International Standard 7211/2

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Textiles — Woven fabrics — Construction — Methods of analysis — Part 2: Determination of number of threads per unit length

Textiles — Tissus — Construction — Méthodes d'analyse — Partie 2: Détermination du nombre de fils par unité de longueur

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (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 authorized 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 7211/2 was developed by Technical Committee ISO/TC 38, *Textiles*, and was circulated to the member bodies in November 1982.

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

Australia	India	Portugal
Belgium	Iran	Romania
Brazil	Iraq	South Africa, Rep. of
Bulgaria	Israel	Spain
Canada	Italy	Sweden
China	Jamaica	Tanzania
Czechoslovakia	Japan	Turkey
Egypt, Arab Rep. of	Korea, Rep. of	United Kingdom
Finland	Mexico	USSR
Germany, F.R.	Netherlands	Venezuela
Ghana	New Zealand	
Hungary	Poland	

The member body of the following country expressed disapproval of the document on technical grounds:

France

Printed in Switzerland

Textiles — Woven fabrics — Construction — Methods of analysis — Part 2: Determination of number of threads per unit length

1 Scope and field of application

This part of ISO 7211 specifies three methods for the determination of the number of threads per centimetre in woven fabrics. Any of the three methods may be used, the choice depending on the character of the fabric. However, in case of dispute method A is recommended.

Method A: Dissection of fabric, suitable for all fabrics. This is the most laborious method but has fewer limitations than the others; in particular, it is the only one that is really suitable for the examination of certain folded structures and other complicated weaves.

Method B: Counting glass, suitable for woven fabrics with more than 50 threads per centimetre.

Method C: Traversing thread counter, suitable for all fabrics.

Where the number of threads per centimetre is low, it may be convenient to express the results as the number of threads per decimetre.

NOTE — Methods using parallel line gratings and tapered line gratings have been given in the annex for information. These methods have not been considered accurate enough to be used as standard test methods but can be used to give rough and ready estimates for routine testing.

2 Reference

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

3 Principle

Three methods of determining the number of threads per centimetre are specified, any of which may be used, the choice depending on the character of the fabric. The principles are as follows:

Method A: A section of fabric of dimensions in accordance with those given in clause 4 is dissected and the number of threads counted. The threads that are to be counted are preferably short, 1 or 2 cm being suitable.

Method B: The number of threads visible within the aperture of a specified counting glass is determined.

Method C: The number of threads per centimetre of the fabric is determined with the aid of a traversing thread counter.

4 Minimum measuring distance

Use the appropriate minimum measuring distance specified in the table.

Table — Minimum measuring distance

Number of threads per centimetre	Minimum measuring distance cm	Number of threads per test piece	Accuracy in percentage (count to within 0,5 thread)
Less than 10	10	Less than 100	Greater than 0,5
10 to 25	5	50 to 125	1,0 to 0,4
25 to 40	3	75 to 120	0,7 to 0,4
More than 40	2	More than 80	Less than 0,6

For the method A, take test pieces containing at least 100 threads.

For narrow fabrics having a width of 10 cm or less, count all warp threads including the selvedge ends and express the result as threads per full width.

When fabrics are patterned by broad areas of higher or lower density of thread spacing, select test specimens containing at least one weave repeat (see clause 10).

5 Conditioning and testing atmosphere

One of the standard atmospheres for conditioning and testing textiles as defined in ISO 139 shall be used for conditioning and testing.

6 Test specimens

No specially prepared specimens are required except for method A (see 7.2), but count the threads at not less than five different points selected to represent the fabric as fully as possible. Expose the fabric or specimens to the standard atmosphere for testing for at least 16 h before making the test.

7 Method A — Dissection of fabric

7.1 Apparatus

7.1.1 Clamp, holding two short pins parallel and with their points being within ± 0,02 cm of the minimum measuring distance specified in clause 4.

