INTERNATIONAL STANDARD

ISO 4604

Second edition
2011-11-15

Reinforcement fabrics — Determination of conventional flexural stiffness — Fixed-angle flexometer method

Tissus de renforcement — Détermination de la rigidité conventionnelle en flexion — Méthode du flexomètre à angle fixe

Reference number
ISO 4604:2011(E)

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Published in Switzerland

Foreword

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The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 4604 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 13, *Composites and reinforcement fibres*.

This second edition cancels and replaces the first edition (ISO 4604:1978), of which it constitutes a minor revision. The main changes are as follows:

— the scope has been broadened to cover all reinforcement fabrics (not just textile glass fabrics) and the title of the standard modified in consequence;

— the normative references clause has been updated.

Reinforcement fabrics — Determination of conventional flexural stiffness — Fixed-angle flexometer method

1 Scope

This International Standard specifies a method of determining the conventional flexural stiffness of reinforcement fabrics by means of a fixed-angle flexometer. This method is not suitable for testing fabrics that are limp or that have a marked tendency to curl or twist or fray.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 291, *Plastics — Standard atmospheres for conditioning and testing*

ISO 3374, *Reinforcement products — Mats and fabrics — Determination of mass per unit area*

3 Principle

A rectangular strip of fabric is supported on a horizontal platform in a direction perpendicular to one edge of the platform. The strip is moved in the direction of its length so that an increasing portion overhangs and bends down under its own weight. When the tip of the specimen has reached a plane passing through the edge of the platform and inclined at an angle of 41,5° below the horizontal, the overhanging length is measured.

The conventional flexural stiffness is calculated from the overhanging length of the test specimen and the mass per unit area of the fabric.

NOTE This determination of the conventional flexural stiffness is based on a report published in *Shirley Institute Memoirs*, **9** (1930), p. 81, and *Journal of the Textile Institute*, **21** (1930), T380.

4 Apparatus

4.1 Fixed-angle flexometer, the essential features of which are shown in Figure 1.

On the horizontal platform P rests a slide S, graduated on its upper surface in millimetres.

The under-surface of S is covered with a layer of high-friction antistatic material such as sheet rubber, and the upper surface of P is polished so that, when S is moved, it will carry forward a specimen placed between the slide and the platform P.

The width of the slide S shall be 25 mm and the length at least 300 mm, and its mass shall be 10 g $\pm$ 2 g per centimetre of length.

When the front edge of the slide coincides with the front edge of P, the zero of the scale on S coincides with a datum line D on the instrument. Two sighting lines, L_1 and L_2, passing through the upper forward edge of P and inclined at an angle of 41,5° below the horizontal, are inscribed on the transparent side-pieces of the instrument.

The range of the instrument is governed by its size. It shall allow the determination of the overhanging length of the specimen.

4.2 Cutting die, measuring 250 mm × 25 mm.

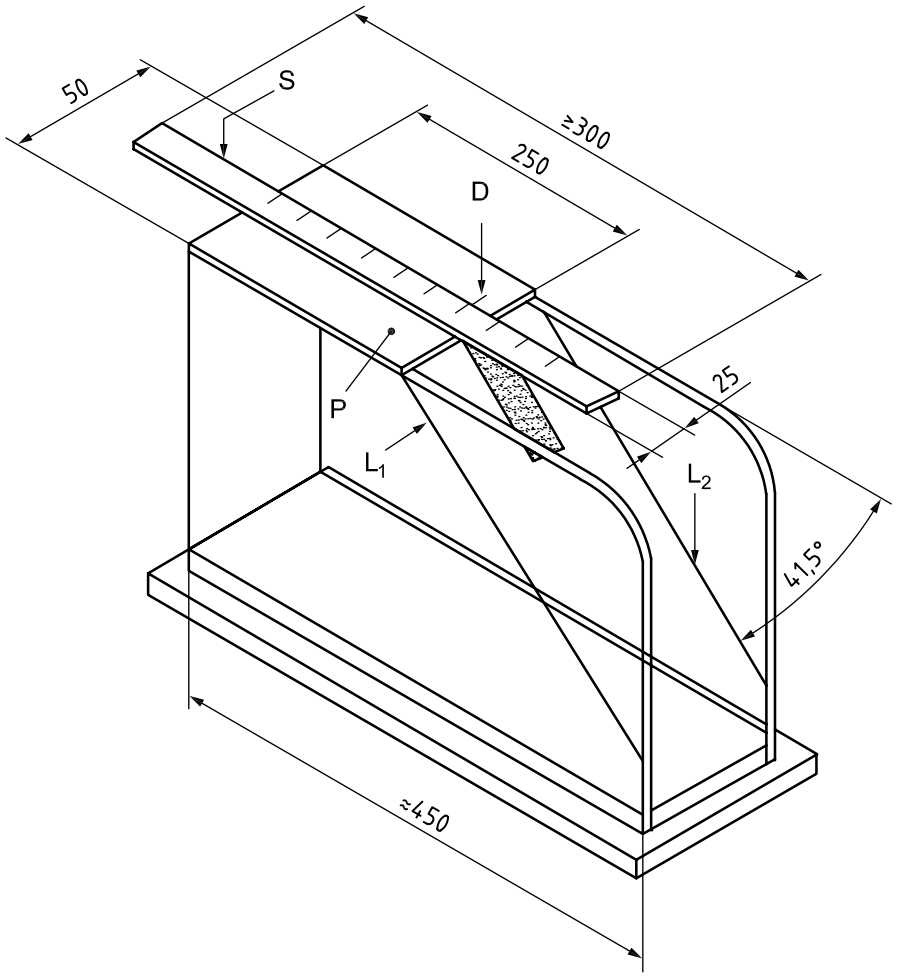
4.3 Suitable cutting device.

