INTERNATIONAL STANDARD

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Fibre-reinforced plastics — Methods of producing test plates —

Part 8: Compression moulding of SMC and BMC

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

Partie 8: Moulage par compression des SMC et BMC

Reference number
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Contents

Page

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 1268-8 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 prepegs*

— *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*

— *Part 10: Injection moulding of BMC and other long-fibre moulding compounds — General principles and moulding of multipurpose test specimens*

— *Part 11: Injection moulding of BMC and other long-fibre moulding compounds — Small plates*

Introduction

Compression moulding of SMC and BMC differs from that of all other compression-mouldable reinforced thermosetting materials. Because of the maturation process which typically takes place before moulding and the ability of the compound to flow during moulding, special procedures need to be used for the production of test plates from these compounds.

Two different methods are given for preparing the mould charge: method A for moulding without the material flowing in the mould and method B for moulding so that the material flows in the mould.

For engineers designing new moulds, knowledge of the anisotropy imparted to the moulding under defined moulding conditions is essential. It is therefore necessary for the test plates from which test specimens will be cut to be manufactured under comparable conditions.

Fibre-reinforced plastics — Methods of producing test plates —

Part 8: Compression moulding of SMC and BMC

1 Scope

This part of ISO 1268 specifies the general principles and procedures for the compression moulding of test plates from two types of fibre-reinforced thermosetting moulding compound: sheet moulding compound (SMC) and bulk moulding compound (BMC).

The aim of this part of ISO 1268 is to ensure the preparation of flat test plates from which test specimens can be cut (for the relevant test methods, see Annex A). The plates are produced in such a way that specimens cut from them give representative results when used in these test methods.

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 472, *Plastics — Vocabulary*

ISO 8604, *Plastics — Prepregs — Definitions of terms and symbols for designations*

ISO 12115:1997, *Fibre-reinforced plastics — Thermosetting moulding compounds and prepregs — Determination of flowability, maturation and shelf life*

EN 1842, *Plastics — Thermoset moulding compounds (SMC - BMC) — Determination of compression moulding shrinkage*

3 Terms and definitions

For the purposes of this part of ISO 1268, the terms and definitions given in ISO 472 and ISO 8604, together with the the following, apply.

3.1
compression time
time during which the required pressure is applied to the mould

4 Health and safety

This part of ISO 1268 is limited to describing test plate preparation methods. The conditions under which the materials used are handled shall comply with the national regulations in force in each country and the staff shall be informed of the hazards involved and appropriate precautions taken.

5 Plate dimensions

The recommended moulded-plate size is 200 mm × 590 mm (necessary for method II in ISO 12115:1997). If no suitable mould is available, use a mould with a minimum area of 300 cm^2 to make plates by method A only, the dimensions of the mould being such that at least five test specimens measuring 20 mm × 250 mm can be cut from the plates.

Most of the methods of test for SMC and BMC require a test specimen thickness of about 4 mm. In special cases, test plates of other thicknesses will have to be moulded. For particular test methods, the moulded plate specified in EN 1842 could be used.

6 Apparatus

6.1 Press

Test plates may be moulded on any hydraulic moulding press which complies with the following requirements:

— it is capable of closing the mould and applying the specified moulding pressure within a maximum of 15 s;

— it is capable of maintaining the specified pressure to within ± 5 % during the compression time.

6.2 Mould

The mould used shall be able to withstand the specified temperature and pressure. The mould design shall ensure that the entire force is applied to the moulding material. The mould cavity shall be flat and have an area of at least 300 cm^2 for method A or 200 mm × 590 mm for method B.

6.3 Cooling rack

A device or fixture shall be used to hold the test plates while they cool. A non-metallic cooling rack with slots to hold the plates in a vertical position spaced at least 20 mm apart is recommended. The ends of the plates should preferably be protected from damage.

To ensure symmetrical cooling of all test plates, the outer plates shall be protected by additional protective plates.

7 Sampling and conditioning

7.1 With SMC, take the sample from the full width of the roll. Trim 5 cm off both sides of the sample to eliminate edge effects resulting from the manufacturing process.

7.2 With BMC, take a sample representative of the material from a production batch.

7.3 Immediately after sampling, protect the material by placing it in a suitable bag to avoid loss of volatile constituents and absorption of moisture. Condition samples to establish temperature equilibrium before moulding by placing them in a room at a temperature of (23 ± 2) °C.