Alternatively, when a clamp is not available,

7.1.2 Two dissecting needles and

7.1.3 Heavy steel rule.

7.2 Procedure

Take five specimens at random (see clause 6) 0,4 to 0,6 cm longer than the minimum measuring distance specified in clause 4 and sufficiently wide to facilitate handling. Take care not to disturb the distribution of threads, especially in a loosely woven fabric.

Pass the pins in the clamp (7.1.1) through a specimen 0,2 to 0,3 cm from each end. Remove the shorter threads (those in the direction to be counted) from the specimen outside the two pins, so that the measuring distance of fabric between the pins remain. Then remove the short threads from the specimen and count them. Count any threads impaled on a pin as half a thread. It is usually convenient to employ a pair of pointed forceps to remove the threads. The threads may be arranged in groups of ten for convenience in counting.

An approved alternative method where a clamp is not available is to insert two dissecting needles (7.1.2) the required distance apart by sliding their points down the appropriate graduation marks of a heavy steel rule (7.1.3) placed on edge.

8 Method B — Counting glass

8.1 Apparatus

8.1.1 Counting glass, the aperture width of which shall be 2 ± 0,005 cm or 3 ± 0,005 cm at all places. The thickness of the base plate at the edges of the aperture shall not exceed 0,1 cm.

8.2 Procedure

Use a measuring distance in accordance with clause 4.

Lay the fabric flat on a horizontal surface and place the counting glass (8.1.1) on the fabric so that one of the edges of its aperture is parallel to the warp threads.

In some fabrics, it is possible to see and count every thread. If this is not possible, weave repeats may be counted. Select a thread in the weave repeat which can be identified readily and position the counting glass so that this thread is adjacent to one side of the aperture of the counting glass. Count the number of whole repeats in the measuring distance, plus the remaining individual threads. Determine the number of threads in a repeat by analysis of the weave or dissection of the fabric.

Count the number of warp threads, or the number of weave repeats, or the number of warp thread units and fractions of a unit bounded by the appropriate pair of opposite sides of the aperture. Repeat with one of the edges of the aperture parallel to the weft threads, and count the number of weft threads or weave repeats or number of weft thread units in a similar manner.

If the face of the fabric is composed mainly of one set of threads, as with certain twills, sateens, etc, it may be found easier to count on the back of the fabric, where the weave design is more readily recognizable.

9 Method C — Traversing thread counter

9.1 Apparatus

9.1.1 Traversing thread counter, incorporating a low-power microscope, of X 4 to X 20, mounted so that it can be traversed by means of a screw over a graduated base sufficiently long to meet the minimum measuring distance requirements of clause 4. Types with an index line in the eyepiece or a pointer traversing with and visible through the microscope are equally suitable.

9.2 Test procedure

Use a measuring distance in accordance with clause 4.

Lay the fabric flat on a horizontal surface and place the thread counter (9.1.1) upon it in such a way that when the screw is turned the microscope moves across the fabric in a direction that is either parallel to the warp or parallel to the weft, depending on which set of threads is being counted. Count the number of threads over the appropiate minimum measuring distance.

In some fabrics it is possible to see and count every thread passed by the pointer or index line as it moves across the fabric. If this is not possible, weave repeats may be counted. Begin counting from a thread in the weave repeat which can be readily identified. Count the number of whole repeats in the measuring distance, plus the remaining individual threads. Determine the number of threads in a repeat by analysis of the weave or dissection of the fabric.

If the face of the fabric is composed mainly of one set of threads, as with certain twills, sateens, etc., it may be found easier to count on the back of the fabric, where the weave design is more readily recognizible.

10 Calculation and expression of results

Calculate the number of threads per centimetre. Quote the mean of individual results for each direction, that for the warp threads as ends per centimetre and that for the weft as picks per centimetre. The number of threads per square centimetre is given by the sum of the mean ends and picks per centimetre.

