INTERNATIONAL STANDARD 1889

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Textile glass products — Continuous filament yarns, staple fibre yarns and rovings in the form of packages — Determination of linear density

Produits en verre textile — Fils de silionne, fils de verranne et stratifils présentés sous forme d'enroulements — Détermination de la masse linéique

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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.

Prior to 1972, the results of the work of the Technical Committees were published as ISO Recommendations; these documents are now in the process of being transformed into International Standards. As part of this process, Technical Committee ISO/TC 61 has reviewed ISO Recommendation R 1889 and found it technically suitable for transformation. International Standard ISO 1889 therefore replaces ISO Recommendation R 1889-1971 to which it is technically identical.

ISO Recommendation R 1889 was approved by the Member Bodies of the following countries :

Australia	Germany	South Africa, Rep. of
Austria	Israel	Spain
Belgium	Italy	Sweden
Canada	Japan	Switzerland
Czechoslovakia	Korea, Rep. of	Turkey
Egypt, Arab Rep of	Netherlands	United Kingdom
France	New Zealand	U.S.A.
Greece	Romania	U.S.S.R.

No Member Body expressed disapproval of the Recommendation.

The Member Body of the following country disapproved the transformation of ISO/R 1889 into an International Standard :

Canada

Printed in Switzerland

Textile glass products – Continuous filament yarns, staple fibre yarns and rovings in the form of packages – Determination of linear density

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies a method for determining the actual linear density[1] of textile glass continuous filament yarns, staple fibre yarns and rovings in the form of packages. It may be used for the inspection of a package or of a batch or consignment of several packages.[2]

The linear density as determined is the linear density of the desized oven-dried textile product.

2 REFERENCES

ISO/R 291, *Plastics – Standard atmospheres for conditioning and testing.*

ISO 1144, *Textiles – Universal system for designating linear density (Tex system).*

ISO 1886, *Textile glass products – Continuous filament yarns, staple fibre yarns and rovings in the form of packages – Sampling of batches or consignments.*

ISO 1890, *Textile glass products – Continuous filament yarns and staple fibre yarns – Determination of twist.*

3 DEFINITIONS

3.1 linear density of a textile glass yarn or roving : The mass per unit length of desized oven-dried glass yarn or roving expressed in the Tex system[3].

Distinction is made between the following types of linear density :

– the *actual linear density* : linear density obtained by following the procedure of this International Standard;

– the *nominal linear density of strand* : linear density as stated in the designation of all types of yarns or rovings;

– the *nominal theoretical linear density*, which is equal to the product of the sum of the nominal linear densities of the strands or slivers constituting the product and a coefficient D which makes allowance for the variation in length due to the twist.

This coefficient is expressed by the formula

$$D = \frac{100}{100 - K}$$

where K is the coefficient of twist contraction (see 3.2).

3.2 coefficient of twist contraction, K : The change in length of a yarn due to the twist, expressed as a percentage of the length of the untwisted yarn. This coefficient K is obtained by measuring the change in length which occurs as a twisted yarn is untwisted in a twist-testing apparatus such as described in ISO 1890.

3.3 pre-tension : The tension applied to a yarn or roving before determining the linear density or the twist.

Value of yarn pre-tension, applied with a tolerance of ± 10 % :

– *of textile glass continuous filament yarns* :

The following formula expresses the standard pre-tension of a yarn :

$$F \text{ (newtons)} = \frac{A \text{ (tex)}}{200} = \frac{A \text{ (decitex)}}{2\ 000}$$

where A is the sum of the nominal linear densities of the strands constituting the yarn or the total linear density of the roving.

– *of textile glass staple fibre yarns* :

1) In French, *titre* is a (deprecated) synonym for linear density (*masse linéique*).

2) However, the procedure is also valid in the case of one single package.

3) The definition of the Tex system will be found in ISO 1144.

The standard pre-tension of a yarn is expressed in newtons according to table 1.

TABLE 1

Linear density in tex	Linear density in decitex	Pre-tension in newtons
125	1 250	0,4
190	1 900	0,5
340	3 400	0,75
680	6 800	1,00
2 000	20 000	2,00

For intermediate linear densities, calculate the normal pre-tension by interpolation.

NOTE — It is possible to apply to glass staple fibres the same formula to calculate pre-tension as for continuous filament, but if this is done it must be noted in the test report.

4 PRINCIPLE

Establishing the mass per unit length in grams per kilometre after desizing, by calcination to constant mass at a standard temperature of 625 ± 20 °C, of test specimens of known length selected in accordance with a prescribed procedure.

NOTE — For glass products which are unstable at the above-mentioned temperature, a temperature between 500 and 600 °C may be chosen according to the glass specification or upon agreement. The chosen temperature must be kept constant at ± 20 °C.

5 APPARATUS

5.1 Muffle furnace capable of maintaining the standard temperature of 625 ± 20 °C, or the chosen temperature.

5.2 Desiccator containing a suitable drying agent (for example, silica gel, calcium chloride, phosphorus pentoxide).

5.3 Specimen holder.

5.4 Stainless steel tongs.

5.5 Balance, accurate to 0,1 mg.

5.6 Wrap reel for the unwinding of the yarn, the perimeter preferably being equal to 1 m, equipped with a revolution counter working from a set value to zero or vice versa.

