



SLOVENSKI STANDARD
SIST EN 2374:2001

01-junij-2001

**Aerospace series - Glass fibre reinforced mouldings and sandwich composites -
Production of test panels**

Aerospace series - Glass fibre reinforced mouldings and sandwich composites -
Production of test panels

Luft- und Raumfahrt - Glasfaserverstärkte Formstoffe und Kernverbunde - Herstellen von
Prüfplatten

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Série aérospatiale - Matériaux stratifiés renforcés de fibres de verre et matériaux
composites sandwich - Préparation des panneaux d'essais

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EUROPEAN STANDARD

EN 2374

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EUROPAISCHE NORM

April 1991

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English version

Aerospace series - Glass fibre reinforced mouldings and sandwich composites - Production of test panels

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This European Standard was approved by CEN on 1991-03-28. 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, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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

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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 successively received the approval of the National Associations and the Official Services of the member countries of AECMA, prior to its presentation to CEN.

According to the Common CEN/CENELEC Rules, the following countries are bound to implement this European Standard :

Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxemburg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

1 Scope and field of application

This standard describes the production of laminate and sandwich composite test panels from glass fibre fabric and resin mixes. Test specimens, which are specified for the determination of the characteristics of the glass fibre reinforced mouldings, for the verification of the properties of their components or for the verification of the adhesive and sandwich composite properties, are taken from the test panel in accordance with the relevant test standard.

This standard is not applicable to the production of test panels from unidirectional glass fibre fabric and resin mixes.

2 References

- EN 2090 Aerospace series - Aluminium alloy 2024-T3 - Clad sheets and strips - $0,4 \leq a \leq 6$ mm ¹⁾
- EN 2334 Aerospace series - Pickling of aluminium alloys in chromic acid ²⁾
- EN 2514 Aerospace series - Aluminium alloy 5052-H191 - Honeycomb core ²⁾
- EN 2743 Aerospace series - Glass reinforced plastics - Standard atmospheres for conditioning and testing ²⁾.

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3 Type of fabrication

3.1 Type A

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Glass fibre fabric is impregnated with liquid resin mix and made into test panels in a press mould under the influence of pressure and temperature in accordance with the resin manufacturer's processing instructions.

3.2 Type B

Preimpregnated glass fibre fabric (prepreg) is made into test panels under the influence of pressure and temperature in accordance with the manufacturer's processing instructions.

3.3 Type C

Glass fibre fabric is impregnated with liquid resin mix and made into test panels at room or elevated temperature without application of pressure in accordance with the resin manufacturer's processing instructions.

¹⁾ Published as AECMA standard at the date of publication of the present standard.
²⁾ In preparation at the date of publication of the present standard.

4 Equipment and apparatus

For types A and B, a hydraulic or mechanical press, an autoclave or equipment for vacuum bag fabrication is required.

The equipment shall be fitted with a continuously variable temperature and pressure control, which allows the prescribed values to be kept constant over the entire cure time.

Provided there are no other agreements with the material supplier, the equipment shall be suitable for maintaining the temperature with an accuracy of ± 5 °C and the press pressure with an accuracy of ± 5 %.

When a press is used, it shall be ensured that the press mould described in clause 5 can be accommodated and that the closure rate for the last two millimetres of the closure travel does not exceed 5 mm/min.

The equipment shall be fitted with suitable measuring devices for monitoring the fabrication parameters temperature, time and pressure. In autoclave or vacuum bag fabrication, a vacuum indicator shall also be available. In vacuum bag fabrication, it shall be ensured that the vacuum pump can maintain a reduced pressure of at least 70 kPa in the bag during the entire cure time.

Provided there are no different agreements with the material supplier, the production of the test panels is to be carried out in a light, well ventilated room at 15 °C to 30 °C and a relative humidity of 30 % to 75 %.

5 Tooling

5.1 Press moulds

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Press moulds according to figures 1 and 2 are used for the production of test panels in a press. The choice of the press mould is to be made according to the material to be processed and the purpose of the test.

