

INTERNATIONAL
STANDARD

ISO
4603

Second edition
1993-11-15

**Textile glass — Woven fabrics —
Determination of thickness**

Verre textile — Tissus — Détermination de l'épaisseur



Reference number
ISO 4603:1993(E)

ISO 4603:1993(E)**Foreword**

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International Standard ISO 4603 was prepared by Technical Committee ISO/TC 61, *Plastics*, Sub-Committee SC 13, *Composites and reinforcement fibres*.

This second edition cancels and replaces the first edition (ISO 4603:1978), which has been technically revised.

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International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

Textile glass — Woven fabrics — Determination of thickness

1 Scope

This International Standard specifies a method of determining the thickness of a textile-glass fabric having a thickness of 0,1 mm or more.¹⁾

This method is applicable to woven fabrics of single or folded (plied) yarns (continuous-filament textile-glass products or staple-fibre textile-glass products), rovings, textured yarns or combinations of these yarns.

For woven fabrics made from staple-fibre or textured yarns, including those with such yarns in the weft or warp only, this standard also enables the compressibility to be determined.

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 291:1977, *Plastics — Standard atmospheres for conditioning and testing.*

ISO 2602:1980, *Statistical interpretation of test results — Estimation of the mean — Confidence interval.*

1) Attention is drawn to the following International Standard: ISO 5084:1977, *Textiles — Determination of thickness of woven and knitted fabrics (other than textile floor coverings).*

3 Definition

For the purposes of this International Standard, the following definition applies.

3.1 thickness of a textile-glass fabric: The perpendicular distance, in millimetres, between the surfaces of the fabric, measured at a specified pressure.

4 Principle

Measurement of thickness of conditioned test specimens under a known pressure by means of a suitable apparatus.

5 Apparatus

5.1 Dead-weight micrometer, with two ground and lapped circular surfaces, flat to within 0,001 mm and parallel to within 0,003 mm. The faces shall move on an axis perpendicular to themselves. The measuring spindle shall be vertical. The frame of the micrometer shall be of such rigidity that a force of 15 N applied to the housing, out of contact with the pressure-foot, will produce a deflection of the frame not greater than 0,01 mm, as indicated on the micrometer read-out. The calibration gauge used to check the instrument shall be accurate to within $\pm 0,001$ mm.

The types of micrometer described in 5.1.1 and 5.1.2 may be used.

5.1.1 Electronic micrometer.

A suitable electronic micrometer with a digital read-out to 0,001 mm.

5.1.2 Dial-gauge micrometer.

The dial shall be at least 50 mm in diameter. It shall be capable of being continuously read directly to

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0,01 mm (the third decimal place can be estimated) and equipped with a counter recording the number of complete revolutions of the large pointer. The indicator mechanism shall be fully jewel-mounted.

5.2 Suitable system for loading the measuring-foot and exerting the specified pressure on the fabric (see table 1).

Table 1

Conditions of measurement	Woven fabrics of continuous single yarns and/or folded (plied) yarns and/or rovings	Woven fabrics of staple-fibre or textured yarns (including woven fabrics with one of these products in the weft or warp only)
Measuring-foot diameter (area)	56,43 mm (25 cm ²)	56,43 mm (25 cm ²)
Standard pressure	2,0 kPa (20 cN/cm ²)	—
Low pressure	—	0,5 kPa (5 cN/cm ²)
High pressure	— ¹⁾	2,0 kPa (20 cN/cm ²)

1) For some textile-glass fabrics (for example, those with high yarn density or for electrical and electronic uses), thickness measurements may be carried out at a pressure substantially higher than the standard pressure and with a measuring-foot of smaller diameter. Such measurements are made to estimate the variation in the ply thickness of laminates (cured under high pressure) produced from the fabric under test. Such pressures shall be used only by agreement between the interested parties.

5.3 Suitable tool for trimming, for example a knife or pair of scissors.

6 Test specimens

6.1 The measurements shall be made on surfaces of a textile-glass fabric without folds or deformations.

6.2 The measurements may be made:

- either on the entire fabric,
- or on a strip of fabric at least 150 mm wide taken from the entire width of the fabric (see 7.1).

7 Procedure

7.1 Make the measurements no closer than 300 mm from the beginning or end of the roll and no less than 50 mm from the edges and selvages.

In the case of bias-cut textile-glass fabric, make the measurements no closer than 50 mm from the cut edges.

7.2 Condition the test specimens for at least 6 h in a standard test atmosphere chosen from those specified in ISO 139 or ISO 291, and make the measurements in the same atmosphere.

7.3 Measure the thickness of the untensioned textile-glass fabric by means of the micrometer (5.1), in accordance with the conditions of measurement given in table 1.

Make the measurements 30 s after applying the measuring force and record the value to the nearest 0,001 mm (see 5.1.1) or 0,01 mm (see 5.1.2), in the latter case estimating the third decimal place and rounding to the nearest hundredth of a millimetre.

Make the measurements at 10 points spaced not less than 75 mm apart and evenly distributed across the width of the textile-glass fabric.

7.4 For fabrics woven from staple-fibre or textured yarns, follow the procedure specified in 7.3 but carrying out two measurements at each point (without modifying the position of the measuring-foot on the fabric) at the following pressures:

- first measurement: low pressure;
- second measurement: high pressure.

7.5 The two-sided confidence interval for the mean (as defined in ISO 2062) at the 95 % confidence level shall be less than or equal to 4 % (for fabrics woven from staple-fibre or textured yarns, calculate the confidence intervals for low-pressure and high-pressure measurements separately).

If the confidence interval is greater than 4 %, carry out the number of supplementary measurements needed to reduce it to 4 %.

8 Expression of results

The thickness of the textile-glass fabric is the arithmetic mean of the 10 (see 7.3) or more (see 7.5) measurements, expressed in millimetres to the nearest 0,001 mm (see 5.1.1) or 0,01 mm (see 5.1.2).

The thickness of fabrics woven from staple fibres and fabrics woven from textured yarns is taken as the thickness measured at low pressure.

The compressibility C , expressed as a percentage, is calculated from the equation

$$C = \frac{(h_1 - h_2) \times 100}{h_1}$$

where

h_1 is the thickness, in millimetres, at low pressure;

h_2 is the thickness, in millimetres, at high pressure.

9 Test report

The test report shall include the following particulars:

- a) a reference to this International Standard;
- b) all details necessary to identify the textile-glass fabric tested;
- c) the conditioning temperature and relative humidity used;
- d) the conditioning time, in hours;
- e) the measurement pressure used, if different from that specified;
- f) the diameter of the measuring-foot, if different from that specified;
- g) the number of measurements made, if different from that specified;
- h) the mean value of the thickness, plus the values of the individual measurements;
- i) the mean value of the compressibility (for staple-fibre and textured-yarn fabrics);
- j) any details of procedure not specified in this International Standard and any incidents that might have had an influence on the results.

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UDC 666.189.212:677.521.017.224

Descriptors: textile glass, fabrics, woven fabrics, tests, thickness measurement.

Price based on 3 pages