When fabrics are patterned by broad areas of higher or lower density of thread spacing, determine the number of threads in each area and report the number of threads per centimetre for different areas of the pattern.

11 Test report

The test report shall include the following particulars:

a) a reference to this International Standard (ISO 7211/2);

b) the standard atmosphere used (temperate or tropical);

c) the actual method used (A, B or C);

d) the measuring distance used;

e) the number of measurements made;

f) the number of warp ends per centimetre and weft picks per centimetre and the mean value of warp ends per centimetre and weft picks per centimetre. If the fabric is patterned by broad areas of greater and lower density, and if required, this information can be given for each different portion of the pattern.

Where the number of threads is low, it is permissible to express and report the results as the number of threads per decimetre. For narrow fabrics (see clause 4), report the results as the number of threads per full width;

g) if required, the number of threads per square centimetre (or square decimetre);

h) details of any deviation from the method.

Annex

Method using taper and parallel line gratings

(Forms part of the Standard.)

A.1 Method D — Parallel-line grating

This method is suitable only for fabrics where thread patterns yield interference bands that are readily visible.

A.1.1 Principle

The number of interference bands produced when the parallel line grating is placed on the fabric is determined.

A.1.2 Apparatus

A.1.2.1 Parallel line grating, with a length of 10 or 20 cm and with about 5 % more or less lines per centimetre than there are threads per centimetre in the cloth to be tested. If several gratings of different gauges are available, select the most suitable by trial.

It is essential that the lines on the grating are straight and parallel. The average number of lines per centimetre over the whole grating shall be known to 0,1, and the average number of lines per centimetre at either edges of known length shall not differ from the general average by more than 0,15 %.

A.1.3 Procedure

Place the grating selected as most suitable on the fabric with its lines parallel to the threads to be counted. If a suitable grating has been chosen, a number of bands parallel to the edge of the grating as shown in figure 1 will be seen. Count the number of these bands along the middle of the grating and divide by the length of the grating in centimetres, to obtain the mean number of bands per centimetre. Either add the number of bands per centimetre to the number of lines per centimetre of the grating, or subtract the number of bands per centimetre from the number of lines per centimetre of the grating, in accordance with the following rule.

If, when the grating is rotated slightly, the bands appear to rotate in the same direction as the grating, the number of bands per centimetre must be subtracted from the lines per centimetre of the grating. If, however, the bands rotate in the opposite direction to the grating, the number of bands must be added to the lines per centimetre of the grating.

A.1.4 Calculation and expression of results

Where the test does not give it directly, calculate the number of threads per centimetre. Quote the mean of individual results for each direction, that for the warp threads as ends per centimetre and that for the weft threads as picks per centimetre. The number of threads per square centimetre is given by the sum of the mean ends and picks per centimetre.

When fabrics are patterned by broad areas of greater and lower density of thread spacing, it may be desirable to record the number of threads per centimetre in each different portion of the pattern.

A.2 Method E — Taper-line gratings

This method is suitable only for fabrics where thread patterns yield interference bands that are readily visible.

A.2.1 Principle

The number of threads is determined by observation of the interference pattern produced when a taper-line grating is placed on the fabric.

A.2.2 Apparatus

A.2.2.1 Taper-line grating, consisting of diverging lines disposed symmetrically between two parallel scales 2,5 cm apart, so that they cut off equal intercepts along any line at right angles to the axis of symmetry. Corresponding graduations on the scales are opposite one another, and the graduations indicate the number of units, consisting of a line and a space, counted in a straight line from a graduation on one scale to the corresponding graduation on the other. The graduations indicate whole numbers with an accuracy of 0,5 %. The divergence of the lines should be such that the greatest and least values of lines per centimetre does not differ by more than 4 times the length of the scale in centimetres.

