

BS EN 15930:2010



BSI Standards Publication

# Fibres — Elasticity of fibres — Test methods

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW

raising standards worldwide™

Copyright British Standards Institution  
Provided by IHS under license with BSI - Uncontrolled Copy  
No reproduction or networking permitted without license from IHS

Not for Resale



National foreword

This British Standard is the UK implementation of EN 15930:2010.

The UK participation in its preparation was entrusted to Technical Committee TCI/24, Physical testing of textiles.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© BSI 2010

ISBN 978 0 580 66784 8

ICS 59.060.01

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 December 2010.

Amendments issued since publication

Date	Text affected
<hr/>	



EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 15930**

September 2010

ICS 59.060.01

English Version

**Fibres - Elasticity of fibres - Test methods**

Fibres - Elasticité des fibres - Méthodes d'essais

Fasern - Elastizität von Fasern - Prüfung

This European Standard was approved by CEN on 7 August 2010.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

**Management Centre: Avenue Marnix 17, B-1000 Brussels**

© 2010 CEN All rights of exploitation in any form and by any means reserved  
worldwide for CEN national Members.

Ref. No. EN 15930:2010: E

Contents		Page
Foreword.....		3
1	Scope .....	4
2	Normative references.....	4
3	Terms and definitions .....	4
4	Principle.....	5
5	Apparatus .....	5
6	Atmosphere of conditioning and testing .....	6
7	Sampling.....	6
8	Preparation of the test specimens.....	6
9	Procedure .....	7
10	Calculation and expression of the results .....	11
11	Test report .....	12
Annex A (normative) "Elastic" qualification of fibres.....		14
Bibliography.....		15

## Foreword

This document (EN 15930:2010) has been prepared by Technical Committee CEN/TC 248 “Textiles and textile products”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2011, and conflicting national standards shall be withdrawn at the latest by March 2011.

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

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

BSI  
British Standards Institution  
11, South Molton Street  
London W1K 2FQ, UK  
Tel: +44 (0)20 8996 9001  
Fax: +44 (0)20 8996 7001  
Email: bs.enquiries@bsi.org.uk  
Website: www.bsi.org.uk



## **1 Scope**

This test method covers the determination of the elasticity of fibres and may lead to classification of the fibre as elastic fibre (see Annex A).

It is applicable to single man-made crimped and uncrimped fibres.

## **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.

EN 12751, *Textiles — Sampling of fibres, yarns and fabrics for testing*

EN ISO 139, *Textiles — Standard atmospheres for conditioning and testing (ISO 139:2005)*

EN ISO 1973, *Textile fibres — Determination of linear density — Gravimetric method and vibroscope method (ISO 1973:1995)*

EN ISO 7500-1, *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Verification and calibration of the force-measuring system (ISO 7500-1:2004)*

## **3 Terms and definitions**

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

### **3.1**

#### **elasticity**

property of a fibre by virtue of which it tends to recover its original size and shape immediately after the removal of the force causing deformation

### **3.2**

#### **linear density**

mass per unit length of an essentially linear structure

### **3.3**

#### **constant-rate-of-extension (CRE) testing machine**

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

### **3.4**

#### **gauge length**

distance between the two effective clamping or holding points of a testing device

### **3.5**

#### **initial length**

length of the test specimen between the two effective clamping or holding points at the required pretension, before testing





### 3.6

#### **extension**

increase in length of a test specimen expressed in units of length e.g. millimetres

### 3.7

#### **elongation**

ratio of the extension of the test specimen to its initial length, expressed as a percentage

### 3.8

#### **maximum force**

force recorded in Newton at the position when a test specimen is taken to a fixed extension

### 3.9

#### **cycle**

process whereby a fibre is taken from the gauge length to fixed extension or elongation and returned to gauge length

### 3.10

#### **elastic recovery**

recovered elongation expressed as a percentage of the specified elongation

### 3.11

#### **permanent deformation**

ratio of un-recovered extension of the test specimen after cycling to its initial length, expressed as a percentage

### 3.12

#### **force decay**

loss of force measured over time when a test specimen is stretched to a specified elongation or extension and held at this position for a given time period

## 4 Principle

The measurements are performed on an individual fibre.

