BRITISH STANDARD

BS ISO
1268-2:2001

Fibre-reinforced plastics — Methods of producing test plates —

Part 2: Contact and spray-up moulding

ICS 83.120;83.140.10;

National foreword

This British Standard reproduces verbatim ISO 1268-2;2001 and implements it as the UK national standard.

The UK participation in its preparation was entrusted to Technical Committee PRI/42, Fibre reinforced thermosetting plastics and prepregs, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

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

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled "International Standards Correspondence Index", or by using the "Find" facility of the BSI Standards Electronic Catalogue.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

This British Standard, having been prepared under the direction of the Sector Committee for Materials and Chemicals, was published under the authority of the Standards Committee and comes into effect on 15 July 2001

Summary of pages

This document comprises a front cover, an inside front cover, ISO title page, pages ii to iv, pages 1 to 7 and a back cover.

The BSI copyright date displayed in this document indicates when the document was last issued.

Amendments issued since publication

Amd. No.	Date	Comments

ISBN 0 580 37743 1

INTERNATIONAL STANDARD

ISO 1268-2

First edition
2001-03-15

Fibre-reinforced plastics — Methods of producing test plates —

Part 2: Contact and spray-up moulding

Plastiques renforcés de fibres — Méthodes de fabrication de plaques d'essai —

Partie 2: Moulage au contact et par projection

Reference number
ISO 1268-2:2001(E)

Contents

Page

Annex

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 3.

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 part of ISO 1268 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 1268-2 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 13, *Composites and reinforcement fibres*.

Together with the other parts (see below), this part of ISO 1268 cancels and replaces ISO 1268:1974, which has been technically revised.

ISO 1268 consists of the following parts, under the general title *Fibre-reinforced plastics — Methods of producing test plates*:

— *Part 1: General conditions*

— *Part 2: Contact and spray-up moulding*

— *Part 3: Wet compression moulding*

— *Part 4: Moulding of prepregs*

— *Part 5: Filament winding*

— *Part 6: Pultrusion moulding*

— *Part 7: Resin transfer moulding*

— *Part 8: Compression moulding of SMC and BMC*

— *Part 9: Moulding of GMT/STC*

The following additional parts are in preparation:

— *Part 10: Injection moulding of SMC and BMC — General principles and moulding of multipurpose test specimens*

— *Part 11: Injection moulding of SMC and BMC — Small plates*

Annex A of this part of ISO 1268 is for information only.

Fibre-reinforced plastics — Methods of producing test plates —

Part 2:
Contact and spray-up moulding

1 Scope

This part of ISO 1268 specifies methods for preparing reinforced plastics test plates either by contact moulding or by spray-up moulding.

It applies exclusively to glass reinforcements.

It is intended to be read in conjunction with ISO 1268-1.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 1268. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 1268 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 1172, *Textile-glass-reinforced plastics — Prepregs, moulding compounds and laminates — Determination of the textile-glass and mineral-filler content — Calcination methods*.

ISO 1268-1, *Fibre-reinforced plastics — Methods of producing test plates — Part 1: General conditions*.

3 Health and safety

See ISO 1268-1.

4 Principle

4.1 Contact moulding

Reinforcement layers (as described in 5.1) are placed on a rigid flat plate and manually impregnated with liquid thermosetting resin. The resin is formulated in accordance with the manufacturer's instructions to attain cure within a period of time that allows completion of the lay-up, yet limits unnecessary exposure to the atmosphere. The glass fibre and resin are consolidated by means of a hand-operated roller.

This method is suitable for any thermosetting resin that cures at room temperature without the need for additional pressure to be applied.

4.2 Spray-up moulding

Textile glass rovings are chopped to predetermined lengths in a cutter and simultaneously combined with a stream of tiny resin droplets emerging from a spray-gun nozzle. This method is normally used with unsaturated-polyester resins.

Glass fibre and resin are dispersed on a rigid flat plate or a mould, and consolidated by means of a hand-operated roller.

5 Materials

5.1 Contact moulding

5.1.1 Layers of reinforcing material, cut to the dimensions of the test plate, marking the warp and weft or preferred direction when appropriate. Suitable materials include chopped-strand mats with a binder that is soluble in the resin mix, woven fabrics made from rovings or yarns, multiaxial non-woven fabrics, etc.

5.1.2 Thermosetting resin and curing agents, mixed in accordance with the supplier's instructions for room temperature curing.

