

# **SLOVENSKI STANDARD**

## **oSIST prEN ISO 527-4:2020**

**01-september-2020**

---

**Polimerni materiali - Določevanje nateznih lastnosti - 4. del: Preskusni pogoji za izotropne in ortotropne z vlakni ojačene polimerne kompozite (ISO/DIS 527-4:2020)**

Plastics - Determination of tensile properties - Part 4: Test conditions for isotropic and orthotropic fibre-reinforced plastic composites (ISO/DIS 527-4:2020)

Kunststoffe - Bestimmung der Zugeigenschaften - Teil 4: Prüfbedingungen für isotrop und anisotrop faserverstärkte Kunststoffverbundwerkstoffe (ISO/DIS 527-4:2020)

Plastiques - Détermination des propriétés en traction - Partie 4 : Conditions d'essai pour les composites plastiques renforcés de fibres isotropes et orthotropes (ISO/DIS 527-4:2020)

<https://standards.iteh.ai/catalog/standards/sist/9b1af06c-af86-48b1-81c3-19cb4ee5fdded/osist-pren-iso-527-4-2020>

**Ta slovenski standard je istoveten z: prEN ISO 527-4**

---

**ICS:**

83.120

Ojačani polimeri

Reinforced plastics

**oSIST prEN ISO 527-4:2020**

**en,fr,de**

## **iTeh STANDARD PREVIEW** **(standards.iteh.ai)**

[oSIST prEN ISO 527-4:2020](https://standards.iteh.ai/catalog/standards/sist/9b1af06c-af86-48b1-81c3-19cb4ee5fded/osist-pren-iso-527-4-2020)

<https://standards.iteh.ai/catalog/standards/sist/9b1af06c-af86-48b1-81c3-19cb4ee5fded/osist-pren-iso-527-4-2020>

# DRAFT INTERNATIONAL STANDARD

## ISO/DIS 527-4

ISO/TC 61/SC 13

Secretariat: JISC

Voting begins on:  
2020-07-01Voting terminates on:  
2020-09-23

### Plastics — Determination of tensile properties —

#### Part 4:

### Test conditions for isotropic and orthotropic fibre-reinforced plastic composites

*Plastiques — Détermination des propriétés en traction —*

*Partie 4: Conditions d'essai pour les composites plastiques renforcés de fibres isotropes et orthotropes*

ICS: 83.120

**iTeh STANDARD PREVIEW**  
(standards.iteh.ai)

[oSIST prEN ISO 527-4:2020](https://standards.iteh.ai/catalog/standards/sist/9b1af06c-af86-48b1-81c3-19cb4ee5fdded/osist-pren-iso-527-4-2020)

<https://standards.iteh.ai/catalog/standards/sist/9b1af06c-af86-48b1-81c3-19cb4ee5fdded/osist-pren-iso-527-4-2020>

THIS DOCUMENT IS A DRAFT CIRCULATED FOR COMMENT AND APPROVAL. IT IS THEREFORE SUBJECT TO CHANGE AND MAY NOT BE REFERRED TO AS AN INTERNATIONAL STANDARD UNTIL PUBLISHED AS SUCH.

IN ADDITION TO THEIR EVALUATION AS BEING ACCEPTABLE FOR INDUSTRIAL, TECHNOLOGICAL, COMMERCIAL AND USER PURPOSES, DRAFT INTERNATIONAL STANDARDS MAY ON OCCASION HAVE TO BE CONSIDERED IN THE LIGHT OF THEIR POTENTIAL TO BECOME STANDARDS TO WHICH REFERENCE MAY BE MADE IN NATIONAL REGULATIONS.

RECIPIENTS OF THIS DRAFT ARE INVITED TO SUBMIT, WITH THEIR COMMENTS, NOTIFICATION OF ANY RELEVANT PATENT RIGHTS OF WHICH THEY ARE AWARE AND TO PROVIDE SUPPORTING DOCUMENTATION.