A fibre is cycled between the gauge length and a specified elongation at a constant rate for an agreed number of cycles. The fibre can be maintained at the specified elongation or at the gauge length – for a specific period of time. Its elasticity is determined by measuring certain physical characteristics.

## 5 Apparatus

### 5.1 Pretension device

Pretension device able to apply  $(0,010 \pm 0,005)$  cN/tex on the individual test specimen.

NOTE Pretension may be applied using masses with discontinuous values (e.g. adhesive paper or clips) or using a high-resolution load cells.

### 5.2 Tensile testing machine

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 elongation values when cycling between gauge length and either a fixed load or fixed extension. Under conditions of use, the accuracy of the apparatus shall be at least class 1 of EN 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 extension from  $(20,0 \pm 0,5)$  mm/min to  $(50,0 \pm 0,5)$  mm/min.
- d) The machine shall be capable of variable gauge length settings from  $(20,0 \pm 0,5)$  mm to  $(50,0 \pm 0,5)$  mm.
- e) The clamping or holding devices shall be positioned with the centre in line with the applied force.

The jaws shall be capable of holding the test specimen without allowing it to slip and designed so that they do not cut or otherwise weaken the test specimen.

## **6 Atmosphere of conditioning and testing**

Samples shall be conditioned in a tension free state for at least 16 h in the standard atmosphere according to EN ISO 139.

Testing shall be performed in this standard atmosphere.

## **7 Sampling**

The sampling of the fibres to be tested from staple fibres, from yarns or from fabrics shall be according to EN 12751.

## **8 Preparation of the test specimens**

### **8.1 Preparation from staples**

In order to isolate one fibre first open very carefully the sample in a direction perpendicular to the local fibre orientation, taking care to apply the force at two points sufficiently distant to allow free fibre movements necessary to disentangle the fibre mass.

In the middle of the small web thus created extract one fibre by using tweezers. There shall be no resistance.

If there is any entanglement, first open this entanglement by pulling the fibres sideways before extracting.

Avoid stretching a fibre, even lightly, by drawing it by one of its ends.

Once separated, the fibre can be pinched at one of its ends for handling.

### **8.2 Preparation from yarns**

For all types of yarns (e.g. monofilament or fused multifilament alone, fused multifilament in core spun – e.g. elastane -, multifilament, etc.), take randomly at least five lengths (approx. 20 cm) from the yarn package.

### 8.3 Preparation from fabrics

For all types of fabric, remove at least five threads (approx. 20 cm) in the production direction (i.e. warp direction for woven fabric, wales' direction for knitted fabric) and/or in the perpendicular production direction (i.e. weft direction for woven fabric and courses' direction for knitted fabric).

## 9 Procedure

### 9.1 Determination of the linear density

Determine the linear density testing according to EN ISO 1973 using only the gravimetric method.

NOTE In the case of crimped fibres, the crimp should be removed in order to determine the length.

### 9.2 Number of results for determination of the elasticity properties

Determine at least five results.

### 9.3 Determination of the pretension

Based on the determination of the linear density, calculate the pretension force to be applied using a pretension of 0,01 cN/tex.

When applicable (in the case of the use of discontinuous values of pretension masses), choose the nearest pretension mass to fix onto the fibre in vertical position.

