SLOVENSKI STANDARD
oSIST prEN ISO 527-1:2018

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Polimerni materiali - Ugotavljanje nateznih lastnosti - 1. del: Splošna načela (ISO/DIS 527-1:2018)

Plastics - Determination of tensile properties - Part 1: General principles (ISO/DIS 527-1:2018)

Kunststoffe - Bestimmung der Zugeigenschaften - Teil 1: Allgemeine Grundsätze (ISO/DIS 527-1:2018)

Plastiques - Détermination des propriétés en traction - Partie 1: Principes généraux (ISO/DIS 527-1:2018)

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Plastics — Determination of tensile properties —

Part 1:
General principles

Plastiques — Détermination des propriétés en traction —

Partie 1: Principes généraux

ICS: 83.080.01

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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

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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 61, *Plastics*, Subcommittee SC 2, *Mechanical properties.*

This third edition cancels and replaces the second edition (ISO 527-1:2012), which has been technically revised.

The main changes compared to the previous edition are as follows:

— An error in Fig 1 concerning ε_{tM} has been has been removed;

— The inconsistency concerning the accuracy of the elongation used in the calculation of the elastic modulus between clause 5.1.5.1 and Fig 1 and Annex C was removed. For gage lengths $L_0 \leq 50$ mm the accuracy is set to ±1 µm.

— Normative references are given without dates;

— Minor editorial changes.

A list of all parts in the ISO 527 series can be found on the ISO website.

Plastics — Determination of tensile properties —

Part 1: General principles

1 Scope

1.1 This part of ISO 527 specifies the general principles for determining the tensile properties of plastics and plastic composites under defined conditions. Several different types of test specimen are defined to suit different types of material which are detailed in subsequent parts of ISO 527.

1.2 The methods are used to investigate the tensile behaviour of the test specimens and for determining the tensile strength, tensile modulus and other aspects of the tensile stress/strain relationship under the conditions defined.

1.3 The methods are selectively suitable for use with the following materials:

— rigid and semi-rigid (see 3.12 and 3.13, respectively) moulding, extrusion and cast thermoplastic materials, including filled and reinforced compounds in addition to unfilled types; rigid and semi-rigid thermoplastics sheets and films;

— rigid and semi-rigid thermosetting moulding materials, including filled and reinforced compounds; rigid and semi-rigid thermosetting sheets, including laminates;

— fibre-reinforced thermosets and thermoplastic composites incorporating unidirectional or non-unidirectional reinforcements, such as mat, woven fabrics, woven rovings, chopped strands, combination and hybrid reinforcement, rovings and milled fibres; sheet made from pre-impregnated materials (prepregs),

— thermotropic liquid crystal polymers.

The methods are not normally suitable for use with rigid cellular materials, for which ISO 1926 is used, or for sandwich structures containing cellular materials.

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

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

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 9513, *Metallic materials — Calibration of extensometer systems used in uniaxial testing*

ISO 16012, *Plastics — Determination of linear dimensions of test specimens*

ISO 20753, *Plastics — Test specimens*

ISO 23529, *Rubber — General procedures for preparing and conditioning test pieces for physical test methods*

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:

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

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

3.1
gauge length
L_0
initial distance between the gauge marks on the central part of the test specimen

Note 1 to entry: It is expressed in millimetres (mm).

Note 2 to entry: The values of the gauge length that are indicated for the specimen types in the different parts of ISO 527 represent the relevant maximum gauge length.

3.2
thickness
h
smaller initial dimension of the rectangular cross-section in the central part of a test specimen

Note 1 to entry: It is expressed in millimetres (mm).

3.3
width
b
larger initial dimension of the rectangular cross-section in the central part of a test specimen

Note 1 to entry: It is expressed in millimetres (mm).

3.4
cross-section
A
product of initial width and thickness, A = bh, of a test specimen.

Note 1 to entry: It is expressed in square millimetres, (mm^2)

3.5
test speed
v
rate of separation of the gripping jaws

Note 1 to entry: It is expressed in millimetres per minute (mm/min).

