INTERNATIONAL STANDARD

ISO 20932-2

First edition
2018-11

Textiles — Determination of the elasticity of fabrics —

Part 2: Multiaxial tests

Textiles — Détermination de l'élasticité des étoffes —

Partie 2: Essais multiaxiaux

Reference number
ISO 20932-2:2018(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 38, *Textiles*, Subcommittee SC 24, *Conditioning atmospheres and physical tests for textile fabrics*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

A list of all parts in the ISO 20932 series can be found on the ISO website.

Introduction

This document was developed as a result of technical advancements in yarn and fabric structures and properties, which increase product range and developments.

This document is based on EN 14704-2[1].

Textiles — Determination of the elasticity of fabrics —

Part 2:
Multiaxial tests

1 Scope

This document specifies the test methods which can be used to measure elasticity and related properties of fabrics when they undergo a deformation of their surface. Two methods are specified: a dynamic method (method A) and a static method (method B). This document does not apply to narrow fabrics.

The results obtained cannot be compared. The choice of test method are agreed between parties and indicated in the test report.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 139, *Textiles — Standard atmospheres for conditioning and testing*

ISO 7500-1, *Metallic materials — Calibration and verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Calibration and verification of the force-measuring system*

ISO 10012, *Measurement management systems — Requirements for measurement processes and measuring equipment*

ISO 20932-1, *Textiles — Determination of the elasticity of fabrics — Part 1: Strip tests*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
narrow fabric
woven or knitted construction intended for use as a trim, binding, edging, strapping or harness, and designed to be used in its full width

[SOURCE: ISO 20932-1:2018, 3.1]

3.2
elasticity
<material> ability to recover original size and shape immediately after the removal of the force causing deformation

[SOURCE: ISO 20932-1:2018, 3.2]

3.3
constant-rate-of-extension testing machine
CRE testing machine
tensile testing machine provided with one clamp, which is stationary and another clamp, which moves with a constant speed throughout the test, the entire testing system being virtually free from deflection

[SOURCE: ISO 20932-1:2018, 3.3]

3.4
bagging
residual deformation (3.6) between the original state and the state of the surface when it has undergone a multidirectional force, which by repetition creates a "bag"

Note 1 to entry: Bagging is expressed in units of the length.

3.5
maximum deformation
deformation developed when a specified force is applied to the surface of the test specimen compared to the original state of a test specimen

Note 1 to entry: Maximum deformation is expressed in units of the length.

3.6
residual deformation
deformation after the removal of the hemispherical probe and an agreed recovery time

Note 1 to entry: Residual deformation is expressed in units of the length.

3.7
maximum force
force at the position when a test specimen is taken to a fixed distension

Note 1 to entry: Maximum force is expressed in newtons.

3.8
modulus
force measured at a given distension on either the load or unload curves

3.9
cycle
process whereby a fabric is taken from the original position to a fixed load or fixed distension and returned to the original position

4 Principle

A fabric test specimen of specified dimensions is distended at a constant rate to either a specified force or distension for an agreed number of cycles, and its elasticity determined by measuring certain characteristics.

5 Sampling

Fabric samples shall be selected in accordance with the product specification. In the absence of a product specification for the fabric, the sampling method given in Annex B may be used.

6 Atmosphere for conditioning and testing

The atmospheres for preconditioning, conditioning and testing shall be as specified in ISO 139.

The fabric samples shall be conditioned for a minimum of 20 h in a tension-free state. The prepared test specimens shall be conditioned in a tension-free state for a further 4 h after preparation, to minimize the effects of handling during preparation.

7 Preparation of test specimens

From each laboratory sample, prepare a minimum of five test specimens. For Method A, no test specimens shall be cut from within 150 mm of either edge of the laboratory sample. No test specimen taken from the sample shall contain the same ends and picks or wales and courses.

NOTE An example of a suitable pattern for cutting test specimens from the laboratory sample is given in Figure C.1.

Avoid selecting test specimens from folded or creased areas, selvedges and areas not representative of the fabric.

8 Method A — Dynamic test

8.1 Apparatus

8.1.1 **CRE testing machine**.

Metrological confirmation system of the tensile testing machine shall be in accordance with ISO 10012.

The constant-rate-of-extension (CRE) testing machine shall conform to the following.

a) The tensile testing machine shall be provided with the means for indicating or recording the force and deformation values when cycling between the original position and either a fixed load or fixed deformation. Under conditions of use, the accuracy of the apparatus shall be at least class 1 of ISO 7500-1. The error of the indicated or recorded maximum force at any point in the range in which the machine is used shall not exceed 1 % and the error of the indicated or recorded jaw separation shall not exceed 1 mm.

b) If recording of force or elongation is obtained by means of data acquisition boards and software, the frequency of data collection shall be at least eight per second.

c) The machine shall be capable of constant rates of distension including 20 mm/min to 500 mm/min, with an accuracy of ±10 %.

d) The machine shall be capable of variable gauge length settings including 0 mm to 100 mm, to an accuracy of ±1 mm.

e) The clamping ring and probe shall be positioned with the centre in line with the applied force. The machine shall be calibrated with the clamp and probe in position.