This document is circulated as received from the committee secretariat.

**ISO/CEN PARALLEL PROCESSING**



Reference number  
ISO/DIS 527-4:2020(E)

© ISO 2020

## iTeh STANDARD PREVIEW (standards.iteh.ai)

[oSIST prEN ISO 527-4:2020](https://standards.iteh.ai/catalog/standards/sist/9b1af06c-af86-48b1-81c3-19cb4ee5fde4/osist-pren-iso-527-4-2020)  
<https://standards.iteh.ai/catalog/standards/sist/9b1af06c-af86-48b1-81c3-19cb4ee5fde4/osist-pren-iso-527-4-2020>



### **COPYRIGHT PROTECTED DOCUMENT**

© ISO 2020

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

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](mailto:copyright@iso.org)  
Website: [www.iso.org](http://www.iso.org)

Published in Switzerland

# Contents

Page

<b>Foreword</b>	<b>iv</b>
<b>Introduction</b>	<b>v</b>
<b>1 Scope</b>	<b>1</b>
<b>2 Normative references</b>	<b>1</b>
<b>3 Terms and definitions</b>	<b>2</b>
<b>4 Principle</b>	<b>4</b>
<b>5 Apparatus</b>	<b>4</b>
<b>6 Test specimens</b>	<b>4</b>
6.1 Shape and dimensions	4
6.2 Preparation of specimens	8
6.2.1 General	8
6.2.2 End tabs (for type 3 specimens)	8
6.2.3 Applications of end tabs (for type 3 specimens)	9
6.3 Gauge marks	9
6.4 Checking the specimens	9
6.5 Anisotropy	9
<b>7 Number of specimens</b>	<b>9</b>
<b>8 Conditioning</b>	<b>9</b>
<b>9 Procedure</b>	<b>10</b>
9.1 Test atmosphere	10
9.2 Measurement of specimen dimensions	10
9.3 Clamping	10
9.4 Prestresses	10
9.5 Setting of extensometers and strain gauges and placing of gauge marks	10
9.6 Speed of testing	10
9.6.1 For type 1B test specimens	10
9.6.2 For type 2, type 3 and type 4 test specimens	10
9.7 Recording of data	11
<b>10 Calculation and expression of results</b>	<b>11</b>
10.1 Calculation of all properties for parallel sided specimens	11
10.2 Failure location related calculation of tensile strength for type 4 specimens	11
<b>11 Precision</b>	<b>11</b>
<b>12 Test report</b>	<b>11</b>
<b>Annex A (normative) Specimen preparation (type 2 and type 3)</b>	<b>12</b>
<b>Annex B (informative) Alignment of specimens</b>	<b>14</b>
<b>Annex C (informative) Unbonded tabs or gripping condition without tabs using fine grip face</b>	<b>16</b>
<b>Annex D (informative) Testing with tapered tensile specimen geometry without tabs (type 4)</b>	<b>19</b>
<b>Annex E (normative) Failure location related calculation of tensile strength for type 4 specimens</b>	<b>22</b>
<b>Bibliography</b>	<b>25</b>

## ISO/DIS 527-4:2020(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.

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](http://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](http://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 of 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 [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document 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 527-4:1997), which has been technically revised.

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

- Implementation of specimen type 4 (tapered tensile specimen) especially for testing of multidirectional, continuous fibre-reinforced thermoplastic composites.
- Adjustment of gripping force or pressure (e.g. via torque or manometer depending on gripping system used).

Implementation of [Annex C](#) (Informative) (Unbonded tabs or gripping condition without tabs using fine grip faces), [Annex D](#) (Informative) (Testing with tapered tensile specimen geometry without tabs) and [Annex E](#) (Normative) (Failure location related calculation of tensile strength for type 4 specimens)

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

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](http://www.iso.org/members.html).

## Introduction

This document introduces a new test specimen, type 4, with a waisted geometry for use without end tabs. The geometry has been developed to overcome difficulties with bonding end-tabbed test specimens, especially when testing materials based on a thermoplastic matrix.

