



**SLOVENSKI STANDARD**  
**SIST EN 2747:2001**

**01-junij-2001**

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**Aerospace series - Glass fibre reinforced plastics - Tensile test**

Aerospace series - Glass fibre reinforced plastics - Tensile test

Luft- und Raumfahrt - Glasfaserverstärkte Kunststoffe - Zugversuch

Série aérospatiale - Plastiques renforcés au verre textile - Essai de traction

**Ta slovenski standard je istoveten z: EN 2747:1998**

[SIST EN 2747:2001](https://standards.iteh.ai/catalog/standards/sist/b437a1d8-ffd2-4e30-98b9-65202f199aa3/sist-en-2747-2001)

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**ICS:**

49.025.40 Guma in polimerni materiali Rubber and plastics

**SIST EN 2747:2001**

**en**

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

EN 2747

August 1998

ICS 49.025.40

Descriptors: Aircraft industry, reinforced plastics, glass reinforced plastics, tests, tension tests

English version

Aerospace series - Glass fibre reinforced plastics - Tensile test

Série aérospatiale - Plastiques renforcés au verre textile -  
Essai de traction

Luft- und Raumfahrt - Glasfaserverstärkte Kunststoffe -  
Zugversuch

This European Standard was approved by CEN on 15 May 1998.

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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

### Foreword

This European Standard has been prepared by the European Association of Aerospace Manufacturers (AECMA).

After inquiries and votes carried out in accordance with the rules of this Association, this Standard has received the approval of the National Associations and the Official Services of the member countries of AECMA, prior to its presentation to CEN.

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 February 1999, and conflicting national standards shall be withdrawn at the latest by February 1999.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.



## 1 Scope

This standard specifies a method for the determination of tensile properties of glass fibre reinforced plastics for aerospace applications.

## 2 Normative references

This European Standard incorporates by dated or undated reference provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

|         |   |
|---------|---|
| EN 2374 | Aerospace series - Glass fibre reinforced mouldings and sandwich composites - Production of test panels   |
| EN 2489 | Aerospace series - Fibre reinforced plastics - Determination of the action of liquid chemicals  |
| EN 2743 | Aerospace series - Reinforced plastics - Standard atmospheres for conditioning and testing <sup>1)</sup>  |
| EN 2823 | Aerospace series - Fibre reinforced plastics - Test method for the determination of the effect of exposure to humid atmosphere on physical and mechanical characteristics <sup>1)</sup> |

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## 3 Definitions

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[65202f199aa3/sist-en-2747-2001](https://standards.iteh.ai/catalog/standards/sist/b437a1d8-ffd2-4e30-98b9-65202f199aa3/sist-en-2747-2001)

For the purpose of this standard the following definitions apply:

### 3.1 Tensile stress

Tensile load experienced by the specimen at any moment during the test, per initial unit cross sectional area within the free length.

### 3.2 Ultimate tensile strength

Tensile stress at the moment failure occurs.

### 3.3 Strains

Change in the distance between reference points in the specimen free length, produced by a tensile load and expressed with respect to the initial distance between these points.

### 3.4 Percentage strain to failure

Increase in the distance between reference points in the specimen free length, produced by a tensile load and expressed as a percentage of the initial distance between these points and measured at the moment of failure.

<sup>1)</sup> Published as AECMA Prestandard at the date of publication of this standard

### 3.5 Modulus of elasticity

Quotient of the tensile stress and corresponding strain within the linear area.

NOTE: It is the slope of the stress/strain diagram obtained during the tensile test.

If the limit of proportionality is exceeded or if there is no linear area, it is necessary to define:

#### 3.5.1 Tangent modulus

Slope of the tangent at the origin of the stress/strain diagram.

#### 3.5.2 Secant modulus at x %

Slope of the straight line going through the origin of the stress/strain diagram and the point in this diagram which corresponds to a strain of x %.

## 4 Principle

The method consists of the measurement of the longitudinal strain in the material, in relation to the load applied, during a tensile test carried out at a constant speed until failure occurs.

