BS ISO 4900:2011

BSI Standards Publication

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

bsi.

...making excellence a habit.™

**National foreword**

This British Standard is the UK implementation of ISO 4900:2011.

The UK participation in its preparation was entrusted to Technical Committee PRI/42, Fibre reinforced thermosetting plastics and prepregs.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.



ISBN 978 0 580 74664 2

ICS 59.100.10

**Compliance with a British Standard cannot confer immunity from legal obligations.**

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 December 2011.

**Amendments issued since publication**

| Date | Text affected |
|---|---|

BS ISO 4900:2011

INTERNATIONAL STANDARD

**ISO 4900**

Second edition
2011-11-15

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

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

Reference number
ISO 4900:2011(E)

## COPYRIGHT PROTECTED DOCUMENT



ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

# 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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

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 constutes 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.

# 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 mm $\pm$ 10 mm in length and 150 mm $\pm$ 2 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.

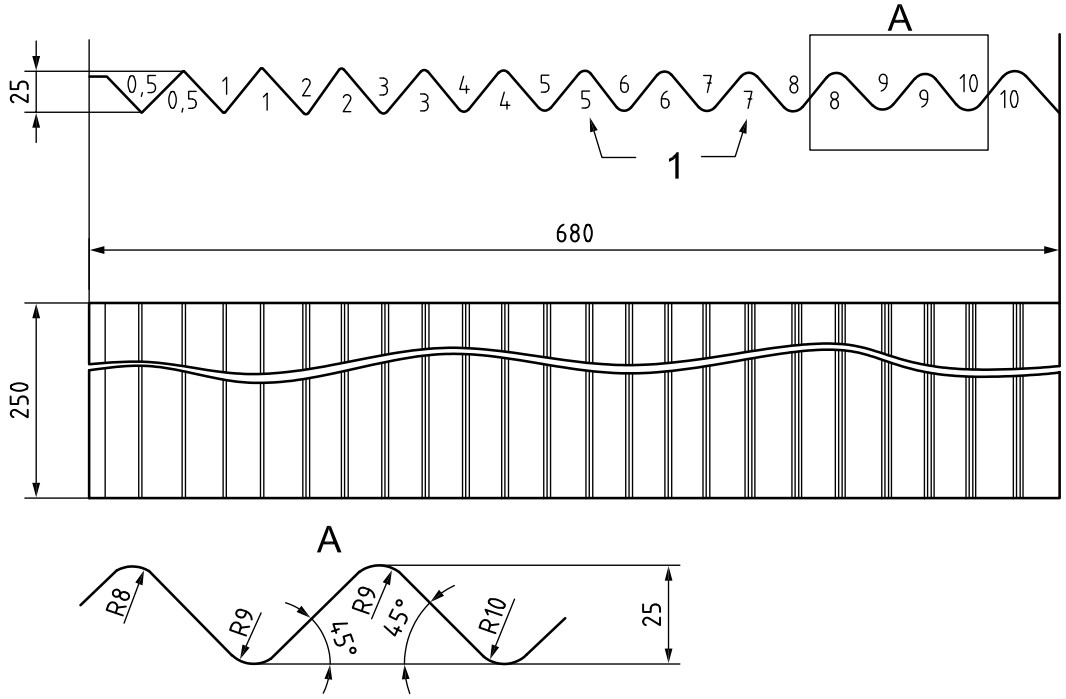
**7.2.7** Place the specimen over the painted band, letting the mat or fabric rest on the peaks of the corrugations, and with the right-hand end of the specimen coinciding with the right-hand end of the mould. Start the stop-watch (6.4) and immediately, by means of the brush, apply resin to the specimen 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.

Dimensions in millimetres




**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:

$$R = \frac{m_{\mathrm{g}}}{m_{\mathrm{l}} - m_{\mathrm{g}}}$$

where

$m_{\mathrm{l}}$ is the mass of the laminate;

$m_{\mathrm{g}}$ 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.

**ICS 59.100.10**

Price based on 4 pages

*This page deliberately left blank*

# British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

## About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

## Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

## Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

## Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

**PLUS** is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email bsmusales@bsigroup.com.

**BSI Group Headquarters**

389 Chiswick High Road London W4 4AL UK

## Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

## Copyright



## Useful Contacts:

**Customer Services**
**Tel:** +44 845 086 9001
**Email (orders):** orders@bsigroup.com
**Email (enquiries):** cservices@bsigroup.com

**Subscriptions**
**Tel:** +44 845 086 9001
**Email:** subscriptions@bsigroup.com

**Knowledge Centre**
**Tel:** +44 20 8996 7004
**Email:** knowledgecentre@bsigroup.com

**Copyright & Licensing**
**Tel:** +44 20 8996 7070
**Email:** copyright@bsigroup.com

bsi.

...making excellence a habit.™