### 9.4 Determination of the elasticity

#### 9.4.1 General

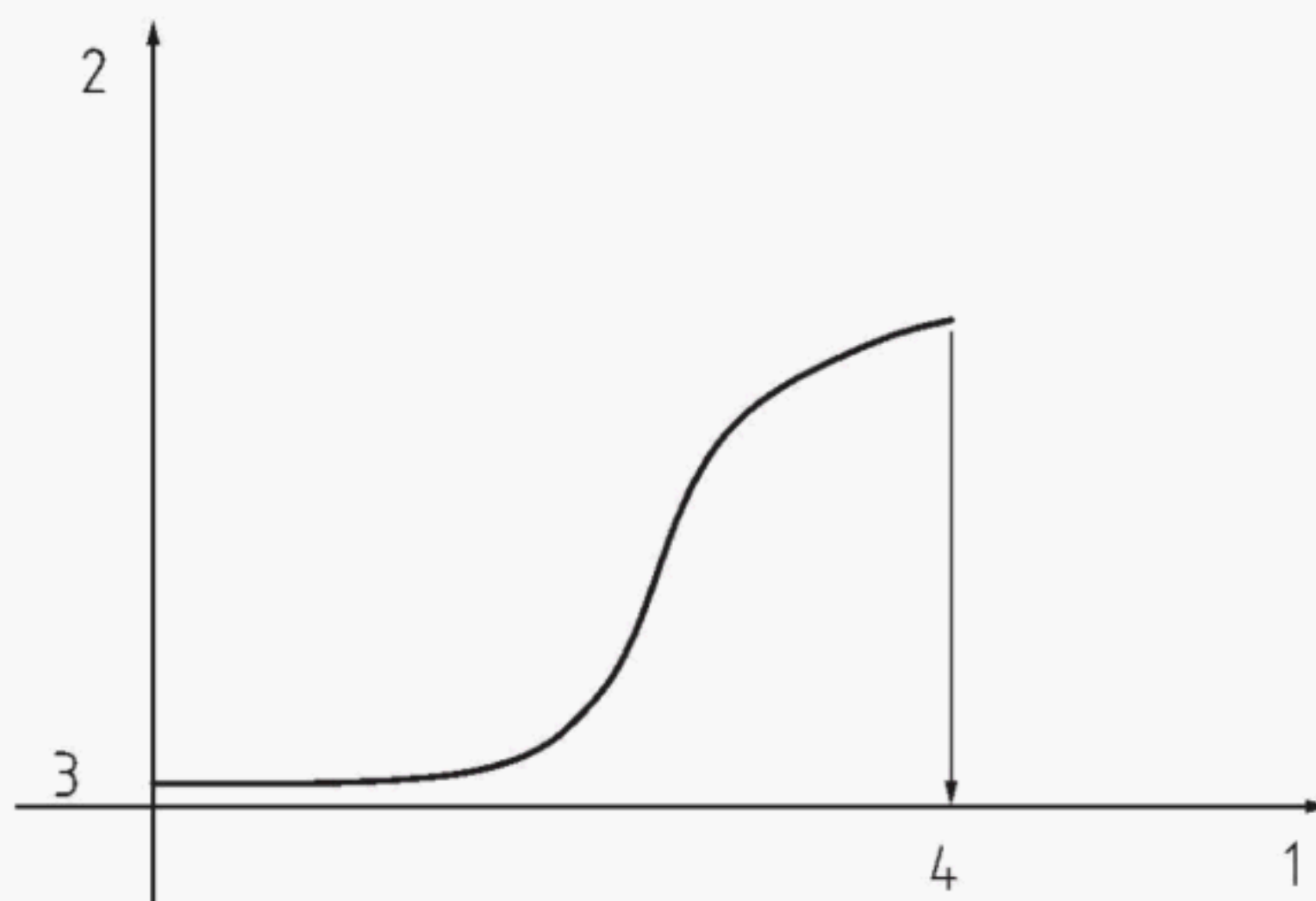
Set the gauge length to 50 mm. If it cannot be achieved, then set to 20 mm.

Set the testing speed at 100 % of the gauge length/minute (i.e. 50 mm/min for gauge length 50 mm).

Zero the load cell with the grips in position and the jaw faces closed, prior to testing.

NOTE See Figure 1 for illustration of the elongation-force curve and the position of the pretension point.