3.6
stress
σ
normal force per unit area of the original cross-section within the gauge length

Note 1 to entry: It is expressed in megapascals (MPa)

Note 2 to entry: In order to differentiate from the true stress related to the actual cross-section of the specimen, this stress is frequently called "engineering stress"

3.6.1
stress at yield
σ_y
stress at the yield strain

Note 1 to entry: It is expressed in megapascals (MPa).

Note 2 to entry: It may be less than the maximum attainable stress (see Figure 1, curves b and c)

3.6.2
strength
σ_m
stress at the first local maximum observed during a tensile test

Note 1 to entry: It is expressed in megapascals (MPa).

Note 2 to entry: This may also be the stress at which the specimen yields or breaks (see Figure 1).

3.6.3
stress at x % strain
σ_x
stress at which the strain reaches the specified value x expressed as a percentage

Note 1 to entry: It is expressed in megapascals (MPa).

Note 2 to entry: Stress at x % strain may, for example, be useful if the stress/strain curve does not exhibit a yield point (see Figure 1, curve d).

3.6.4
stress at break
σ_b
stress at which the specimen breaks

Note 1 to entry: It is expressed in megapascals (MPa).

Note 2 to entry: It is the highest value of stress on the stress-strain curve directly prior to the separation of the specimen, i.e directly prior to the load drop caused by crack initiation.

3.7
strain
ε
increase in length per unit original length of the gauge.

Note 1 to entry: It is expressed as a dimensionless ratio, or as a percentage (%).

3.7.1
strain at yield
yield strain
ε_y
the first occurrence in a tensile test of strain increase without a stress increase

Note 1 to entry: It is expressed as a dimensionless ratio, or as a percentage (%).

Note 2 to entry: See Figure 1, curves b and c.

Note 3 to entry: See Annex A (informative) for computer-controlled determination of the yield strain.

3.7.2
strain at break
ε_b
strain at the last recorded data point before the stress is reduced to less than or equal to 10 % of the strength if the break occurs prior to yielding

Note 1 to entry: It is expressed as a dimensionless ratio, or as a percentage (%).

Note 2 to entry: See Figure 1, curves a and d.

3.7.3
strain at strength
ε_m
strain at which the strength is reached

Note 1 to entry: It is expressed as a dimensionless ratio, or as a percentage (%).

3.8
nominal strain
ε_t
crosshead displacement divided by the gripping distance

Note 1 to entry: It is expressed as a dimensionless ratio, or as a percentage (%).

Note 2 to entry: It is used for strains beyond the yield strain (see 3.7.1) or where no extensometers are used.

Note 3 to entry: It may be calculated based on the crosshead displacement from the beginning of the test, or based on the increment of crosshead displacement beyond the strain at yield, if the latter is determined with an extensometer (preferred for multipurpose test specimens).

3.8.1
nominal strain at break
ε_{tb}
nominal strain at the last recorded data point before the stress is reduced to less than or equal to 10 % of the strength if the break occurs after yielding

Note 1 to entry: It is expressed as a dimensionless ratio, or as a percentage (%).

Note 2 to entry: See Figure 1, curves b and c.

3.9
modulus
E_t
slope of the stress/strain curve $\sigma(\varepsilon)$ in the strain interval between ε_1 = 0,05 % and ε_2 = 0,25 %

Note 1 to entry: It is expressed in megapascals (MPa).

Note 2 to entry: It may be calculated either as the chord modulus or as the slope of a linear least-squares regression line in this interval (see Figure 1, curve d).

Note 3 to entry: This definition does not apply to films.

3.10
Poisson's ratio
μ
negative ratio of the strain decrease $\Delta\varepsilon_n$, in one of the two axes normal to the direction of extension, to the corresponding strain increase $\Delta\varepsilon_l$ in the direction of extension, within the linear portion of the longitudinal versus normal strain curve

Note 1 to entry: It is expressed as a dimensionless ratio.