimens may be required in order to achieve the desired confidence limits (see clause 5).

6.5 Preparation of specimens

Lay the specimens out flat, singly and with the use-surface uppermost in the atmosphere for conditioning and testing described in clause 4, until they reach constant mass as defined in 3.1.

6.6 Procedure

6.6.1 Determine the mass, m, in grams, of each specimen to the nearest 0,01 g.

6.6.2 Measure the length and width of each specimen on the back, to the nearest millimetre, each in four places.

6.7 Expression of results

For each specimen, calculate the average length and width, in millimetres, and multiply these to obtain the area, A, in square millimetres. For each specimen, calculate the total mass per unit area, in grams per square metre, using the formula

$$10^6 \times \frac{m}{A}$$

Calculate the coefficient of variation (CV) and, if necessary, test further specimens according to clause 5. Calculate the mean and CV of all the results.

6.8 Test report

The test report shall include the following information:

a) that the procedure was conducted in accordance with clause 6 of this International Standard;

b) the identity (source and type) of the sample from which the specimens were taken, and whether it was of varying pile height or density;

c) the standard atmosphere used for conditioning and testing;

d) the number of specimens tested;

e) the total mass per unit area of each specimen, in grams per square metre;

f) the mean total mass per unit area, in grams per square metre, and the overall coefficient of variation.

7 Determination of total pile mass per unit area

7.1 Field of application

The method is applicable to textile floor coverings with uniform or varying pile height or density, but is not appropriate for those where backing compound has been applied to the tufts. It can be used in conjunction with the method specified in clause 6, with which it is compatible.

7.2 Principle

A known area of the textile floor coverings is weighed and dissected completely. The pile yarn is separated from the other components and is weighed separately.

NOTE — For the definition of total pile mass per unit area, see 3.2.

7.3 Apparatus

7.3.1 ***Sharp pointed knife.***

7.3.2 **Rule,** graduated in millimetres.

7.3.3 **Balance,** accurate to 0,01 g.

7.3.4 **Dissecting needles** and **forceps.**

7.4 Specimens

Select specimens according to the standard procedure specified in ISO 1957. Cut out, using the sharp pointed knife, at least four square specimens, each at least 200 mm × 200 mm, selected at random from the area available. Trim them so that each side of each specimen is formed by a complete row of pile or line of stitches.

Measure the length and width at four places on the back of each specimen, to the nearest millimetre.

NOTE — More than four specimens may be required in order to achieve the desired degree of accuracy (see clause 5).

7.5 Procedure

7.5.1 With the needle and forceps, carefully remove all the yarn forming tufts and collect it together for each specimen.

NOTE — In analysing multi-frame Wilton carpets, treat buried pile yarn from dead frames as pile yarn, irrespective of whether it forms tufts in the specimen under examination or not.

7.5.2 Condition the tufts and buried pile (if present) in the atmosphere for conditioning and testing specified in clause 4, until they reach constant mass as defined in 3.1.

7.5.3 Determine the mass m, in grams, of the conditioned yarn forming tufts and of the buried pile (if present) to the nearest 0,01 g.

NOTE — In some multi-frame Wilton carpets, the buried pile yarn may be of a different composition from the working pile. If this is so in the specimen under test, determine the mass of the buried pile separately from that of the working pile.

7.6 Expression of results

Calculate the area A, of each specimen, in square millimetres. Then calculate the total pile per unit area, in grams per square metre, for each specimen, using the formula

$$10^6 \times \frac{m}{A}$$

Calculate the coefficient of variation (CV) and, if necessary, test further specimens according to clause 5. Calculate the mean and CV of all the results.

7.7 Test report

The test report shall include the following information:

a) that the test procedure was conducted in accordance with clause 7 of this International Standard;

b) the identity (source and type) of the sample from which the specimens were taken, and whether it was of varying pile height or density;

c) the standard atmosphere used for conditioning and testing;

d) the number of specimens tested;

e) the total pile mass per unit area, in grams per square metre, for each specimen;

f) the mean total pile mass in grams per square metre and the overall coefficient of variation;

g) if, in a multi-frame Wilton carpet, the buried pile is of a different composition from the working pile, state this fact and report the buried pile mass separately from that of the working pile.

8 Determination of mass of pile per unit area above the substrate

8.1 Field of application

This method is applicable to textile floor coverings with a pile of cut and/or looped yarn, and may be used for textile floor coverings with varying pile height or density. It may be used in conjunction with the methods specified in clauses 6 and 9, and in ISO 1766, on the same specimens.