#### Key

- 1 extension (mm) axis
- 2 force (cN) axis
- 3 pretension (cN)
- 4  $E_{\text{spec}}$

**Figure 1 — Example of force/elongation curve**

### 9.4.2 Determination of the elasticity with exercising

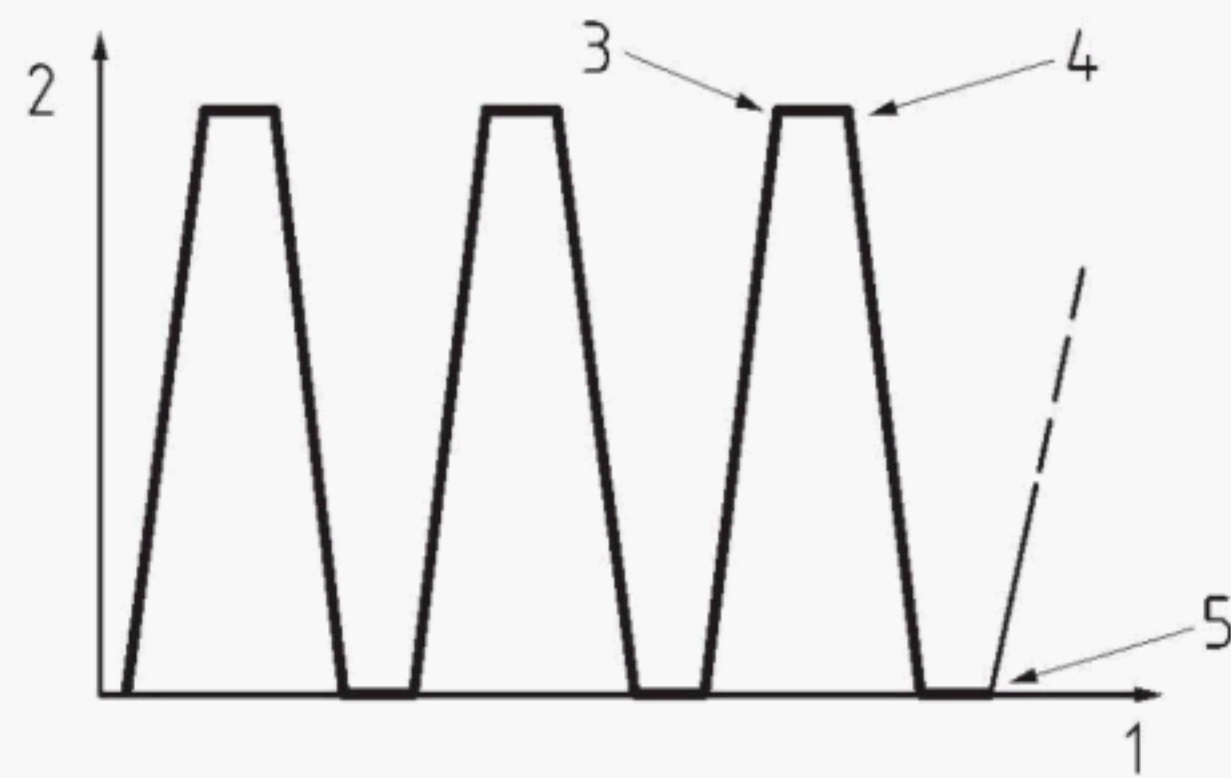
#### 9.4.2.1 Description of the cycles

The fibre is extended at a constant rate to a specified elongation and is maintained for a specified time, then the fibre is relaxed to the initial length and maintained for the same specified time.

This cycle is applied again 2 times (Figure 2 illustrates the cycles by the curve extension in function of time).

A 4<sup>th</sup> load cycle is applied past the specified pretension in order to determine the recovery extension  $E_{\text{rec}}$  (Figure 3 illustrates this point).

