

# INTERNATIONAL STANDARD

**ISO**  
**527-3**

First edition  
1995-08-01

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## **Plastics — Determination of tensile properties —**

### **Part 3:**

Test conditions for films and sheets

*Plastiques — Détermination des propriétés en traction —  
Partie 3: Conditions d'essai pour films et feuilles*



Reference number  
ISO 527-3:1995(E)

## 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.

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.

International Standard ISO 527-3 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 11, *Products*.

Together with the other parts of ISO 527, it cancels and replaces ISO Recommendation R/527:1966, as well as ISO 1184:1983, of which it constitutes a technical revision.

ISO 527 consists of the following parts, under the general title *Plastics — Determination of tensile properties*:

- *Part 1: General principles*
- *Part 2: Test conditions for moulding and extrusion plastics*
- *Part 3: Test conditions for films and sheets*
- *Part 4: Test conditions for isotropic and orthotropic fibre-reinforced plastic composites*
- *Part 5: Test conditions for unidirectional fibre-reinforced plastic composites*

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

Printed in Switzerland

# Plastics — Determination of tensile properties —

## Part 3:

### Test conditions for films and sheets

#### 1 Scope

**1.1** This part of ISO 527 specifies the conditions for determining the tensile properties of plastic films or sheets less than 1 mm thick, based upon the general principles given in part 1.

NOTE 1 For sheets greater than 1 mm thick, the user is referred to part 2 of this International Standard.

**1.2** See ISO 527-1, subclause 1.2.

**1.3** This part of ISO 527 is not normally suitable for determining the tensile properties of:

- a) cellular materials;
- b) plastics reinforced by textile fibres.

**1.4** See ISO 527-1, subclause 1.5.

#### 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 527. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 527 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 527-1:1993, *Plastics — Determination of tensile properties — Part 1: General principles*.

ISO 4591:1992, *Plastics — Film and sheeting — Determination of average thickness of a sample, and average thickness and yield of a roll, by gravimetric techniques (gravimetric thickness)*.

ISO 4593:1993, *Plastics — Film and sheeting — Determination of thickness by mechanical scanning*.

#### 3 Principle

See ISO 527-1, clause 3.

#### 4 Definitions

See ISO 527-1, clause 4.

#### 5 Apparatus

See ISO 527-1, clause 5, subject to the following additional requirements:

In 5.1.2, the tensile-testing machine shall be capable of maintaining the speeds of testing as specified in table 1 of ISO 527-1. It is normal for films and sheets to be tested at a speed of 5 mm/min, 50 mm/min, 100 mm/min, 200 mm/min, 300 mm/min or 500 mm/min. The information contained in ISO 527-1, subclause 9.6, also applies.

In 5.1.5, when testing thin sheets or film material, the specimen shall not carry the weight of the extensometer.

In 5.2, devices complying with the requirements in ISO 4593 shall be used for measuring the thickness, except in the case of very thin film (less than 0,01 mm thick) or embossed film. In those cases, the thickness shall be determined by the method specified in ISO 4591. When ISO 4591 is used, the average thickness of the film sample shall be taken as the thickness of the test specimen.

## 6 Test specimens

### 6.1 Shape and dimensions

**6.1.1** The preferred form of test specimen for the determination of tensile properties by this method is a strip 10 mm to 25 mm wide and not less than 150 mm long (specimen type 2 — see figure 1),

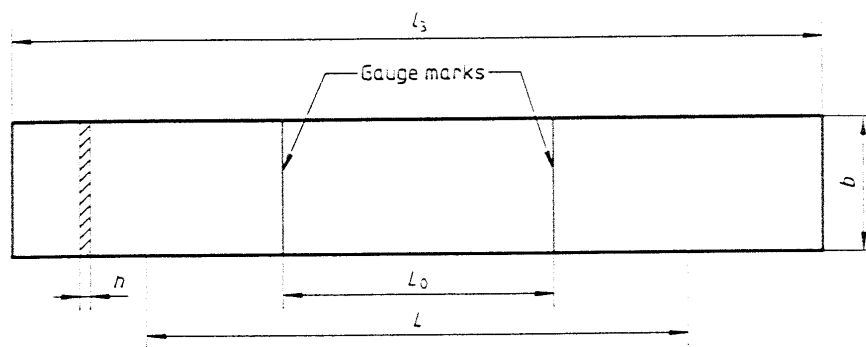
having two parallel gauge marks, 50 mm apart, on the central portion of the specimen.

Some film materials have a very high elongation at break which may result in them being outside the stretching capacity of the testing machine. In such cases, it is permissible to reduce the initial distance between the grips to 50 mm.

**6.1.2** When required by the specification for the material under test or for routine quality-control tests, dumb-bell specimen types 5, 1B and 4 of the shape and dimensions shown in figures 2, 3 and 4 may be used. These specimens are convenient to produce and permit rapid quality-control testing.