This method enables the following tensile properties to be determined:

- ultimate tensile strength;
- modulus of elasticity;
- percentage strain to failure.

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## 5 Apparatus

### 5.1 Test machine

Constant speed tensile machine with:

- a) A fixed part with a suitable grip and a mobile part with a second grip.

The grips shall be designed such that the axis of the specimen is aligned at all times with the direction of the applied load. This can be achieved, for example, by using centring pins within the grips.

- b) A load measuring system of negligible inertia accurate to  $\pm 1$  % in the load range used.

The fixed and mobile parts shall be constructed such that during the test the total longitudinal deformation of these parts does not exceed 1 % of the specimen free length.

This requirement applies for the whole of the load range used.

## 5.2 Extensometer

It shall enable determination of the distance between two reference marks situated on the free length of the specimen at any time during the test.

The extensometer used shall not damage the specimen nor cause failures at the attachment points.

The extensometer of negligible inertia with regard to the test speed, shall give the strain to  $\pm 1\%$  of the measured value.

The gauge lengths recommended are given in table 1. However, shorter distances may be used, as long as the above requirements are met.

## 5.3 Micrometer with 6 mm diameter flat faces and accurate to $\pm 0,01$ mm.

## 6 Specimens

### 6.1 Dimensions

The types of specimens are defined in table 1 and figures 1 to 4.

Table 1: Types of specimens

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Dimensions in millimetres

| Recommended specimen types |   | Thermoplastics | Thermosets             |                        | Unidirectional thermosets        |
|----------------------------|---|----------------|------------------------|------------------------|----------------------------------|
|                            |   | Type 1         | Type 2                 | Type 3                 | Type 4                           |
| $F$                        | Minimum total length                                    | 150            | 250                    | 250                    | 164                              |
| $W$                        | Width of ends   | $20 \pm 0,5$   | —                      | —                      | —                                |
| $h$                        | Semi-finished products                                  | 2 to 10        | 2 to 10                | 2 to 10                | —                                |
|                            | Test panels according to EN 2374                        | 2 to 3,5       | 2 to 3,5               | 2 to 3,5               | $1 \pm 0,2$<br>to<br>$3 \pm 0,2$ |
| $B$                        | Free length   | $60 \pm 0,5$   | —                      | —                      | —                                |
| $b$                        | Width of free length                                    | $10 \pm 0,5$   | $25 \pm 0,5$           | $25 \pm 0,5$           | $10 \pm 0,5$                     |
| $L_0$                      | Gauge length  | 50             | 50<br>or<br>100        | 50<br>or<br>100        | 25                               |
| $E$                        | Distance between grips                                  | $115 \pm 5$    | $170 \pm 5$            | $170 \pm 5$            | $50 \pm 2$                       |
| $D$                        | Distance between tabs                                   | —              | —                      | $150 \pm 5$            | $64 \pm 1,5$                     |
| $T$                        | Minimum length of tabs                                  | —              | —                      | 50                     | 50                               |
| $P$                        | Diameter of centring holes (drilling of holes optional) | —              | $3 + 0,25$<br>$- 0,05$ | $3 + 0,25$<br>$- 0,05$ | $3 + 0,25$<br>$- 0,05$           |
| $e$                        | Thickness of tabs                                       | —              | —                      | $2 \pm 0,2$            | $0,5 \pm 0,1$                    |
| $R$                        | Radius  | $\geq 60$      | —                      | —                      | —                                |