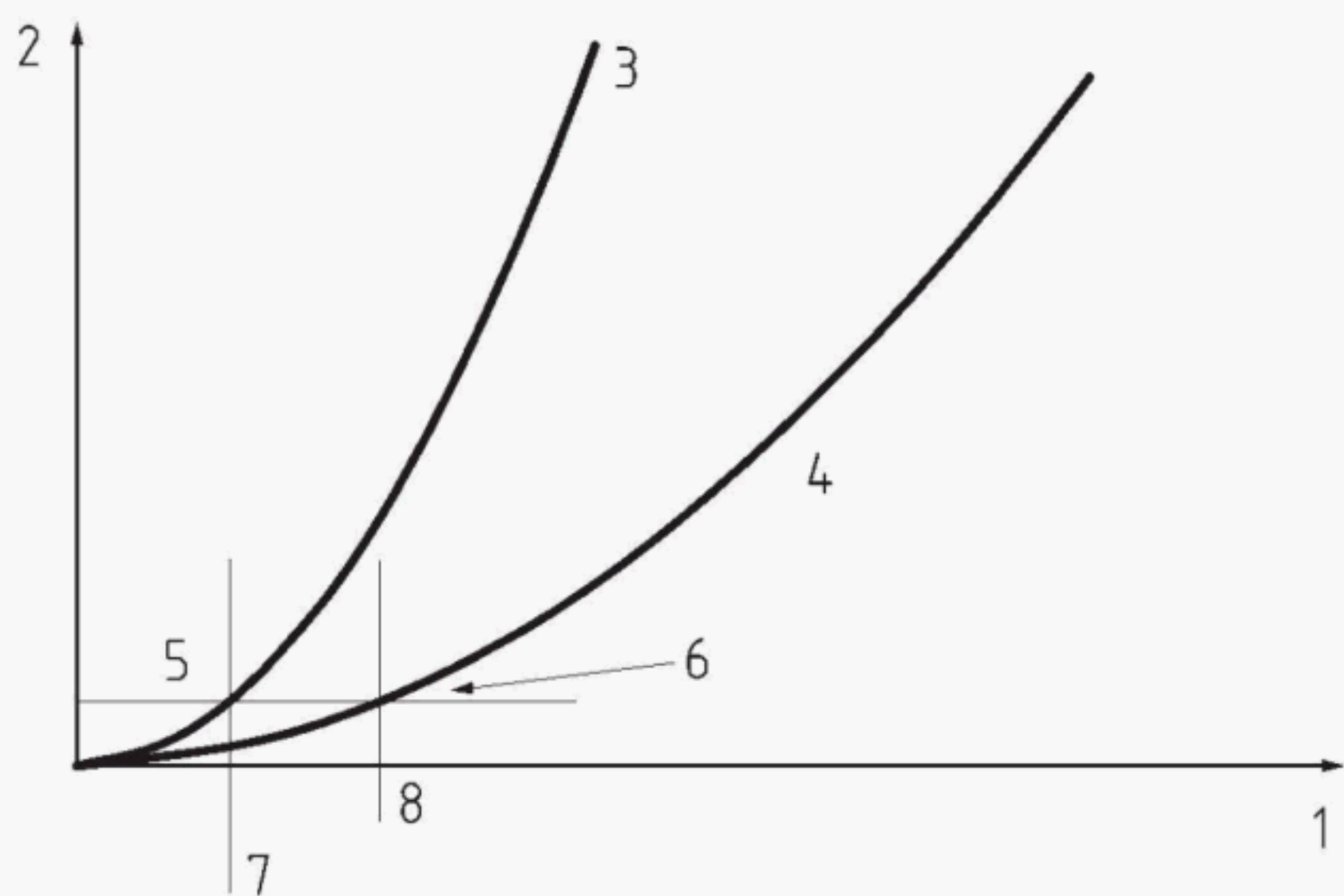
If the force decay is required, the 3<sup>rd</sup> cycle is taken into account for the calculation (Figure 4 illustrates this determination).