8 Procedure

8.1 Preparation of charge

8.1.1 Method A: For moulding without the material flowing in the mould

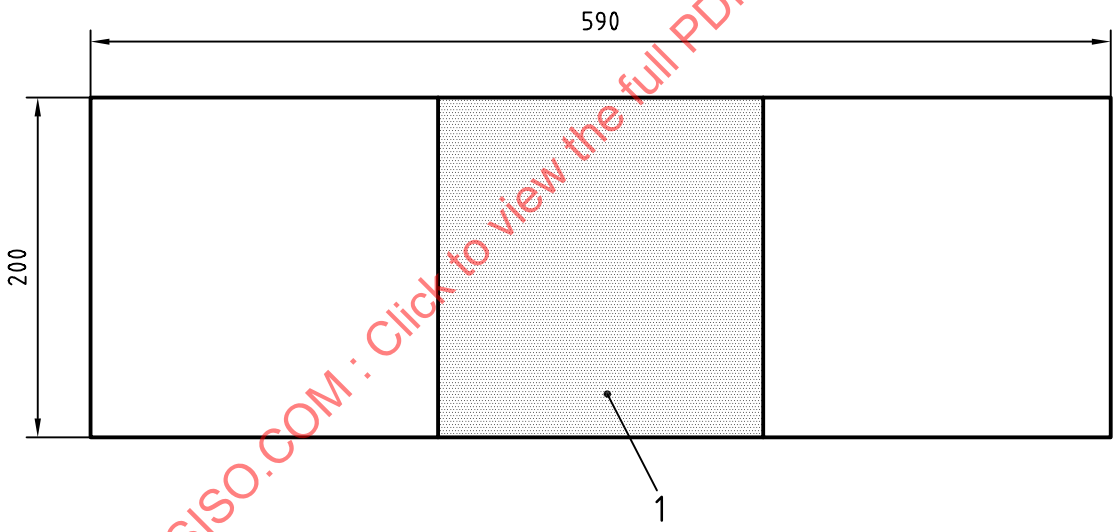
With SMC, 100 % mould-surface coverage is recommended, but it shall not be less than 90 % of the total cavity area unless otherwise specified or agreed between the interested parties. Prepare the SMC required to charge the mould by stacking the necessary number of layers. Note the sequence and orientation of the layers. If a mould coverage of less than 100 % is used, reduce both the length and the width of the layers proportionately in order to prevent flow during moulding altering the orientation of the fibres.

With BMC, pre-shape the moulding material manually on a flat tray to give a flat layer with as even a thickness as possible and of the same size as the mould cavity.

8.1.2 Method B: For moulding so that the material flows in the mould

Prepare the charge as specified in method II of ISO 12115:1997 to give an initial mould-surface coverage of between 25 % and 30 % (see Figure 1).

Dimensions in millimetres



Key

1 charge

Figure 1 — Charge covering 25 % to 30 % of total area of mould cavity

8.2 Moulding conditions

The mould temperature shall be 140 °C ± 2 °C, unless otherwise specified or agreed.

The moulding pressure and the compression time shall be as given in the relevant material specification.

8.3 Moulding procedure

8.3.1 Set the moulding conditions to those to be used.

8.3.2 Prepare the charge as described in 8.1.1 or 8.1.2 to obtain the specified test plate thickness.

8.3.3 Weigh the charge.

8.3.4 Load the charge into the mould cavity — taking care that it is in the centre of the mould cavity, if applicable — and close the press immediately. As soon as the specified pressure is reached, start measuring the compression time.