6 TEST SPECIMENS

From each package selected in accordance with ISO 1886, unwind under *a standard pre-tension* (see 3.3), taking care to avoid any modification of twist during the operation, a test specimen of the length specified below. Measure the specimen with an accuracy of 0,1 % in the case of continuous filament yarns and 0,5 % in the case of glass staple fibre yarns or rovings.

This length of yarn should be as follows :

6.1 Textile glass continuous filament yarns

6.1.1 *Single yarns and rovings*

Table 2 gives the quantity of yarn to take (in general the length in metres) as a function of the linear density Tt of the yarn.

TABLE 2

Linear density in tex	Quantity of yarn to take
$Tt < 5$	2 000 m
$5 \leqslant Tt < 10$	1 000 m
$10 \leqslant Tt < 50$	500 m
$50 \leqslant Tt < 200$	100 m
$200 \leqslant Tt < 500$	50 m
$500 \leqslant Tt < 1\,000$	20 m
$1\,000 \leqslant Tt < 2\,500$	10 m
$2\,500 \leqslant Tt < 5\,000$	5 m
$Tt \geqslant 5\,000$	length such that the mass lies between 5 g and 25 g

6.1.2 *Folded yarns, cabled yarns, multiple wound yarns*

Take the length corresponding to that of the single yarn from which it was constructed, divided by the number of ends constituting the folded yarn, the cabled yarn, or the multiple wound yarns.

6.2 Textile glass staple fibre yarns

From each package select a given length, without drafting it, chosen according to the linear density of the staple fibre yarn so that the test specimen has a mass of at least 5 g.

In practice, to determine the length, choose a value in the region of that given by the formula

$$L \text{ (metres)} = \frac{1\,000}{\text{Tt (tex)}} \times 5 = \frac{10\,000}{\text{Tt (decitex)}} \times 5$$

where Tt is the linear density or the nominal linear density.

7 PROCEDURE

Desize the test specimen prepared in accordance with clause 6, as described below.

7.1 Weighing of holder

Stabilize the mass of the holder (5.3) by placing it in the muffle furnace (5.1) controlled at a temperature of 625 ± 20 °C or at the chosen temperature between 500 and 600 °C (see clause 4).

Cool the holder in the desiccator (5.2) to standard room temperature (see ISO/R 291).

Weigh the holder with an accuracy of 0,001 g.

7.2 Calcination of test specimen

Place the test specimen flat on the holder and put the holder with the specimen in the muffle furnace (5.1) controlled at 625 ± 20 °C[1] or at the chosen temperature between 500 and 600 °C (see clause 4).

Allow to burn for 5 min with the door of the furnace open[2]. Then close the door of the furnace and heat for a further 30 min. If a temperature lower than 625 °C is chosen, the latter heating period should be increased to at least 1 h.

Remove the test specimen and holder from the furnace and transfer to the desiccator (5.2). Allow to cool to standard room temperature (see ISO/R 291).

Weigh the calcined test specimen and holder with an accuracy of 0,001 g.

7.3 Precautions during test procedure

7.3.1 Ensure that the test specimen does not come into contact with the furnace during the heating stage.

7.3.2 Transfer the test specimen plus holder between furnace, desiccator and balance with great care to avoid loss of material.

7.3.3 Never touch the test specimen with the fingers, but use the tongs (5.4).

8 EXPRESSION OF RESULTS

8.1 Calculate the mass m_i of each test specimen by the formula

$$m_i = (m_1 - m_0)_i$$

where

m_0 is the mass, in grams, of the holder;

m_1 is the mass, in grams, of the holder plus calcined specimen.

8.2 Calculate the *linear density* Tt_i of each test specimen by the formula

$$Tt_i \text{ (tex)} = \frac{1\,000\, m_i}{L_i} \quad \text{or } Tt_i \text{ (decitex)} = \frac{10\,000\, m_i}{L_i}$$

where

m_i is the desized, oven-dried yarn mass, in grams;

L_i is the length of yarn in the test specimen, in metres.

To calculate the *mean actual linear density* Tt of the batch or consignment, take the arithmetic mean of the linear densities Tt_i of the test specimens. Calculate the confidence interval (95 % probability) corresponding to the mean actual linear density of the particular consignment.

9 TEST REPORT

The test report shall include the following particulars :

a) reference to this International Standard;

b) a table showing the actual linear densities of the test specimens (Tt_i);

c) the mean actual linear density of the batch or consignment together with the 95 % confidence limits;

d) the number of test specimens used and sampling procedure applied;

e) the standard deviation of individual values for all the measurements;

f) the heating time in the oven and the temperature of the muffle, if the latter differs from 625 ± 20 °C;

g) any operational details not specified in this International Standard and any other circumstances liable to have had an influence upon the results.

1) This temperature is the temperature measured at the centre of the muffle furnace with the door closed.

2) The door is left open to allow volatile products to escape from the furnace, thus preventing their redeposition on the specimen or the holder.