**Key**

- 1 time (s) axis
- 2 extension (mm) axis
- 3  $F_1$
- 4  $F_2$
- 5 point "P"

**Figure 2 — Curve extension in function of the time**

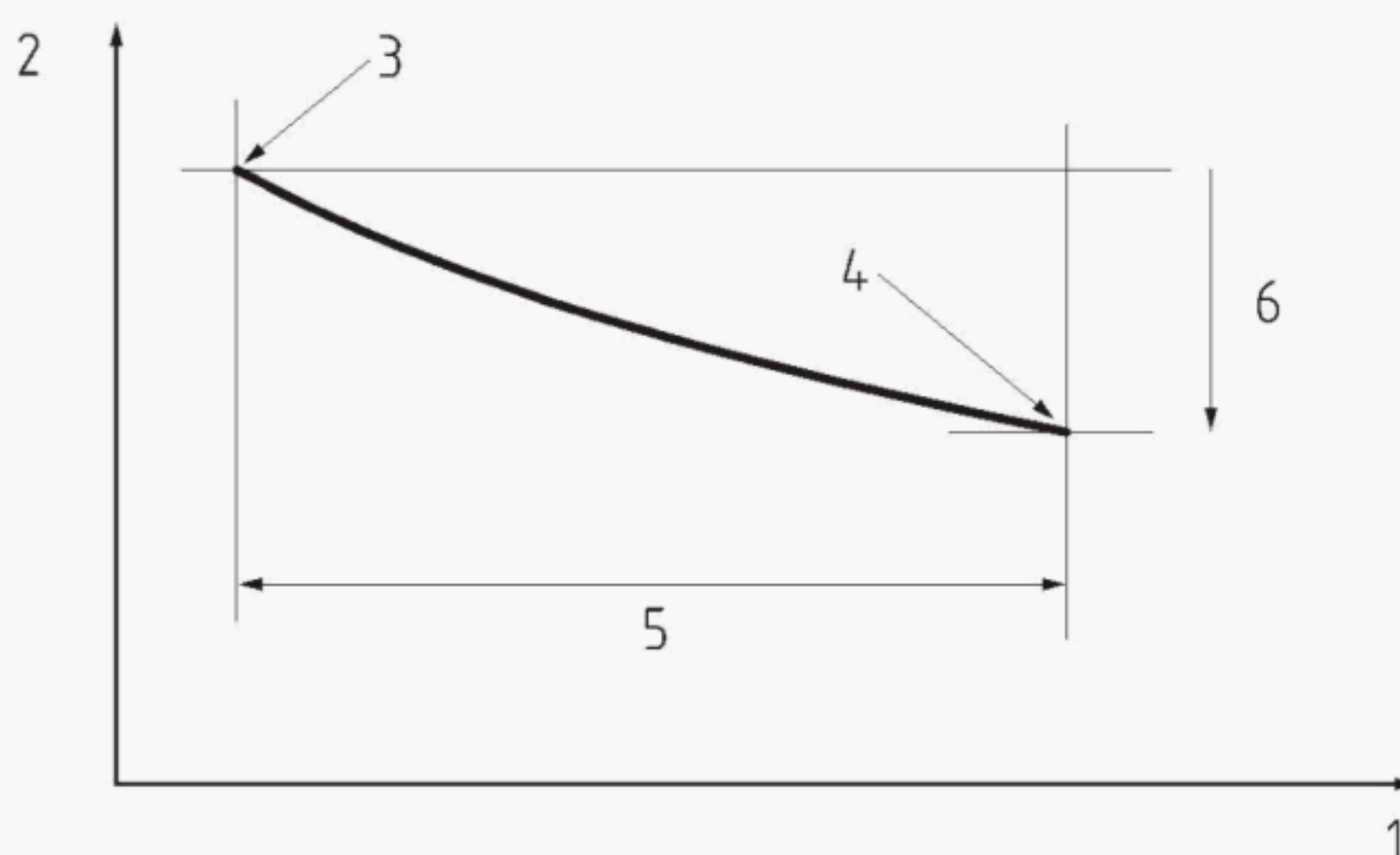


**Key**

- 1 extension (mm) axis
- 2 force (cN) axis
- 3 1<sup>st</sup> cycle (beginning)
- 4 4<sup>th</sup> cycle (beginning)
- 5 pretension
- 6 point "P"
- 7 initial length
- 8  $E_{rec}$