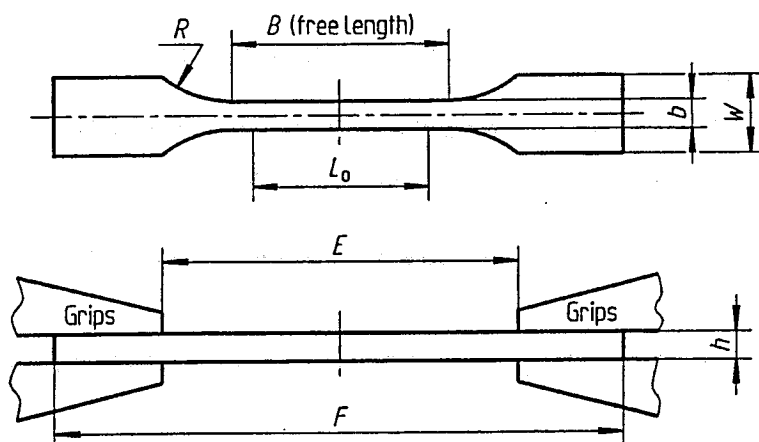


Figure 1: Specimen type 1

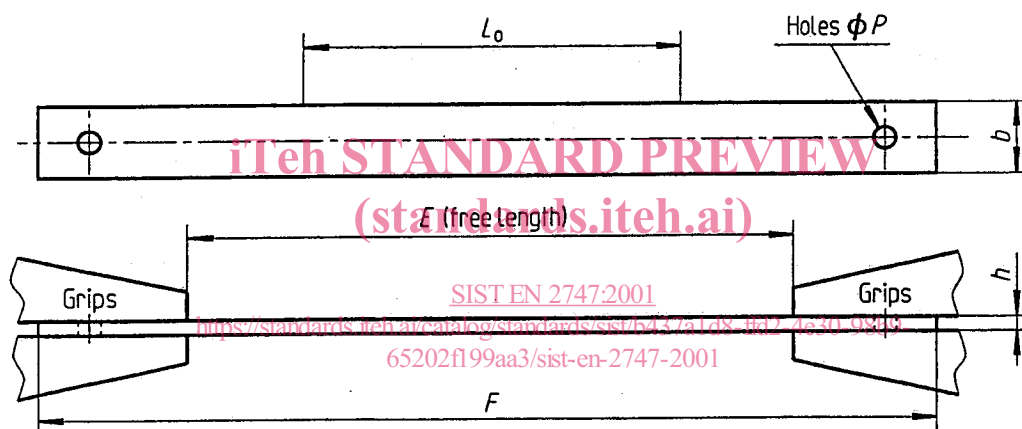


Figure 2: Specimen type 2