NOTE — Difficulties have been experienced when using this method for bonded-pile textile floor coverings, textile floor coverings with needled-pile and flocked-pile textile floor coverings, because of the problems of determining a suitable end point when shearing these products. The results obtained from such products should therefore be treated with caution.

8.2 Principle

The masses of specimens of textile floor coverings of known dimensions are determined before and after the pile has been shorn.

8.3 Apparatus

8.3.1 Sharp pointed knife.

8.3.2 Balance, accurate to 0,01 g.

8.3.3 Rule, graduated in millimetres.

8.3.4 Bank knife machine or **hand-held clippers,** capable of shearing the pile close to the substrate.

NOTES

1 The particulars of the shearing machine and details of its operation should be agreed between the interested parties.

2 The results from the two types of apparatus may not be identical.

8.3.5 Press and **cutter,** or other apparatus, either circular or square, of known areas A_2, not less than 25 000 mm^2.

8.4 Specimens

Select specimens according to the standard procedure specified in ISO 1957. Cut out, using the sharp pointed knife, at least four specimens, each at least 200 mm × 200 mm, with the sides parallel with, and at right angles to, the direction of manufacture.

NOTE — More than four specimens may be required in order to achieve the desired degree of accuracy (see clause 5).

8.5 Preparation of specimens

Lay the specimens out flat, singly and with the use-surface uppermost in the atmosphere for conditioning and testing described in clause 4, until they reach constant mass as defined in 3.1.

8.6 Procedure

8.6.1 Determine the mass of each specimen, m_1, in grams, to the nearest 0,01 g.

8.6.2 Measure the length and width, in millimetres, each in four places, on the back of each specimen, to the nearest 1 mm.

8.6.3 Shear the pile from the specimen. When using a band knife machine, keep on repeating the process with the roller being set progressively lower until it is as low as possible without damaging the substrate. At each setting, insert the specimen into the machine several times, each time in a different direction. After each process, brush the pile upright.

When using clippers, use forward strokes in all directions. Shear as close as possible to the substrate by running the points of the comb and cutter along the substrate without digging in. Avoid plucking any tufts or damaging the substrate. It is not necessary to shear the edges of the specimen, provided that the area of 25 000 mm^2 in the centre is closely shorn.

Brush, blow or suction clean the specimen during and/or after shearing. Continue shearing until no further significant amount of pile yarn dust appears on the shearing blades or falls away when the specimen is shaken, pile down, over a smooth surface of contrasting colour.

8.6.4 After shearing, unless the total area of the specimen is completely shorn without damage to the substrate and can be used to determine the mass per unit area of the substrate, cut a completely shorn piece of not less than 25 000 mm^2 from the centre of the specimen, using the press and cutter. In either case, the substrate yarns in this area shall be undamaged, and no tufts shall have been plucked from it.

8.6.5 Condition each area cut out of the shorn carpet specimens by laying them flat, singly, in the atmosphere for conditioning and testing described in clause 4, until they reach constant mass as defined in 3.1.

8.6.6 Determine the final conditioned mass of the shorn area of each specimen, m_2, to the nearest 0,01 g.

8.7 Expression of results

From the measurements made in 8.6.2, calculate for each specimen the average length and width, in millimetres, and the area (A_1), in square millimetres. Calculate the total mass per unit area (m_1/A_1) of carpet for each specimen separately, in grams per square millimetre. Note the area (A_2), in square millimetres, of each specimen of shorn carpet as described in 8.6.4, and calculate the mass per unit area (m_2/A_2) for each, in grams per square millimetre.

NOTE — In cases where it was possible to determine the mass of the whole of the shorn original specimen, then $A_2 = A_1$. In cases where the cutter was used, A_2 equals the known area of the cutter.

For each specimen, calculate the mass of shorn pile per unit area, Q_A, in grams per square metre, to the nearest gram per square metre, using the formula

$$10^6 \times \left(\frac{m_1}{A_1} - \frac{m_2}{A_2} \right)$$

Calculate the coefficient of variation (CV) and, if necessary, test further specimens according to clause 5. Calculate the mean and CV of all the results.

8.8 Test report

The test report shall include the following information:

a) that the test procedure was conducted in accordance with clause 8 of this International Standard;

b) the identity (source and type) of the sample from which the specimens were taken, and whether it was of varying pile height or density;

c) the standard atmosphere used for conditioning and testing;

d) the number of specimens tested;

e) the mass of pile per unit area above the substrate, in grams per square metre, for each specimen;

f) the mean mass of pile per unit area above the substrate, in grams per square metre, and the overall coefficient of variation;

g) whether the sample was of varying pile height or density;

h) the type of shearing apparatus used.