The press moulds shall satisfy the following requirements

- a) length and breadth of the pressing areas of the press mould shall be large enough to allow the manufacture of test panels from 150 mm × 150 mm to 400 mm × 400 mm.
- b) the moulding surfaces (surfaces designed for shaping the test panels) of the press mould should be hardened, polished and, if possible, hard chromium plated.
- c) the lower moulding surface shall have a mark, which is reproduced on the test panel on pressing, in order to make the lower side of the test panel identifiable after the pressing procedure. The mark on the test panel shall not have a deleterious effect on the subsequent tests (see first note page 6).
- d) the temperature over the entire moulding surface of the press mould shall not deviate locally by more than ± 3 °C from the specified value e.g. measured by means of a thermocouple.

e) the press mould type 1 consists of the elements shown in figure 1. The height of the frame shall be large enough to provide a moulding cavity in which the glass fibre fabric impregnated with the resin mix can be inserted in one operation.

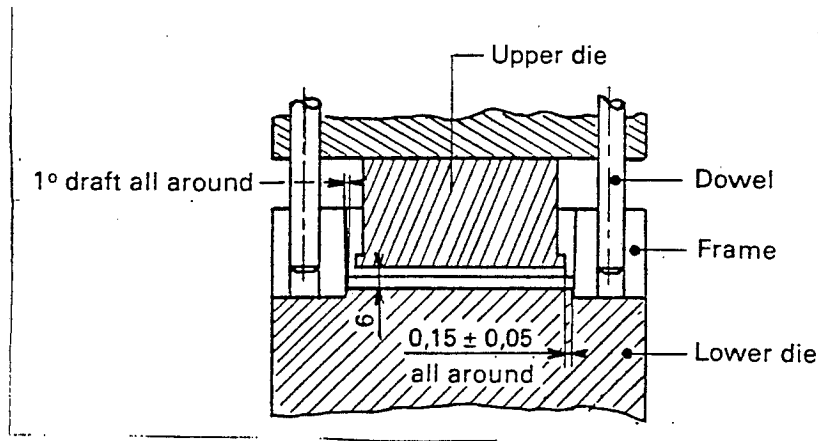


Figure 1 — Press mould type 1

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f) the mould type 2 consists of the elements shown in figure 2. The plates shall be plane and parallel and are guided only at the four corners (open press mould). By placing spacers in the region of the guides, it is possible to mould to stops if required, i.e. a specific thickness of the test panel can be set.

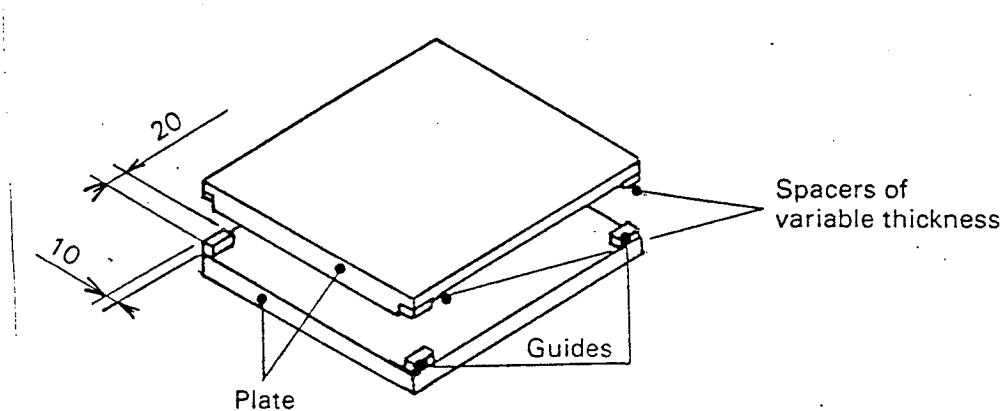


Figure 2 — Press mould type 2

NOTE : The properties of the upper and lower faces of a pressed test panel are not exactly the same. As a result of the time span, which is necessary for putting the laminate in place and the closure process, the lower face of the test panel is heated longer and possibly also subjected to a higher temperature than the upper face. In the standards concerned, therefore, it is to be stipulated, if necessary, for which surface of the test panels the results shall be valid.