Guidance on gripping, including grip face design, is also added.

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[oSIST prEN ISO 527-4:2020](https://standards.iteh.ai/catalog/standards/sist/9b1af06c-af86-48b1-81c3-19cb4ee5fded/osist-pren-iso-527-4-2020)  
<https://standards.iteh.ai/catalog/standards/sist/9b1af06c-af86-48b1-81c3-19cb4ee5fded/osist-pren-iso-527-4-2020>

## **iTeh STANDARD PREVIEW** **(standards.iteh.ai)**

[oSIST prEN ISO 527-4:2020](https://standards.iteh.ai/catalog/standards/sist/9b1af06c-af86-48b1-81c3-19cb4ee5fded/osist-pren-iso-527-4-2020)

<https://standards.iteh.ai/catalog/standards/sist/9b1af06c-af86-48b1-81c3-19cb4ee5fded/osist-pren-iso-527-4-2020>



# Plastics — Determination of tensile properties —

## Part 4:

## Test conditions for isotropic and orthotropic fibre-reinforced plastic composites

### 1 Scope

**1.1** This part of ISO 527 specifies the test conditions for the determination of the tensile properties of isotropic and orthotropic fibre-reinforced plastic composites, based upon the general principles given in part 1.

Unidirectionally reinforced materials are covered by Part 5.

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

**1.3** The test method is suitable for use with the following materials:

- fibre-reinforced thermosetting and thermoplastic composites incorporating non-unidirectional reinforcements such as mats, woven fabrics, woven rovings, chopped strands, combinations of such reinforcements, hybrids, rovings, short or milled fibres or preimpregnated materials (prepregs) (for directly injection-moulded specimens, see specimen 1A in ISO 527-2);
- combinations of the above with unidirectional reinforcements and multidirectional reinforced materials constructed from unidirectional layers, provided such laminates are symmetrical (for materials with completely, or mainly, unidirectional reinforcements, see ISO 527-5);
- finished products made from these materials.

The reinforcement fibres covered include glass fibres, carbon fibres, aramid fibres and other similar fibres.

**1.4** The method is performed using specimens machined from a test panel made in accordance with ISO 1268 or by equivalent methods, or from finished and semi-finished products with suitable flat areas.

### 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, *Plastics — Determination of tensile properties — Part 1: General principles*

ISO 527-2, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics*

ISO 527-5, *Plastics - Determination of tensile properties - Part 5: Test conditions for unidirectional fibre-reinforced plastic composites*

## ISO/DIS 527-4:2020(E)

ISO 1268, *Plastics - Preparation of glass fibre reinforced, resin bonded, low-pressure laminated plates or panels for test purposes*

ISO 2818, *Plastics — Preparation of test specimens by machining*

ISO 3534-1, *Statistics — Vocabulary and symbols — Part 1: General statistical terms and terms used in probability*

ISO 6344-1, *Coated abrasives — Grain size analysis — Part 1: Grain size distribution test*

### 3 Terms and definitions

For the purposes of this part of ISO 527, the following definitions apply.

#### 3.1 gauge length

See ISO 527-1, subclause 3.1.

#### 3.2 thickness

$h$  - See ISO 527-1, subclause 3.2

#### 3.3 width

$b$  - See ISO 527-1, subclause 3.3 for parallel sided specimens

$b_1$  - See [Annex D](#) for tapered specimens

#### 3.4 speed of testing

See ISO 527-1, subclause 3.5. <https://standards.iteh.ai/catalog/standards/sist/9b1af06c-af86-48b1-81c3-19cb4ee5f1ed/osist-pren-iso-527-4-2020>

#### 3.5 tensile stress

$\sigma$  (engineering): See ISO 527-1, subclause 3.6, except that  $\sigma$  for "1"-direction specimens is defined as  $\sigma_1$  and for "2"-direction specimens as  $\sigma_2$  (see 4.8 for definitions of these directions).