**Figure 3 — Determination of the extension  
(regarding Point "P" at the pretension force) on the 4<sup>th</sup> cycle**





#### Key

- 1 time (s) axis
- 2 force (cN) axis
- 3  $F_1$
- 4  $F_2$
- 5 specified times (s)
- 6 force decay

**Figure 4 — Determination of the force decay at the 3<sup>rd</sup> cycle**

#### 9.4.2.2 Setting of the testing parameters

Set the following testing parameters:

- specified elongation at 50 % (i.e. for a gauge length of 50 mm, specified elongation of 50 % represents 25 mm);
- specified time at 60 s;
- specified pretension at 0,01 cN/tex.

## 10 Calculation and expression of the results

### 10.1 Calculation of the elastic recovery

Elastic recovery is calculated according to the following formula:

$$\text{Elastic Recovery} = \frac{E_{\text{spec}} - E_{\text{rec}}}{E_{\text{spec}}} \times 100, \text{ expressed in percentage,}$$

where

$E_{\text{spec}}$  is the specified extension of the fibre, expressed in mm,

$E_{\text{rec}}$  is the extension determined at the specified pretension on the 4<sup>th</sup> cycle (recovery extension), expressed in mm.

Based on the individual values, calculate the arithmetic mean value and the standard deviation.

## 10.2 Calculation of the permanent deformation

Permanent deformation is calculated according to the following formula:

$$\text{Permanent Deformation} = \frac{E_{\text{rec}}}{L_{\text{init}}} \times 100, \text{ expressed in percentage,}$$

where,

$E_{\text{rec}}$  is the extension determined at the specified pretension on the 4<sup>th</sup> cycle (recovery extension), expressed in mm,

$L_{\text{init}}$  is the initial length at the specified pretension on the 1<sup>st</sup> cycle, expressed in mm.

Based on the individual values, calculate the arithmetic mean value and the standard deviation.

## 10.3 Calculation of the force decay (optional)

Force decay is calculated according to the following formula:

$$\text{Force Decay} = \frac{F_1 - F_2}{F_1} \times 100, \text{ expressed in percentage,}$$

where,

$F_1$  is the first force at the maximum extension on the 3<sup>rd</sup> cycle (measured at 1 s after the beginning of the 3<sup>rd</sup> cycle), expressed in cN,

$F_2$  is the last force at the maximum extension on the 3<sup>rd</sup> cycle (measured at 1s before the end of the specified time of the 3<sup>rd</sup> cycle), expressed in cN.

Based on the individual values, calculate the arithmetic mean value and the standard deviation.

## 11 Test report

The test report shall include the following information:

- a) Reference to this standard;
- b) All details necessary for complete identification of the sample tested;



- c) Description of the sampling procedure;
- d) Testing parameters applied;
- e) Pretension used;
- f) Elastic recovery: individual, mean and standard deviation values;
- g) Permanent deformation: individual, mean and standard deviation values;
- h) If required, Force decay: individual, mean and standard deviation values;
- i) Any deviation by agreement or otherwise from the procedure specified.

13

## Annex A

(normative)

### "Elastic" qualification of fibres

Based on the testing results, the tested fibre can be qualified as an "elastic" fibre, when it is extended under a tensile force until reaching 1,5 times its initial length (i.e. elongation of 50 %), comes back quickly and substantially to its initial length as soon as the tensile force ceases being applied.

"Substantially" means that the elastic recovery,  $E_{\text{rec}}$ , shall be more than 80 %.