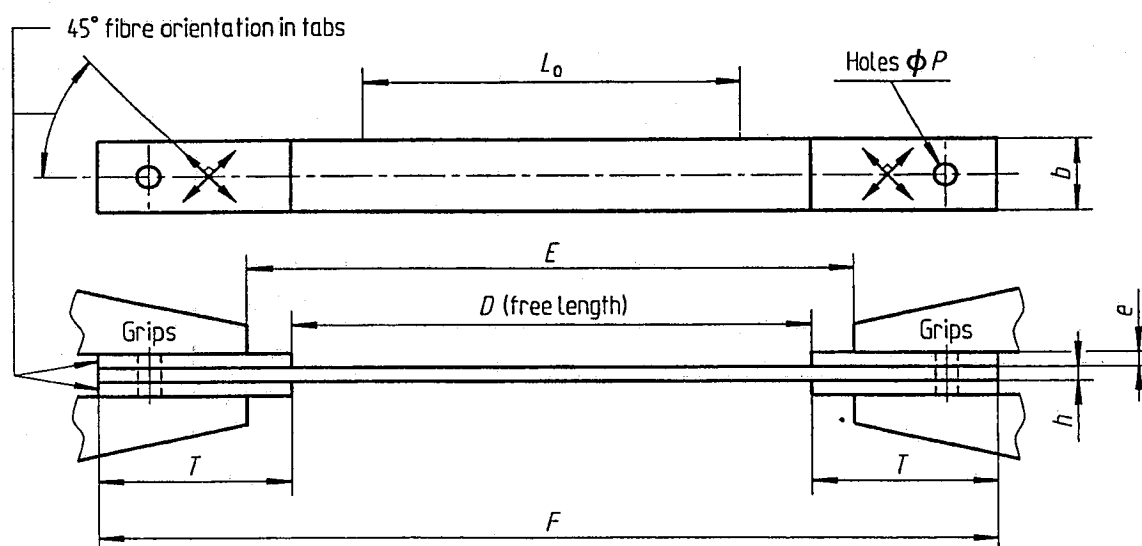


Figure 3: Specimen type 3



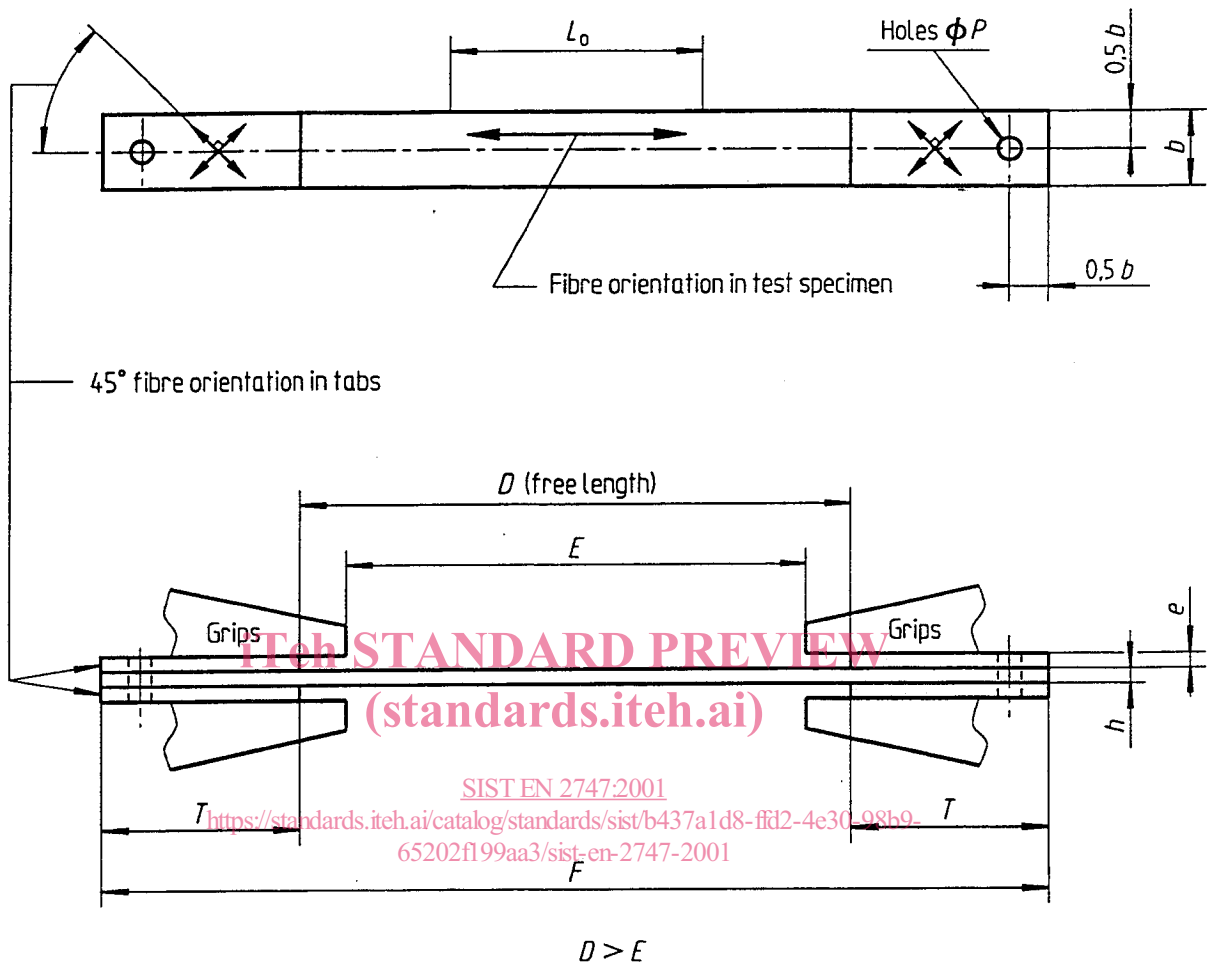


Figure 4: Specimen type 4