#### 3.6 tensile strength

$\sigma_M$ : See ISO 527-1, subclause 3.6.2, except that  $\sigma_M$  for "1"-direction specimens is defined as  $\sigma_{M1}$  and for "2"-direction specimens as  $\sigma_{M2}$ .

#### 3.7 tensile strain

$\varepsilon$ : See ISO 527-1, subclause 3.7, except that  $\varepsilon$  for "1"-direction specimens is defined as  $\varepsilon_1$  and for "2"-direction specimens as  $\varepsilon_2$ .

It is expressed as a dimensionless ratio or in percent.

##### 3.7.1 tensile strain at tensile strength; tensile failure strain

$\varepsilon_M$ : The tensile strain at the point corresponding to the tensile strength of the specimen.

For "1"-direction specimens,  $\varepsilon_M$  is defined as  $\varepsilon_{M1}$  and for "2"-direction specimens as  $\varepsilon_{M2}$ .

It is expressed as a dimensionless ratio or in percent.

### 3.8

#### modulus of elasticity in tension; Young's modulus

$E$ : See ISO 527-1, subclause 3.9, except that  $E$  for "1"-direction specimens is defined as  $E_1$  and for "2"-direction specimens as  $E_2$ .

The strain values used are as given in ISO 527-1, subclause 3.9, i.e.  $\varepsilon' = 0,000\ 5$  and  $\varepsilon'' = 0,002\ 5$  (see [figure 1](#)), unless alternative values are given in the material or technical specifications.

### 3.9

#### Poisson's ratio

$\mu$ : See ISO 527-1, subclause 3.10, except that for "1"-direction specimens  $\mu_b$  is defined as  $\mu_{12}$  and  $\mu_h$  as  $\mu_{13}$ , using the coordinates shown in [figure 2](#). For "2"-direction specimens,  $\mu_b$  is defined as  $\mu_{21}$  and  $\mu_h$  as  $\mu_{23}$ .

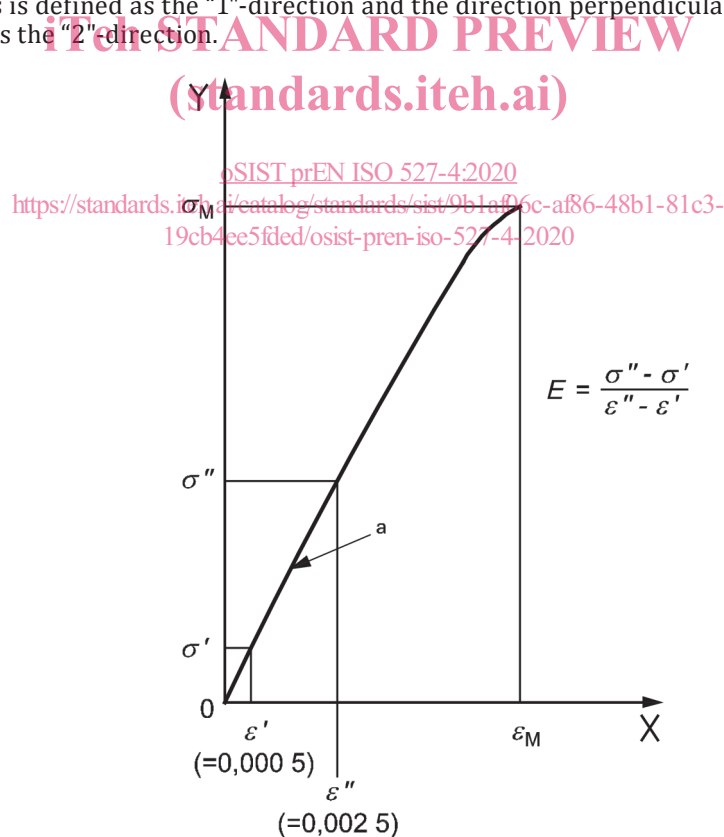
### 3.10

#### specimen coordinate axes

The "1"-direction is normally defined in terms of a feature associated with the material structure or the production process, such as the length direction in continuous-sheet processes (see [figure 2](#)). The "2"-direction is perpendicular to the "1"-direction.