9 Calculation of measured surface pile density and measured pile fibre volume ratio

9.1 Field of application

This method is applicable to textile floor coverings capable of being shorn from the backing, but is not applicable to textile floor coverings of varying pile thickness or density unless the areas can be measured separately. It is used in conjunction with the methods specified in clause 8 and ISO 1766.

NOTE — Difficulties have been experienced when using this method for bonded-pile textile floor coverings, textile floor coverings with needled-pile and flocked-pile textile floor coverings, because of the problems of determining a suitable end point when shearing these products. The results obtained from such products should therefore be treated with caution.

9.2 Principle

Pile thickness and mass are determined before and after the pile has been shorn. The measured surface pile density and the measured pile fibre volume ratio are calculated from the values obtained.

NOTE — For the definitions of measured surface pile density and measured pile fibre volume ratio, see 3.3 and 3.4.

9.3 Apparatus

Sharp pointed knife, balance, rule, band-knife machine or **hand-held clippers,** and **press** and **cutter,** as specified in 8.3, and **carpet thickness tester** and **straightedge** as described in ISO 1765.

9.4 Specimens

Select four (or more) specimens as described in 8.4.

9.5 Preparation of specimens

Lightly brush the use-surface, first against, then with, the direction of pile lean, using a straightedge, e.g. a ruler. Lay the specimens out flat, singly and with the use-surface uppermost in the atmosphere for conditioning and testing as specified in clause 4, for a period of at least 24 h, and until they reach constant mass as defined in 3.1.

9.6 Procedure

9.6.1 Measure the thickness of each specimen as described in ISO 1765.

9.6.2 Determine the mass of the pile per unit area before and after shearing, as described in clause 8, shearing the pile from the specimen as described in 8.6.3.

9.6.3 Measure the thickness of each shorn specimen as described in 9.6.1.

9.7 Expression of results

9.7.1 Calculate the mean pile thickness d for all specimens, in millimetres, as described in ISO 1766, to the nearest 0,1 mm.

9.7.2 Calculate the mean mass of shorn pile per unit area above the substrate as described in 8.7, in grams per square metre, to the nearest gram per square metre.

9.7.3 Calculate Q_S, the measured surface pile density, in grams per cubic centimetre, under a pressure of 2,0 kPa, using the formula

$$10^{-3} \times \frac{Q_A}{d}$$

$$= 10^3 \times \frac{\frac{m_1}{A_1} - \frac{m_2}{A_2}}{d}$$

where

m_1, m_2, A_1, A_2, and Q_A are defined in 8.6 and 8.7;

d is the pile thickness determined in accordance with ISO 1766.

9.7.4 Calculate the measured pile fibre volume ratio using the formula

$$\frac{Q_S}{Q_F}$$

where

Q_S is the measured surface pile density (9.7.3);

Q_F is the pile fibre density[2], in grams per cubic centimetre.

NOTE — Pile fibre volume ratio may be estimated by expressing, as a percentage, the measured surface pile density (see 3.3) divided by the pile fibre density.

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2) If the pile consists of two or more fibre types, the average pile fibre density $\overline{Q_F}$ may be calculated as follows:

$$\overline{Q_F} = \frac{100}{(C_1/Q_{F1}) + (C_2/Q_{F2}) + \ldots + (C_n/Q_{Fn})}$$

where

C_1 is the percentage, by mass, of the fibre of density Q_{F1};

C_2 is the percentage, by mass, of the fibre of density Q_{F2};

...

C_n is the percentage, by mass, of the fibre of density Q_{Fn}.

9.8 Test report

The test report shall include the following information:

a) that the test procedure and calculation were conducted in accordance with clause 9 of this International Standard;

b) the identity (source and type) of the sample from which the specimens were taken;

c) the standard atmosphere used for conditioning and testing;

d) the pile thickness for each specimen;

e) the mean pile thickness, in millimetres, to the nearest 0,1 mm;

f) the mass of pile per unit area above the substrate, for each specimen;

g) the mean mass of pile per unit area above the substrate, in grams per square metre;

h) the measured surface pile density under a pressure of 2,0 kPa, in grams per cubic centimetre;

i) the measured pile fibre volume ratio;

j) the type of shearing apparatus used.

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