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**Textile glass — Mats and fabrics —  
Determination of contact mouldability**

*Verre textile — Mats et tissus — Détermination de l'aptitude au moulage  
au contact*





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## Foreword

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ISO 4900 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 4900:1990), of which it constitutes a minor revision designed to specify more clearly how many specimens are tested, in which directions they are cut out of the sample and how the results are calculated in each case.

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# Textile glass — Mats and fabrics — Determination of contact mouldability

## 1 Scope

This International Standard specifies a method for the determination of the contact mouldability of textile glass mats and fabrics.

**NOTE** The hand lay-up method of moulding is generally not regarded as lending itself to objective determinations. However, if the process is carried out by the same operator, useful comparisons can be drawn between results obtained with different mats or fabrics.

## 2 Normative references

The following referenced documents are indispensable for the application 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*

## 3 Terms and definitions

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

### 3.1

#### **mouldability of a textile glass mat (fabric)**

ease with which the mat (fabric), when it is wetted out with resin, can be made to conform permanently to a mould of specified configuration

## 4 Principle

The mould is in the form of steps as indicated in Figure 1, with progressively decreasing radii of the peaks and valleys of the mould.

A rectangular strip of mat or fabric is laid up on the mould and the minimum radius at which the mat or fabric conforms to the contour is recorded as the mouldability. The time taken to perform the test is also recorded.

## 5 Conditioning and testing atmosphere

Condition the test specimens for at least 6 h in one of the standard laboratory atmospheres specified in ISO 291. Carry out the test under the same conditions.

## 6 Apparatus and materials

### 6.1 Radius mould, as shown in Figure 1, with the specified radii marked at each ridge.

The mould shall be made from glass-fibre-reinforced plastic.

### 6.2 Standard “hand lay-up” polyester resin (to be agreed between the supplier and the purchaser), incorporating methyl ethyl ketone peroxide catalyst and cobalt naphthenate accelerator, to give a pot life of approximately 30 min at the specified test temperature.

- 6.3 **Balance**, accurate to 0,1 g.
- 6.4 **Stop-watch**, graduated in seconds.
- 6.5 **Bristle paint brush**, 50 mm in width, with bristles 50 mm to 60 mm in length.
- 6.6 **Sharp knife**.
- 6.7 **Mould release agent**.

## 7 Procedure

### 7.1 Preparation of the mould

Keep the mould as clean as possible. Before each test, coat the surface of the mould with mould release agent. After every test, remove all excess resin using solvent and/or a plastic scraper (not a sharp metal one which might damage the surface).

### 7.2 Moulding of the specimen

**7.2.1** Users should note that Subclauses 7.2.5 to 7.2.10 are written for a right-handed operator. Left-handed operators shall carry out this part of the procedure in the same way, but starting with the mould positioned so that the larger radii are to the left, and working from left to right.

**7.2.2** Using the knife (6.6), cut out specimens  $950 \text{ mm} \pm 10 \text{ mm}$  in length and  $150 \text{ mm} \pm 2 \text{ mm}$  in width. With both mats and fabrics, cut out three specimens parallel to and three perpendicular to the length direction of the mat or fabric.

**7.2.3** Weigh a specimen (mass  $m_g$ ).

**7.2.4** Weigh in an unwaxed container a quantity of the resin (6.2) equal to two and a half times the specimen mass plus approximately 50 g to allow for wastage on the brush (6.5) and in the container.