5.1.3 Release agent, to be applied to the mould or plate on which the test plate is to be made.

5.2 Spray-up moulding

5.2.1 Roving or yarn packages.

5.2.2 Pre-activated thermosetting resin (use a resin specially recommended for spray-up moulding).

5.2.3 Catalyst that is recommended for the resin used.

5.2.4 Release agent.

6 Plate dimensions

6.1 General

The length, width and thickness of the plate will depend upon the material being processed and the method used for processing.

6.2 Contact moulding

The recommended dimensions are 600 mm × 600 mm. This size is sufficient to obtain test specimens for tensile and flexural tests along two perpendicular directions.

The thickness shall be from 2 mm to 10 mm.

6.3 Spray-up moulding

The recommended dimensions are 600 mm × 600 mm. This size is sufficient to obtain test specimens for tensile and flexural tests along two perpendicular directions.

The thickness shall not be greater than that which allows all air bubbles to be removed from the laminate by use of a roller (typically 2 mm to 5 mm).

7 Reinforcement content

7.1 General

The reinforcement content of the laminate produced will depend on the type of reinforcement used. The recommended percentage of reinforcement by mass for woven rovings is (50 ± 3) %; for mats and chopped rovings it is (32 ± 4) %.

7.2 Contact moulding

To achieve the thickness and reinforcement content desired, it may be necessary to conduct preliminary trials and measure these properties before the final technique for fabrication is determined.

A guide to determining the number of layers of reinforcement to be used is given in annex A.

7.3 Spray-up moulding

To achieve the thickness and reinforcement content desired, it may be necessary to conduct preliminary trials and measure these properties before the final spraying technique is determined.

Multiple sprayed layers are preferable to a single spray application and it is recommended that one layer of sprayed material has a thickness of about 1 mm.

8 Apparatus

8.1 Contact moulding

8.1.1 Scissors or **knife**, for cutting the reinforcement material.

8.1.2 Balance, accurate to the nearest 0,1 g.

8.1.3 Beakers, made of glass, plastic or uncoated paper (waxed paper is also suitable).

8.1.4 Brushes.

8.1.5 Mohair or steel rollers, with or without liner.

8.1.6 Rigid flat plate, made of polished steel or any other non-porous material, with raised edges (to prevent resin run-off) made from material which is not affected by the resin used.

8.1.7 Ventilated oven, with timer and controls (if necessary).

8.1.8 Desiccator (if necessary).

8.2 Spray-up moulding

The apparatus specified in 8.1, plus the following:

8.2.1 Glass-chopper/spray-gun unit.

8.2.2 Stopwatch.

9 Procedure

9.1 Contact moulding

9.1.1 Prepare the test plate using the same parameters (number of layers, orientation, glass fibre content and type of resin) as would be used to produce the laminate being assessed.

9.1.2 Coat the plate or mould on which the laminate will be made with a layer of release agent, allow the layer to dry, and polish it if necessary.

9.1.3 Cut layers of reinforcement to the dimensions necessary to give a surface area large enough to enable the specified number of test specimens to be obtained.

Follow the manufacturer's instructions regarding conditioning of the reinforcement material. Dry the material, if necessary, before processing.

9.1.4 Determine the total mass m_1 of the conditioned reinforcement layers.

9.1.5 Determine the amount of resin m_2 required to give the desired reinforcement content. The following equation may be used as a guide for this:

$$m_2 = m_1 \times \frac{100 - w_g}{w_g} \times 1{,}2$$

where

m_1 is the mass of glass fibre, in grams;

m_2 is the mass of resin, in grams;

w_g is the glass fibre content desired in the laminate, expressed as a percentage of the total mass.

NOTE A 20 % excess of resin is included to compensate for losses due to resin spills along the edges, absorption by the rollers, etc.

9.1.6 Condition the resin to the temperature of the laminating room before addition of the curing agents. Once the resin is fully mixed, begin laminating immediately.

9.1.7 Apply a thin layer of resin and spread evenly over a surface area equivalent to the laminate dimensions. The amount of resin to be used will depend on the thickness of the individual reinforcement layers.

Then carefully place the first layer of reinforcement on the resin film.

Once the resin has wetted the reinforcement from beneath, remove any remaining air pockets by means of a roller.

Next apply a further coat of resin and put a second layer of reinforcement material in place, impregnating it in the same way as described above.

9.1.8 When all the layers have been applied, proceed to the curing of the plate (see 9.3).

9.2 Spray-up moulding

9.2.1 Insert the specified type of glass fibre roving into the chopper and adjust the pressure between the cutter roller and anvil roller to give clean chopping without excessive friction.