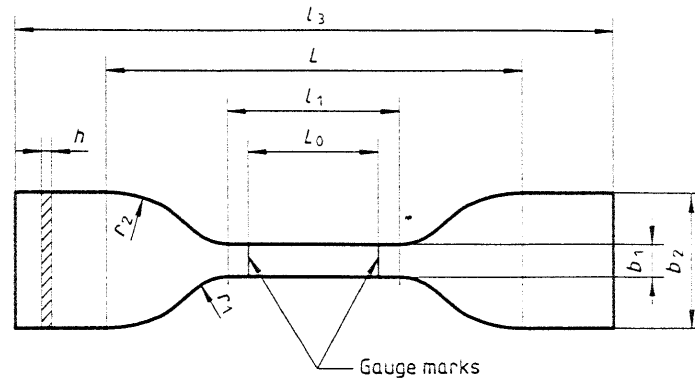
Specimen type 5 (figure 2) is recommended for film and sheet with a very high strain at break. Specimen type 4 is recommended for other types of flexible thermoplastic sheet.

Specimen type 1B (figure 3) is recommended for rigid sheets.



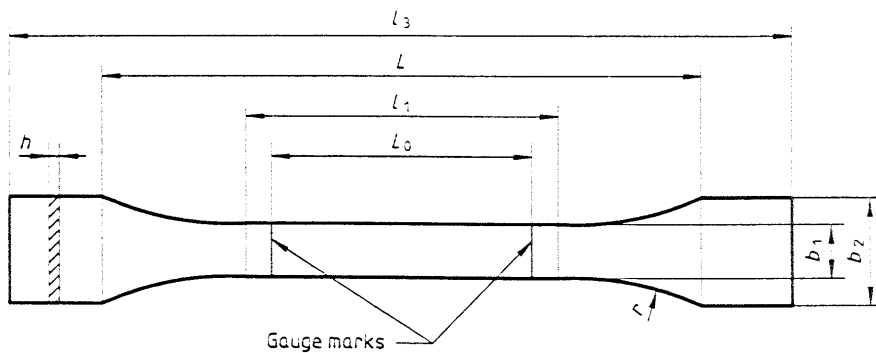
- $b$  Width: 10 mm to 25 mm
- $h$  Thickness:  $\leq 1$  mm
- $L_0$  Gauge length:  $50 \text{ mm} \pm 0,5 \text{ mm}$
- $L$  Initial distance between grips:  $100 \text{ mm} \pm 5 \text{ mm}$
- $L_3$  Overall length:  $\geq 150 \text{ mm}$

Figure 1 — Specimen type 2



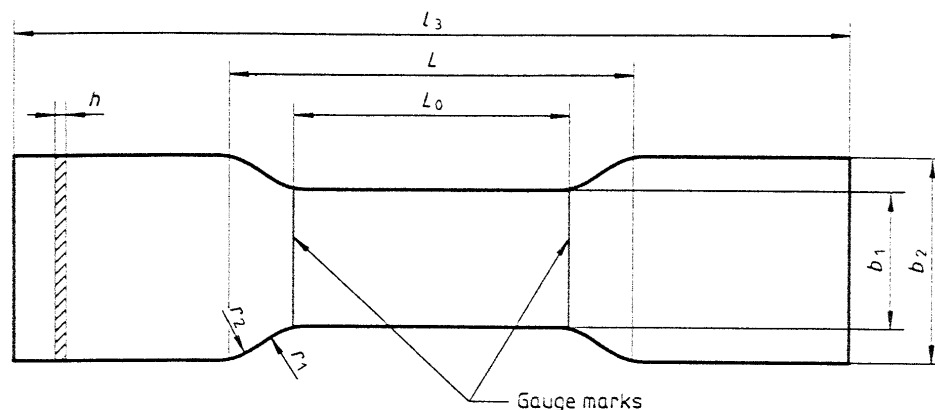
- $b_1$  Width of narrow parallel-sided portion:  $6 \text{ mm} \pm 0,4 \text{ mm}$
- $b_2$  Width at ends:  $25 \text{ mm} \pm 1 \text{ mm}$
- $h$  Thickness:  $\leq 1 \text{ mm}$
- $L_0$  Gauge length:  $25 \text{ mm} \pm 0,25 \text{ mm}$
- $l_1$  Length of narrow parallel-sided portion:  $33 \text{ mm} \pm 2 \text{ mm}$
- $L$  Initial distance between grips:  $80 \text{ mm} \pm 5 \text{ mm}$
- $l_3$  Overall length:  $\geq 115 \text{ mm}$
- $r_1$  Small radius:  $14 \text{ mm} \pm 1 \text{ mm}$
- $r_2$  Large radius:  $25 \text{ mm} \pm 2 \text{ mm}$