**7.2.5** Position the mould (6.1) with the larger radii to the right.

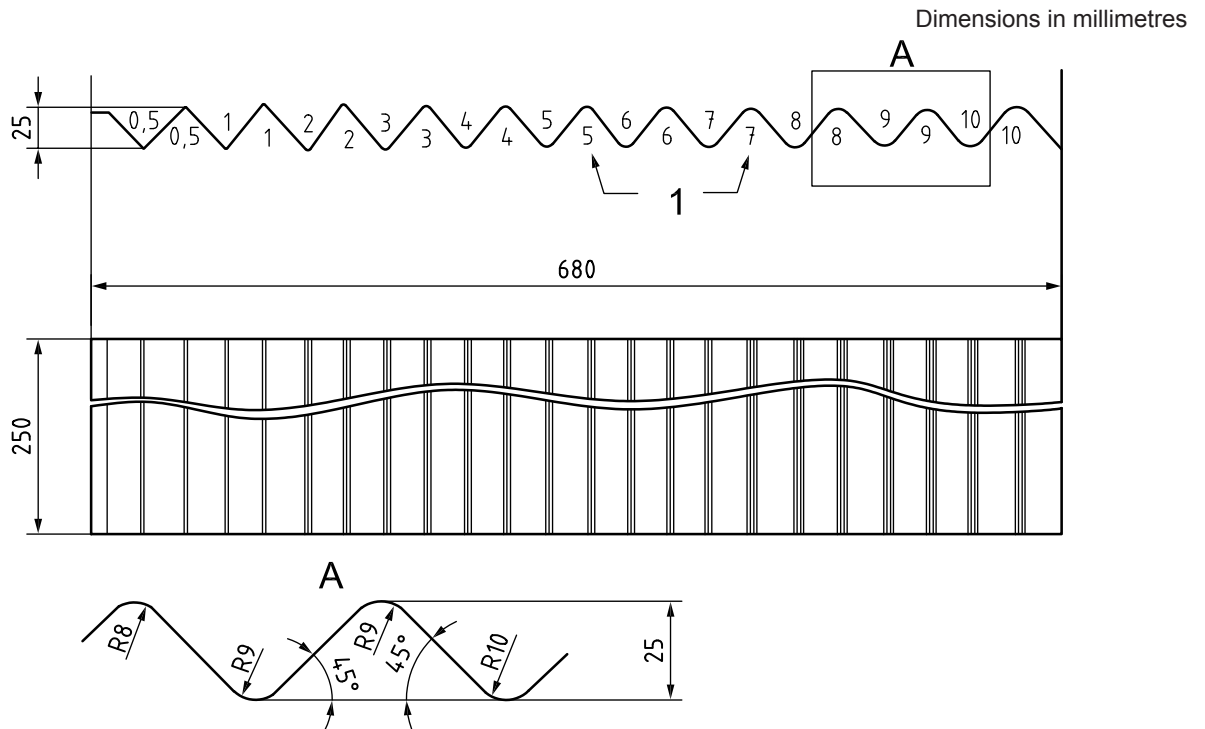
**7.2.6** Using the brush, paint a thin coat of resin, the same width as the specimen, along the centreline of the mould.

**7.2.7** Place the specimen over the painted band, letting the mat or fabric rest on the peaks of the corrugations, and with the right-hand end of the specimen coinciding with the right-hand end of the mould. Start the stop-watch (6.4) and immediately, by means of the brush, apply resin to the specimen as evenly as possible, leaving a very small dry area at the extreme left-hand end of the specimen for handling.

**7.2.8** Holding the left-hand end of the specimen up, clear of the mould, so that the mat or fabric only touches the mould at the start of the corrugations on the right-hand side, push the specimen by means of the brush into the first of the corrugations.

**7.2.9** Lowering the left hand slowly, work the specimen by means of the brush into and over the succeeding corrugations fairly rapidly until the specimen is roughly moulded in.

**7.2.10** Returning to the right-hand end, mould the specimen to the contours of the corrugations by means of the brush, progressively moving to the left.



**Key**

1 radii (all curved sections are full quadrants; flats are tangents at 45° to the horizontal)

**Figure 1 — Radius mould for mats and fabrics**

**7.2.11** If at any corrugation the specimen “springs away” from the mould, continue the moulding operation until the specimen conforms to the contour, i.e. do not proceed on to a more difficult corrugation until all the previous ones have been moulded correctly.

Note the time elapsed between the first application of the resin to the specimen and the end of the operation (working time).

The maximum working time shall be 5 min. At the end of this period, inspect the specimen.

**7.2.12** Note the ridge of the corrugation (not the valley) at which the specimen will no longer conform to the contour.

Record the mouldability value as the actual radius, in millimetres, of the previous, less severe contour. In case of doubt, use the following guideline:

If the specimen has broken away over more than 25 % of its width on a particular ridge, record the radius of the previous ridge as the mouldability value.

Normally, the mouldability value is ascertained on the uncured laminate. In case of doubt, it might be necessary to wait for polymerization of the resin before removing the laminate from the mould to enable the underside to be examined for air pockets and non-conformity with the mould.

**7.2.13** Weigh the cured laminate (mass  $m_1$ ).

**7.2.14** Repeat the test on the remaining specimens.

## 8 Expression of results

### 8.1 Mouldability value

For both mats and fabrics, calculate the average of the radii recorded for the three specimens cut out parallel to the length direction of the mat or fabric and the average of the radii recorded for the three specimens cut out perpendicular to the length direction of the mat or fabric, and round to the nearest 1 mm in each case.

### 8.2 Ratio of mass of reinforcement to mass of resin

Calculate the ratio,  $R$ , of the mass of the reinforcement to the mass of the resin in the laminate using the equation:

$$R = \frac{m_g}{m_l - m_g}$$

where

$m_l$  is the mass of the laminate;

$m_g$  is the total mass (glass plus size and/or binder) of the reinforcement.

Calculate the average of the three results obtained for each set of specimens, expressed to one place of decimals.

## 9 Test report

The test report shall include the following information:

- a) a reference to this International Standard;
- b) the reference number and a full description of the mat or fabric;
- c) a full description of the resin;
- d) the formulation of the catalysed and accelerated resin system used and the viscosity of the system at the test temperature;
- e) the average value and the individual values of the mouldability, the working time and the ratio of reinforcement to resin content, by mass, for each set of three specimens;
- f) details of any operations not specified in this International Standard as well as of any incidents liable to have influenced the results;
- g) the date of the test;
- h) any other relevant information.







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