5.2 Tools for autoclave and vacuum bag fabrication

For the fabrication of the laminate test panels, a pressure-tight base plate for the assembly, cover plate and various ancillaries, such as release films, sealing tape etc., are needed. For the fabrication of sandwich composite test panels, a rigid frame is also required, which shall be adjusted so that it takes up the forces acting laterally on the sandwich composite structure in this fabrication process.

5.3 Tools for hand lay-up of laminate

For the production of test panels in accordance with method C, a plane fixed support, approx. 500 mm × 500 mm in size and a cover (e.g. of glass) of the same size, are required, as well as spacers which can be inserted between the support and cover plate.

NOTE : Air bubbles can be detected easily if the support is either dark coloured or translucent and illuminated from below.

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6 Fabrication of laminate test panels

6.1 Preparation

6.1.1 Pretreatment

Unless otherwise specified, a pretreatment of the semifinished products shall be carried out for at least 2 h in the standard atmosphere in accordance with EN 2743.

6.1.1.1 Glass fibre fabric

A sufficient number of plies of glass fibre fabric for the fabrication of the test panel, see clause 6.1.2, is cut to size and dried in air for 1 h at 80 °C. Then the plies are immediately stacked flat upon one another in a desiccator, where they shall be allowed to cool to room temperature. The drying can be omitted if the glass fibre fabric plies are kept in the standard atmosphere in accordance with EN 2743, for at least 48 h before processing.

6.1.1.2 Preimpregnated glass fibre fabric

Preimpregnated glass fibre fabric products, which have to be stored at temperature lower than room temperature, shall be air-tight packed then be brought to room temperature in a polyethylene bag so that no moisture pick-up can take place. The time required for the equilibration of temperature depends on the amount, but it shall not be less than 4 h. The time required is to be stated in the report.

6.1.2 Number of plies of glass fibre fabric for types A and C

The number of plies of glass fibre fabric needed for a specific laminate thickness and a specific glass content can be calculated according to the following formula :

$$n = \frac{s \cdot \rho_{GL} \cdot \rho_{RM} \cdot b \cdot 1000}{m_{GL} \cdot [b \cdot \rho_{RM} + \rho_{GL} \cdot (100 - b)]}$$

in which :

- n = number of plies of glass fibre fabric
- s = thickness of the test laminate, in mm
- m_{GL} = mass per unit area of the glass fibre fabric product, in g/m²
- ρ_{GL} = density of the glass fibre fabric product, in g/cm³
- ρ_{RM} = density of the resin mix, in g/cm³
- b = glass content of the test laminate, in mass-%.

The number of plies of glass fibre fabric determined by this formula is to be rounded up or down in such a way that the test panel complies with the glass content in accordance with subclause 6.1.5 and also the thickness requirement specified in the test standard.

6.1.3 Resin mixes

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6.1.3.1 The resin mixes shall be produced and processed in accordance with the resin manufacturer's processing instructions.

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6.1.3.2 The amount m_{RM} of the resin mix theoretically required is calculated according to the following formula :

$$m_{RM} = m_{tot.} \cdot \frac{100 - b}{b}$$

in which :

- m_{tot.} = mass of all plies of glass fibre fabric, in g
- b = glass content in mass-%.

The theoretically determined amount m_{RM} is to be increased by a least 20 % for the laminating process in practice to ensure a sufficient resin flow.

6.1.4 Number of plies of preimpregnated glass fibre fabric for type B

The number of plies of glass fibre fabric necessary for a specific laminate thickness and a specific glass content can be calculated according to the formula given in subclause 6.1.2. For a sufficient resin flow, the glass content of the prepreg minus 1 % is used for b (glass content in mass-%) in the formula.