The clamping ring shall be capable of holding the test specimen without allowing it to slip and designed so that it does not cut or otherwise weaken the test specimen (see Annex D, Figures D.1 to D.3).

8.1.2 **Equipment for cutting** circular test specimens to the required dimensions.

8.1.3 **Calibrated metal rule** graduated in millimetres.

8.2 Test specimen preparation

Each test specimen shall be cut (145 ± 2) mm in diameter (see Annex C).

8.3 Procedure for loading test specimen in clamping ring

8.3.1 Position the clamping ring (key 2 in Figure D.1) onto loading base (key 7 in Figure D.1), place the test specimen face down into the ring, the face of the fabric will be visible to the operator during the test. Next locate holding ring (key 4 in Figure D.1) onto the specimen and finally locking ring (key 5 in Figure D.1) and screw down on the specimen.

8.3.2 Set the distension rate of the specimen at 200 mm/min for woven and nonwoven fabrics and 500 mm/min for knitted.

8.3.3 Fix a suitable load cell to the moving crosshead of the testing machine and then connect the probe.

8.3.4 Set the required cycling limits to cycle between the original position and 10 N (knitted and nonwoven), 50 N (woven) or 100 N (upholstery). Other loading limits can be used as agreed between parties.

8.3.5 Invert the loaded clamping ring with specimen in place onto the base unit (key 6 in Figure D.1) which has been attached onto the base of the testing machine (see Figure D.2).

8.3.6 Position the probe to give a distance of between 2 mm and 5 mm between the fabric surface and the bottom of the probe.

8.3.7 Engage the device for recording the force and deformation measurements required. Put the crosshead in motion and cycle the test specimen between the original position and the required maximum force for five cycles. During the first cycle determine the deformation at a force of 0,2 N.

If it is required to determine the unrecovered deformation, wait for 60 s after completion of the fifth cycle. Take the crosshead down for a further sixth cycle and record the deformation after cycling and recovery at a force of 0,2 N.

Many of the parameters measured can be determined by manual analysis of graphs and by software data collection procedures. It is recommended that assessment of the individual software is carried out to establish accuracy of the data collected.

8.4 Recording

8.4.1 Record the maximum deformation in millimetres at the maximum force during the fifth cycle, from the curves or data generated in the test, as agreed between the relevant parties.

8.4.2 Record the modulus at any deformation point along the load or unload curves as agreed between relevant parties.

8.5 Expressions and calculations of test results

The following values shall, where applicable, be calculated from the data recorded during the test.

Maximum deformation, S, expressed in millimetres, as shown in Formula (1).

$$S = E - L \tag{1}$$

where

E is the deformation (mm) at maximum force on the fifth cycle;

L is the original deformation at 0,2 N (mm).

Unrecovered deformation (bagging), C, expressed in mm, as shown in Formula (2).

$$C = Q - P \quad (2)$$

where

Q is the deformation at 0,2 N (mm) after a specified recovery period at the original position;

P is the original deformation take during the first cycle at 0,2 N.

8.6 Test report

The test report shall include the following information:

a) a reference to this document (i.e. ISO 20932-2:2018) and the date of test;

b) identification of test sample and sampling procedure, if required;

c) force used to record the deformation before and after cycling;

d) rate of extension used in millimetres per minute;

e) state or condition of test specimens (original, washed, aged);

f) number of test specimens, particularly if less than five;

g) diameter of test ring and probe;

h) any deviation from this procedure;

i) maximum cycling force;

j) arithmetic mean of maximum deformation in millimetres, whichever is required and for which cycle;

k) arithmetic mean of modulus, the deformation point in millimetres and cycle, when required;

l) arithmetic mean of unrecovered deformation, when required;

m) if required, the coefficient of variation for the relevant measured and calculated values;

n) if required, the 95 % confidence limits of the relevant measured and calculated values.

9 Method B — Static test

9.1 Preliminary test

9.1.1 Apparatus

CRE testing machine, as described in ISO 20932-1:2018, Method A.

9.1.2 Preparation of test specimens

Cut two specimens (50 ± 1) mm by (300 ± 1) mm, one with the longer dimension in the length direction of the fabric, and one with the longer dimension in the width direction of the fabric.

9.1.3 Procedure

Determine the maximum percentage elongation of the fabric in each direction at (30 ± 1) N, according to ISO 20932-1:2018, Method A, and record to the nearest 5 %, noting which direction has the ”higher” elongation and which has the “lower” elongation.