A.2.3 Procedure

Place the grating on the fabric with its long edge parallel to the threads to be counted. If a suitable grating has been chosen, there will be one point on it where the number of lines per centimetre equals the number of threads per centimetre. At this point a light or dark cross, which may be symmetrical or skew, will be formed by the curvilinear pattern of the bands which appear. The scale reading to which the two short arms of this cross point give the threads per centimetre. In the event of asymmetry of the cross, take the mean of the readings from both scales. The interference pattern produced by a fabric with 25 threads/cm is shown in figure 2.

Often at scale readings which are multiples or fractions of the number of threads per centimetre, other patterns may be seen, but there is seldom cause for doubt in selecting the fundamental one, as the others are much fainter.

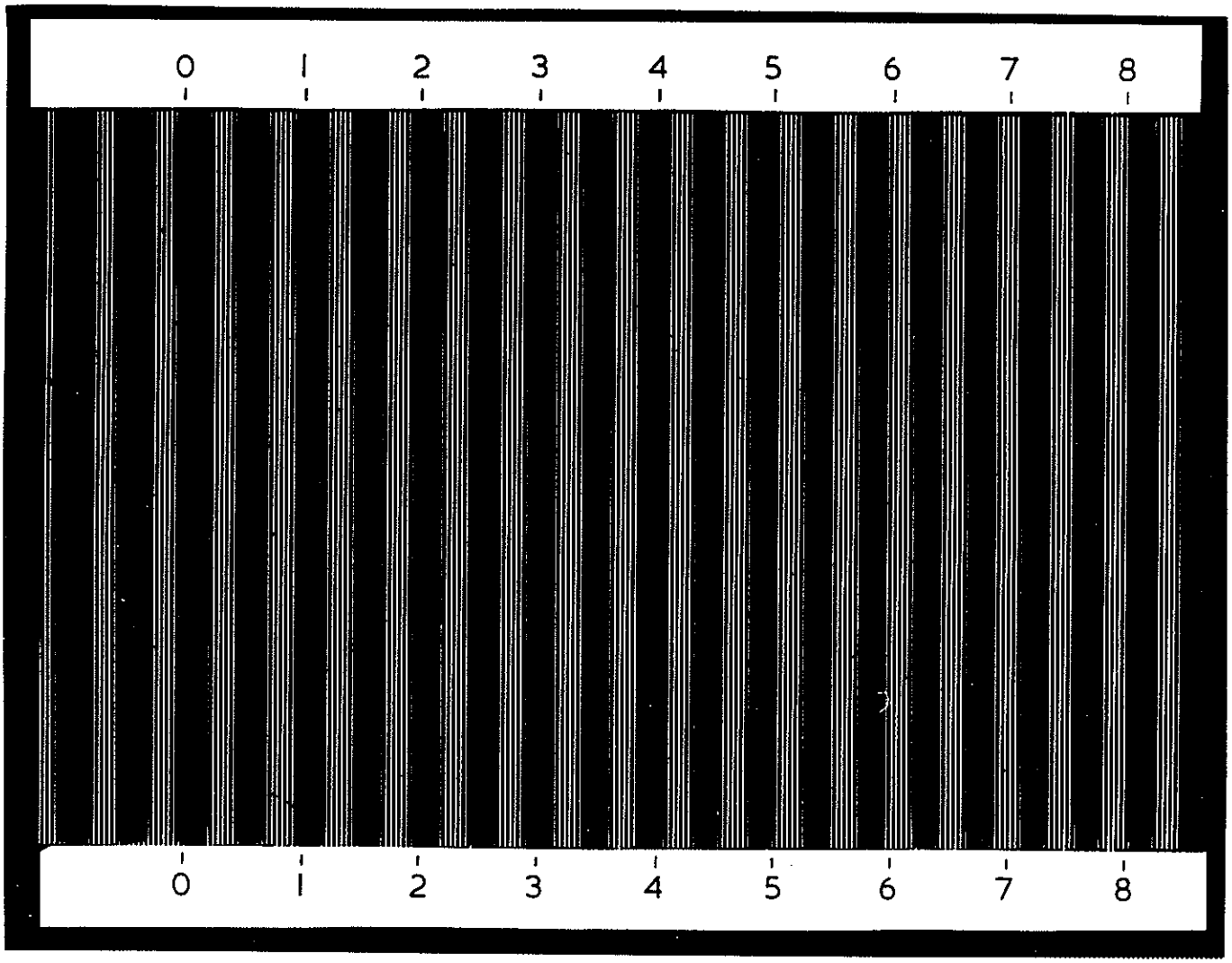

Figure 1 — Parallel-line grating

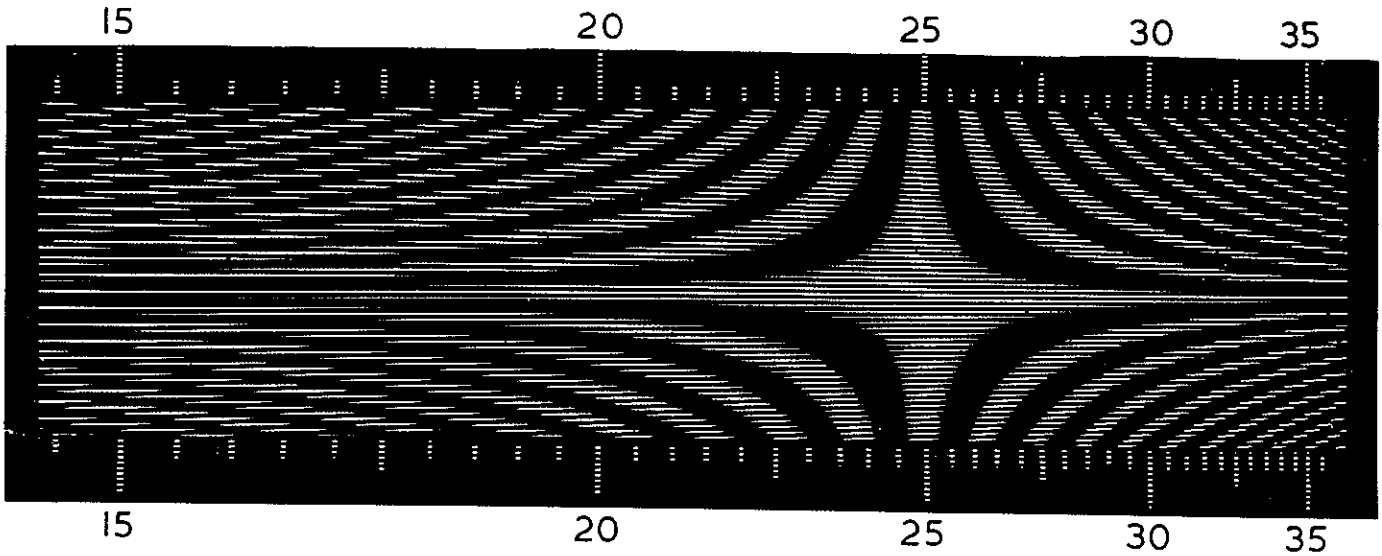

Figure 2— Taper-line grating

Take care to avoid the formation of patterns by twill lines, by ensuring that the shorter edge of the grating is parallel with the threads to be measured. This is particularly necessary with smooth surfaces, such as those of satins, where twill lines make a very small angle with the threads.

In general, the best results are obtained when the light shines along the grating lines, but this is not always so, particularly with lustrous fabrics, and it is advisable to find the most satisfactory conditions by trial. Transmitted light may be used.

A.2.4 Calculation and expression of results

Quote the mean of individual results for each direction, that for the warp threads as ends per centimetre, and that for the weft as picks per centimetre. The number of threads per square centimetre is given by the sum of the mean ends and picks per centimetre.

When fabrics are patterned by broad areas of greater and lower density of thread spacing, it may be desirable to record the number of threads per centimetre in each different portion of the pattern.