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**Aeronavtika - Z vlakni ojačeni polimerni materiali - Ugotavljanje učinkov vlažne atmosfere na njihove fizične in mehanske karakteristike**

Aerospace series - Fibre reinforced plastics - Determination of the effect of exposure to humid atmosphere on physical and mechanical characteristics

Luft- und Raumfahrt - Faserverstärkte Kunststoffe - Ermittlung des Einflusses der Auslagerung in feuchtem Klima auf die mechanischen und physikalischen Eigenschaften

Série aérospatiale - Plastiques renforcés de fibres - Détermination de l'influence de l'exposition à l'atmosphère humide sur les caractéristiques mécaniques et physiques

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**Ta slovenski standard je istoveten z: EN 2823:2017**

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**ICS:**

49.025.40      Guma in polimerni materiali      Rubber and plastics

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 2823**

March 2017

ICS 49.025.40

English Version

**Aerospace series - Fibre reinforced plastics -  
Determination of the effect of exposure to humid  
atmosphere on physical and mechanical characteristics**

Série aérospatiale - Plastiques renforcés de fibres -  
Détermination de l'influence de l'exposition à  
l'atmosphère humide sur les caractéristiques  
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Luft- und Raumfahrt - Faserverstärkte Kunststoffe -  
Ermittlung des Einflusses der Auslagerung in feuchtem  
Klima auf die mechanischen und physikalischen  
Eigenschaften

This European Standard was approved by CEN on 6 February 2017.

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

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## European foreword

This document (EN 2823:2017) has been prepared by the Aerospace and Defence Industries Association of Europe - Standardization (ASD-STAN).

After enquiries 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 ASD, 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 September 2017, and conflicting national standards shall be withdrawn at the latest by September 2017.

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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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## 1 Scope

This European Standard specifies the method for determining the effect of exposure to a humid atmosphere on the physical and mechanical characteristics of fibre reinforced plastics.

This standard applies to all laminates, whatever the nature of the reinforcement and organic matrix used, unless otherwise indicated in the material standard and/or technical specification.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 2743, *Aerospace series — Fibre reinforced plastics — Standard procedures for conditioning prior to testing unaged materials*

EN 2744, *Aerospace series — Non-metallic materials — Preferred test temperatures*

EN 3615, *Aerospace series — Fibre reinforced plastics — Determination of the conditions of exposure to humid atmosphere and moisture absorption* <sup>1)</sup>

## 3 Terms and definitions

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

### 3.1

#### "pilot" specimens

specimens intended to establish the exposure temperature required to achieve an equilibrium condition at the specified humidity level in a limited period of time

### 3.2

#### specimens "to be aged"

specimens intended to determine the mechanical and physical characteristics after exposure

### 3.3

#### "traveller" specimens

specimens representative of specimens "to be aged" which accompany these in the climatic chamber and are intended to monitor moisture absorption

### 3.4

#### equilibrium condition

condition of the material at a specified hygrometry when it has reached constant mass

### 3.5

#### constant mass

mass of the specimen obtained after several successive weighings carried out at regular intervals when the difference between weighings is less than a specified value

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1) Published as ASD-STAN Prestandard at the date of publication of this standard by AeroSpace and Defence industries Association of Europe - Standardization (ASD-STAN) ([www.asd-stan.org](http://www.asd-stan.org))

**3.6****as-cured condition**

see EN 2743

**4 Methodology**

The test results obtained with the specimens in the as-cured condition are compared with those obtained with specimens "to be aged" after exposure to the specified humid atmosphere, in accordance with the following procedure:

- a) carry out the mechanical or physical test according to the appropriate standard on specimens in the as-cured condition (see EN 2743A);
- b) using pilot specimens determine the highest possible exposure temperature guaranteeing a behaviour of the material in conformity with Fick's law (reaching an equilibrium condition). This determination shall be carried out at least once for each case of fibre/resin/temperature combination;
- c) expose the specimens "to be aged" to the specified hygrometry and to the temperature as determined above until they reach the equilibrium condition. Traveller specimens shall be permanently subjected to the same exposure conditions;
- d) carry out the mechanical or physical tests according to the applicable standards.

NOTE 1 In the preparation of this standard both Langmuir model and Fick's law were considered. While acknowledging that Langmuir Models more exact, Fick's law will be used to define equilibrium conditions in composite materials.

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A temperature of 70 °C is chosen as the initial verification temperature in order to achieve a reasonable rate of moisture pick-up. If the pilot specimens results suggest a significant deviation from Fick's law then a lower temperature should be selected.