## Bibliography

- [1] REPORT (Administrative Arrangement N. 2003-21200) "Fibre labelling - Elastomultiester – DuPont", Ref. EUR 21760 EN: 2005 - Analysis conducted on behalf of DG ENTERPRISE, European Commission.
- [2] REPORT (Administrative Arrangement N. 2004-22595) "Fibre labelling - Elastolefin – Dow Chemical", Ref. EUR 22308 EN: 2006 - Analysis conducted on behalf of DG ENTERPRISE, European Commission.
- [3] EN ISO 5079, *Textiles — Fibres — Determination of breaking force and elongation at break of individual fibres (ISO 5079:1995)*
- [4] EN 14704-1, *Determination of the elasticity of fabrics — Part 1: Strip tests*
- [5] EN 14704-2, *Determination of the elasticity of fabrics — Part 2: Multiaxial tests*
- [6] EN 14704-3, *Determination of the elasticity of fabrics — Part 3: Narrow fabrics*



Copyright British Standards Institution



# British Standards Institution (BSI)

BSI is the independent national body responsible for preparing British Standards and other standards-related publications, information and services.

It presents the UK view on standards in Europe and at the international level.

It is incorporated by Royal Charter.

## Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover.

Tel: +44 (0)20 8996 9001 Fax: +44 (0)20 8996 7001

BSI offers Members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Tel: +44 (0)20 8996 7669 Fax: +44 (0)20 8996 7001  
Email: [plus@bsigroup.com](mailto:plus@bsigroup.com)

## Buying standards

You may buy PDF and hard copy versions of standards directly using a credit card from the BSI Shop on the website [www.bsigroup.com/shop](http://www.bsigroup.com/shop). In addition all orders for BSI, international and foreign standards publications can be addressed to BSI Customer Services.

Tel: +44 (0)20 8996 9001 Fax: +44 (0)20 8996 7001  
Email: [orders@bsigroup.com](mailto:orders@bsigroup.com)

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

## Information on standards

BSI provides a wide range of information on national, European and international standards through its Knowledge Centre.  
Tel: +44 (0)20 8996 7004 Fax: +44 (0)20 8996 7005  
Email: [knowledgecentre@bsigroup.com](mailto:knowledgecentre@bsigroup.com)

Various BSI electronic information services are also available which give details on all its products and services.

Tel: +44 (0)20 8996 7111 Fax: +44 (0)20 8996 7048  
Email: [info@bsigroup.com](mailto:info@bsigroup.com)

BSI Subscribing Members are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration.

Tel: +44 (0)20 8996 7002 Fax: +44 (0)20 8996 7001  
Email: [membership@bsigroup.com](mailto:membership@bsigroup.com)

Information regarding online access to British Standards via British Standards Online can be found at [www.bsigroup.com/BSOL](http://www.bsigroup.com/BSOL)

Further information about BSI is available on the BSI website at [www.bsigroup.com/standards](http://www.bsigroup.com/standards)

## Copyright

Copyright subsists in all BSI publications. BSI also holds the copyright, in the UK, of the publications of the international standardization bodies.

Except as permitted under the Copyright, Designs and Patents Act 1988 no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, photocopying, recording or otherwise – without prior written permission from BSI. This does not preclude the free use, in the course of implementing the standard of necessary details such as

symbols, and size, type or grade designations. If these details are to be used

for any other purpose than implementation then the prior written permission

of BSI must be obtained. Details and advice can be obtained from the Copyright & Licensing Manager.

Tel: +44 (0)20 8996 7070  
Email: [copyright@bsigroup.com](mailto:copyright@bsigroup.com)

### BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

Tel +44 (0)20 8996 9001  
Fax +44 (0)20 8996 7001  
[www.bsigroup.com/standards](http://www.bsigroup.com/standards)



raising standards worldwide™

Copyright British Standards Institution  
Provided by IHS under license with BSI - Uncontrolled Copy  
No reproduction or networking permitted without license from IHS

Not for Resale