Figure 2 — Specimen type 5



- $b_1$  Width of narrow parallel-sided portion:  $10 \text{ mm} \pm 0,2 \text{ mm}$
- $b_2$  Width at ends:  $20 \text{ mm} \pm 0,5 \text{ mm}$
- $h$  Thickness:  $\leq 1 \text{ mm}$
- $L_0$  Gauge length:  $50 \text{ mm} \pm 0,5 \text{ mm}$
- $l_1$  Length of narrow parallel-sided portion:  $60 \text{ mm} \pm 0,5 \text{ mm}$
- $L$  Initial distance between grips:  $115 \text{ mm} \pm 5 \text{ mm}$
- $l_3$  Overall length:  $\geq 150 \text{ mm}$
- $r$  Radius:  $\geq 60 \text{ mm}$

Figure 3 — Specimen type 1B



- $b_1$  Width of narrow parallel-sided portion: 25,4 mm  $\pm$  0,1 mm
- $b_2$  Width at ends: 38 mm
- $h$  Thickness:  $\leq$  1 mm
- $L_0$  Gauge length: 50 mm  $\pm$  0,5 mm
- $L$  Initial distance between grips: 73,4 mm
- $l_3$  Overall length: 152 mm
- $r_1$  Small radius: 22 mm
- $r_2$  Large radius: 25,4 mm

Figure 4 — Specimen type 4

## 6.2 Preparation of specimens

**6.2.1** The test specimens described in 6.1.1 shall be cut or punched so that the edges are smooth and free from notches; examination with a low-power magnifier is recommended to check the absence of notches. Razor blades, suitable paper cutters, scalpels or other devices capable of cutting the specimens to the proper width and producing straight, clean, parallel edges with no visible imperfections shall be used. Punch dies shall be kept sharp by regular honing, and a suitable backing material shall be used with punch dies to ensure a clean-cut edge.

**6.2.2** The test specimens described in 6.1.2 shall be obtained by the use of punch dies, using suitable backing material to ensure a clean-cut edge. Dies shall be kept sharp by regular honing, and the edges of the specimen shall be examined with a low-power magnifier to ensure the absence of notches. Discard any specimen with obvious imperfections on the cut edges.

## 6.3 Gauge marks

See ISO 527-1, subclause 6.3.

The marking device used to produce the gauge marks shall have two parallel edges which are ground smooth and true, 0,05 mm to 0,10 mm wide at the edge and bevelled at an angle of not more than 15°. An ink stamp may also be used to apply ink to the area of the gauge marks, before or after producing them with the marking device, using an ink of a suitable contrasting colour that has no deleterious effect on the film being tested.

## 6.4 Checking the specimens

Discard any test specimen with obvious imperfections on the cut edges.

## 6.5 Anisotropy

The properties of certain types of film material may vary with direction in the plane of the film (anisotropy). In such cases, it is essential to prepare two groups

of test specimens with their major axes respectively parallel and perpendicular to the direction of orientation of the film.

**7 Number of specimens**

See ISO 527-1, clause 7.

**8 Conditioning**

See ISO 527-1, clause 8.

**9 Procedure**

See ISO 527-1, clause 9.

**10 Calculation and expression of results**

See ISO 527-1, clause 10, except for "10.3 Modulus calculation", and "10.4 Poisson's ratio,  $\mu$ ".

**11 Precision**

The precision of the test method is not known because inter-laboratory data are not available. When inter-laboratory data are obtained, a precision statement will be added at the following revision.

**12 Test report**

The test report shall include the following information:

- a) a reference to this part of ISO 527, including the type of specimen and the test speed, written in the following format:

Tensile test ISO 527-3/1B/50  
 Type of specimen \_\_\_\_\_  
 Test speed in millimetres per minute \_\_\_\_\_

- b) to q) see ISO 527-1, clause 12, b) to q).



Published 2001-04-15

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

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R N 86 1

## Plastics — Determination of tensile properties —

### Part 3: Test conditions for films and sheets

#### TECHNICAL CORRIGENDUM 2

*Plastiques — Détermination des propriétés en traction —  
Partie 3: Conditions d'essai pour films et feuilles*

*RECTIFICATIF TECHNIQUE 2*

Technical Corrigendum 2 to International Standard ISO 527-3:1995 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 11, *Products*.

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**Figure 3** (last line of key)

After “*r* Radius:  $\geq 60$  mm”, add “(recommended radius:  $60,0 \text{ mm} \pm 0,5 \text{ mm}$ )”.





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## Plastics — Determination of tensile properties —

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#### TECHNICAL CORRIGENDUM 1

*Plastiques — Détermination des propriétés en traction —*

*Partie 3: Conditions d'essai pour films et feuilles*

*RECTIFICATIF TECHNIQUE 1*

Technical Corrigendum 1 to International Standard ISO 527-3:1995 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 2, *Mechanical properties*.

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#### Figure 4

Correct the value of  $L$  (initial distance between grips) from 73,4 mm to 98 mm.

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**ICS 83.140**

**Descriptors:** plastics, films, plastic sheets, tests, determination, tensile properties, testing conditions, test specimens.

Price based on 5 pages

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