Note 1 to entry: The "1"-direction is also referred to as the  $0^\circ$  or longitudinal direction and the "2"-direction as the  $90^\circ$  or transverse direction. The "3"-direction is perpendicular to the plane of the "1"-direction and "2"-direction. The "3"-direction is also referred to as the "through-thickness" direction for planar systems.

Note 2 to entry: For unidirectional materials covered by part 5 of this International Standard, the direction parallel to the fibres is defined as the "1"-direction and the direction perpendicular to the fibres (in the plane of the prepreg/plate) as the "2"-direction.



#### Key

- X strain,
- Y stress,  $\sigma$
- a Slope  $E$

Figure 1 — Stress-strain curve

### 3.11 failure position

$u_F$ : The failure location of the specimen type 4 within the local coordinate system (u, v) of the tapered section.

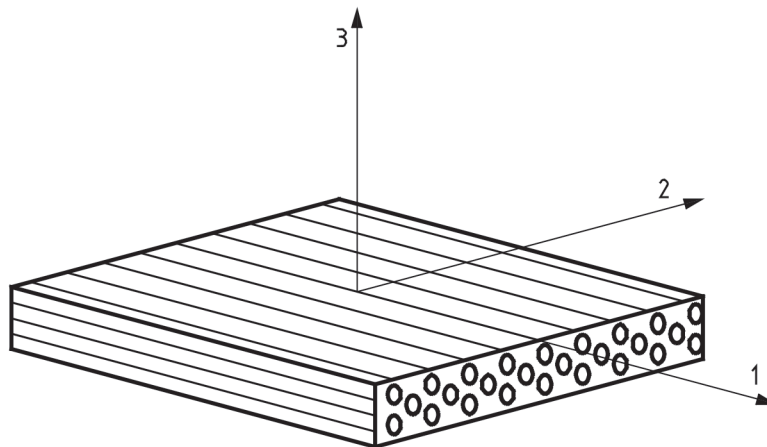


Figure 2 — Fibre-reinforced plastic composite showing axes of symmetry

## 4 Principle

See ISO 527-1, clause 4.

**iTeh STANDARD PREVIEW**  
(standards.iteh.ai)

## 5 Apparatus

See ISO 527-1, clause 5, except for the following:

The micrometre or its equivalent (see ISO 16012, subclause 5.2) shall read to 0,01 mm or better. It shall have a suitable-size ball-ended anvil if used on irregular surfaces and a flat anvil if used on flat, smooth (e.g. machined) surfaces.

When using extensometers with specimen type 4, a gauge length of 25 mm (see ISO 527-1, subclause 5.1.5) is recommended.

NOTE It is recommended that alignment of the specimen and loading train be checked as described in [Annex B](#).

## 6 Test specimens

### 6.1 Shape and dimensions

Four types of test specimen are specified for use with this part of ISO 527, as detailed and illustrated in [figure 3](#) (type 1 B) and [figure 4](#) (types 2 and 3) and [figure 5](#) (type 4).

Type 1B is for testing fibre-reinforced thermoplastics. Type 1B specimens may also be used for fibre-reinforced thermosets if they break within the gauge length. Type 1B shall not be used for multidirectional, continuous-fibre-reinforced materials.

Type 2 (rectangular without end-tabs) and type 3 (rectangular with bonded end-tabs) are for testing fibre-reinforced thermosets and thermoplastics. Specimens with unbonded end tabs are considered as type 2.

The preferred width of type 2 and type 3 specimens is 25 mm, but widths of 50 mm or greater may be used if the tensile strength is low due to the particular type of reinforcement used.