9.2.2 Fill the dispenser tanks of the equipment with the pre-activated resin and the catalyst.

9.2.3 Operate the chopper for exactly 15 s, then weigh the chopped fibres.

Spray the resin for exactly 15 s, without using atomizing air, into a suitable receptacle (e.g. a paper cup) and weigh the resin in the receptacle.

Adjust the pressure on the chopper and the spray gun to give the desired ratio of resin and glass fibre in the output.

9.2.4 Coat the plate or mould on which the laminate will be made with a layer of release agent, allow the layer to dry, and polish it if necessary.

9.2.5 Apply regular layers of chopped fibres and resin, rolling after the application of each layer to remove excess air.

9.2.6 When the required thickness has been reached, proceed to the curing of the plate (see 9.3).

9.3 Curing conditions

Unless other conditions are recommended by the resin manufacturer, use one of the following:

— either leave the plate on its plate-mould for 48 h at room temperature;

— or release the plate from the plate-mould after a maximum of 4 h, place it on a plane support in an oven set at 40 °C and leave in the oven at this temperature for 16 h.

These curing conditions allow production of a stabilized material corresponding to general use. When a plate is specifically manufactured to fit particular needs, it is necessary to carry out, in addition, a post-curing stage, using times and temperatures in accordance with the resin manufacturer's recommendations.

On completion of curing, cool the plate for 60 min at room temperature, if applicable.

Trim the edges of the plate before taking test specimens.

10 Verification of the characteristics of the plate obtained

Visually examine the plate obtained to determine if it is acceptable in appearance.

If so, determine the fibre content by the method specified in ISO 1172. The recommended values of the fibre content are given in 7.1.

If required, determine the void content by a suitable method.

11 Marking

Mark each plate with a reference linking it with the relevant test plate preparation report.

12 Test plate preparation report

The test plate preparation report shall include the following information:

a) a reference to this part of ISO 1268;

b) the place and date of production of the test plate;

c) the procedure used (contact moulding or spray-up moulding);

d) in the case of contact moulding:

   1) details of any conditioning of the reinforcement,

   2) the number of layers, and the direction of each layer if applicable;

e) in the case of spray-up moulding, the nominal length of the chopped fibres;

f) a description of the materials used (including type of reinforcement, type of resin, type of filler, if applicable, catalyst curing system, etc.);

g) a description of the equipment used;

h) the operating conditions (production time, curing temperature and time, details of post-curing conditions if applicable);

i) the thickness of the test plate produced;

j) the fibre content and filler content, if applicable;

k) the quality of the plate (appearance, impregnation);

l) any other information needed to reproduce the plates exactly;

m) any deviations from this part of ISO 1268.

Annex A
(informative)

Estimation of the number of reinforcement layers for various reinforcement materials

A.1 Calculation method

$$n = \frac{h\rho_g w_g}{\rho_A[w_g\rho_r + \rho_g(1 - w_g)]} \times 1\,000$$

where

n is the number of layers;

h is the thickness of the plate, in mm;

ρ_g is the density of the glass, in g/cm^3;

ρ_r is the density of the resin, in g/cm^3;

w_g is the glass content, expressed as a fraction by mass;

ρ_A is the mass per unit area of the reinforcement, in g/m^2.

A.2 Product method

Table A.1

Type of reinforcement	Mass per unit area g/m^2	Typical fibre content mass %	Theoretical thickness mm
Mat	300	30	0,7
	450	30	1,0
	600	30	1,4
Woven fabric	270	60	0,5
Woven rovings	270	50	0,4
	500	50	0,6
	800	50	0,9
Mat + woven roving			
One 450 g/m^2 mat + one 500 g/m^2 woven roving	950	40	1,4
One 600 g/m^2 mat + one 500 g/m^2 woven roving	1 100	40	1,7
One 600 g/m^{2}mat + one 800 g/m^2 woven roving	1 400	40	2,1
Three 450 g/m^2 mats + two 500 g/m^2 woven rovings	2 350	40	3,3

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: 020 8996 9000. Fax: 020 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: 020 8996 9001. Fax: 020 8996 7001. Standards are also available from the BSI website at http://www.bsi-global.com.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: 020 8996 7111. Fax: 020 8996 7048.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: 020 8996 7002. Fax: 020 8996 7001. Further information about BSI is available on the BSI website at http://www.bsi-global.com.

Copyright

BSI
389 Chiswick High Road
London
W4 4AL