5 Conditioning and test atmosphere

The test specimens shall be conditioned for at least 6 h in an atmosphere chosen from those specified in ISO 291 until the mass of each specimen remains constant to within 0,25 % of its original mass when the specimen is reweighed at intervals of 2 h.

The test shall be carried out in the same atmosphere.

Dimensions in millimetres



Key

D datum line on platform
L_1 sighting line
L_2 sighting line
P platform
S slide

Figure 1 — Fixed-angle flexometer for determination of stiffness

6 Test specimens

Rectangular specimens of width 25 mm and length 250 mm shall be cut from the fabrics to be tested.

Six specimens shall be taken with their long edges parallel to the direction of the warp threads (subsequently referred to as warp specimens) and six in the perpendicular direction (subsequently referred to as weft specimens). On each test specimen, identify the fabric faces.

The specimens shall be cut so that, as far as possible, no two warp specimens contain the same warp threads and no two weft specimens contain the same weft threads.

Selvedges, end pieces and creased or folded places shall not be included in the specimens. The fabric and the specimens shall be handled as little as possible.

7 Procedure

7.1 Place the flexometer (4.1) on a level table. Place the test specimen on the platform P with one end coinciding with the front edge of the platform. Place the slide S on the specimen so that the zero of the scale is in line with the mark D. Push the slide slowly forward so that the specimen is made to project over the edge of P and bends down under its own weight. Continue to move the slide forward until the end of the specimen comes into line with the two lines L_1 and L_2.

If the specimen twists, align the mid-point of the end with L_1 and L_2.

Read the graduation on the slide S opposite the datum line D. The reading, in millimetres, is the overhanging length of the specimen.

NOTE 1 A minor readjustment of the position of the slide might have to be made immediately before this reading is taken.

NOTE 2 It will be found helpful in carrying out this procedure to place the flexometer so that the zero on the slide S lies towards the observer and at a level which enables the reading to be read with comfort. The position of the end of the specimen relative to the sighting lines can then be observed in a mirror suitably placed or attached to one side of the instrument.

7.2 Carry out the same operation with two other specimens taken in the same direction and with the same surface of the fabric upwards. Repeat with the other three specimens taken in the same direction and with the other surface of the fabric upwards.

7.3 Repeat steps 7.1 and 7.2 on the specimens taken in the other direction.

8 Expression of results

Calculate for each direction (warp or weft) of the fabric, and separately for each face, the average overhanging length l.

Using the appropriate average value, calculate the conventional flexural stiffness G separately for each face of the fabric and separately for the warp and weft directions of the fabric, using the formula

$$G = 9{,}81\,\rho_A \left(\frac{l}{2}\right)^3$$

where

ρ_A is the mass per unit area, in grams per square metre, of the fabric, determined in accordance with ISO 3374;

l is the appropriate average overhanging length, in metres;

G is the conventional flexural stiffness, in millinewton metres, for the direction and face being considered.

9 Test report

The test report shall include the following information:

a) a reference to this International Standard;

b) all details necessary for complete identification of the reinforcement fabric tested, including its construction;

c) the conditioning temperature and relative humidity chosen from ISO 291;

d) the conditioning time, in hours, if different from that specified;

e) the number of warp and weft specimens tested, if different from that specified;

f) the conventional warp flexural stiffness for each face of the fabric;

g) the conventional weft flexural stiffness for each face of the fabric;

h) details of any operations not provided for by this International Standard and of any incidents which might have had an influence upon the results;

i) the date of the test;

j) any other relevant information.

ICS 59.100.10

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