**5 Apparatus**

**5.1** Climatic chamber capable of keeping the specified temperature to within  $\pm 1$  °C and relative humidity to within  $\pm 3$  %.

**5.2** Desiccator.

**5.3** Balance accurate to within 0,1 mg.

**5.4** Air circulating oven capable of keeping the specified temperature to within  $\pm 5$  °C.

**5.5** Clean and dry absorbent cloth or filter paper.

**5.6** Sealed container: metallized polythene bag or airtight metal or glass enclosure.

**6 Specimens**

All the aspects of the manufacturing process (in particular the surface finish) influence the test results.

## 6.1 Pilot specimens

The panels intended to make up the pilot specimens shall be symmetrically arranged in layers:

- unidirectional preimpregnates: unidirectional ( $0^\circ$ ) or crossed ( $0^\circ/90^\circ$ ) lay-up;
- fabrics: all plies warpwise in the same direction.

The dimensions of the pilot specimens shall be in conformity with Figure 1 and Table 1.

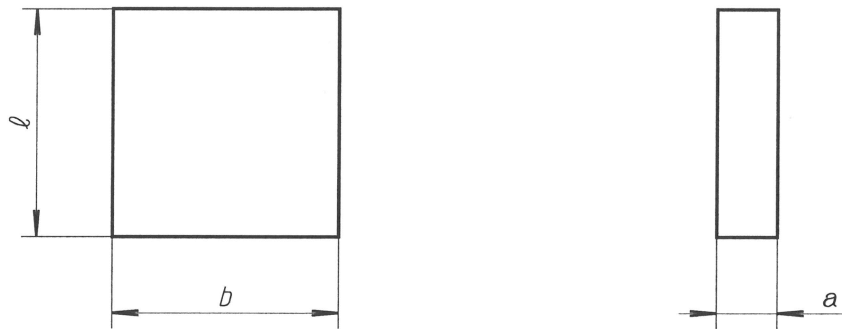


Figure 1

Table 1

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Dimensions in millimetres

$l$	$75 \pm 1$
$b$	$75 \pm 1$
$a$	the lowest possible

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## 6.2 Specimens "to be aged" (specimens for mechanical and physical tests)

The shape, dimensions and manufacturing procedure for the specimens are specified in the material standard or test method.

They shall be in their final form, for example, machined, drilled, tabbed, etc.

## 6.3 Traveller specimens

A minimum of three traveller specimens, taken from the same panel as the specimens "to be aged", but without tabs, holes, etc. shall be used.

The traveller specimens shall be rectangular or square, their length and width equal to or greater than 25 mm and their mass greater than 1,5 g.

The quality of the faces and edges shall be identical to that of the ageing specimens.



## 7 Procedure

### 7.1 Conditioning before exposure

Specimens to be aged shall not undergo any special conditioning, a condition of equilibrium being the only criterion sought.

### 7.2 Exposure conditions

#### 7.2.1 The humidity level shall be specified.

Standard condition:  $\left(85^{+5}_{-1}\right)\%$

Optional:  $\left(95^{+5}_{-1}\right)\%$

#### 7.2.2 Determination of exposure temperature

It shall be determined on the pilot specimens according to the following procedure:

- expose a pilot specimen to the exposure temperature of  $(70 \pm 2) ^\circ\text{C}$ ;
- check that the condition of equilibrium has been reached (see 7.2.3) at this temperature;
- if this is not the case, expose a new pilot specimen to a lower temperature chosen from EN 2744;
- check that the condition of equilibrium has been reached (see 7.2.3) at this new temperature;
- if this is not the case, redo the procedure until a temperature is determined whereby the condition of equilibrium is reached.

NOTE 1 If the condition of equilibrium is reached at  $70 ^\circ\text{C}$ , a higher exposure temperature may be sought, chosen from EN 2744.

NOTE 2 This operation may be replaced by a continuous weighing (thermobalance type setup) of the pilot specimen in a humid atmosphere.

#### 7.2.3 Determination of the condition of equilibrium

The total period of exposure for all specimens shall be continued until they reach the equilibrium condition.

Constant mass is achieved for test specimens of a thickness of  $(2 \pm 0,2)$  mm when the difference between three successive weighings carried out at an interval of 168 h on traveller specimens (see figure 2) and in conformity with the formula below:

$$\frac{|M_{j-2} - M_j|}{M_j} \leq 5 \times 10^{-4}$$

where

$M_j$  represents the mean weights of the travellers specimens at the time  $t_j$ .