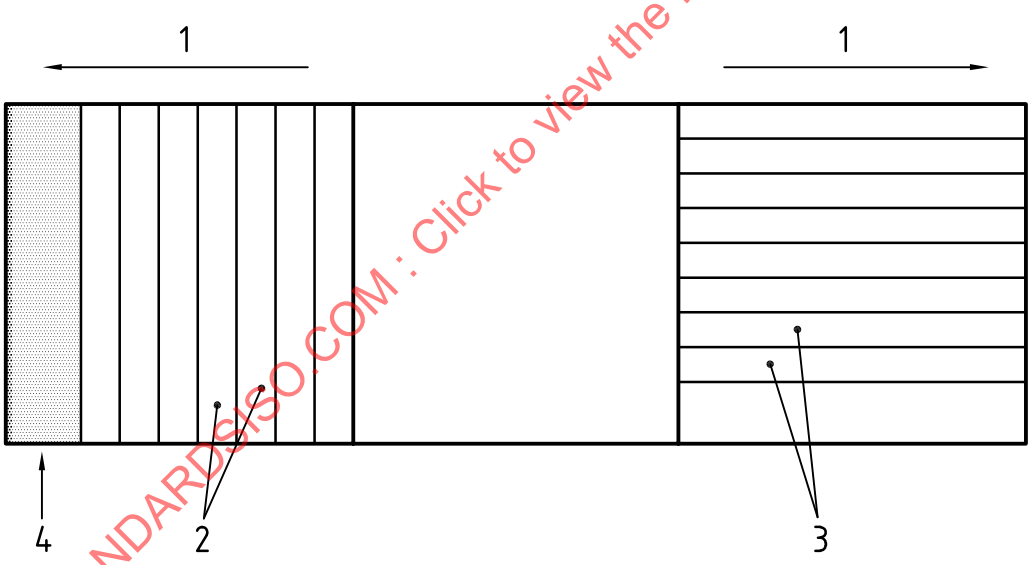
8.3.5 When the compression time is complete, open the press, remove the moulded plate and place it in the cooling rack to cool to room temperature.

8.3.6 Discard any defective plates.

8.3.7 Measure the thickness of each plate.

9 Stabilization

It is recommended that, unless otherwise specified or agreed, the test plates are kept for 48 h at the ambient conditions in the laboratory before cutting the test specimens from them. When cutting test specimens from plates produced using charges prepared by method B, cut them as shown in Figure 2.



Key

1 direction of flow
2 specimens perpendicular to direction of flow
3 specimens parallel to direction of flow
4 discard

NOTE There is an end effect perpendicular to the direction of flow, so the left-hand end strip (4) has to be discarded. Any edge effect in the corresponding area at the right-hand end of the plate is confined to the tab area of the test specimens and thus does not affect the value of the property measured. The edges parallel to the direction of flow do not exhibit significant edge effects, so do not need to be discarded.

Figure 2 — Areas of flow and directions in which specimens are cut from the moulded plate

10 Test plate preparation report

The test plate preparation report shall include the following information:

a) a reference to this part of ISO 1268;

b) a full description of the moulding material used, including at least the type, the source of supply, the manufacturer's name and the designation of the material;

c) the date of manufacture of the material;

d) the type and size of mould used;

e) a description of the charge (length, width, mass and number of layers for SMC, mass of charge for BMC);

f) the moulding conditions (temperature, pressure, compression time);

g) identification of the plates, using a suitable numbering or code system;

h) the thickness of the plates;

i) details of any incidents or modifications to the procedure which might influence the properties of test specimens taken from the test plates.

Annex A
(informative)

Applicable test methods

Test specimens cut from of test plates prepared in accordance with this part of ISO 1268 can be used for the following test methods. This list is purely informative and will not be updated every time a test method is amended, revised or withdrawn.

A.1 Mechanical properties

ISO 179-1, *Plastics — Determination of Charpy impact properties — Part 1: Non-instrumented impact test*

ISO 179-2, *Plastics — Determination of Charpy impact properties — Part 2: Instrumented impact test*

ISO 180, *Plastics — Determination of Izod impact strength*

ISO 527-1, *Plastics — Determination of tensile properties — Part 1: General principles*

ISO 527-2, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics*

ISO 527-4, *Plastics — Determination of tensile properties — Part 4: Test conditions for isotropic and orthotropic fibre-reinforced plastic composites*

ISO 14125, *Fibre-reinforced plastic composites — Determination of flexural properties*

ISO 14126, *Fibre-reinforced plastic composites — Determination of compressive properties in the in-plane direction*

ISO 6603-1, *Plastics — Determination of puncture impact behaviour of rigid plastics — Part 1: Non-instrumented impact testing*

ISO 6603-2, *Plastics — Determination of puncture impact behaviour of rigid plastics — Part 2: Instrumented impact testing*

A.2 Thermal properties

ISO 75-1, *Plastics — Determination of temperature of deflection under load — Part 1: General test method*

ISO 75-2, *Plastics — Determination of temperature of deflection under load — Part 2: Plastics and ebonite*

ISO 75-3, *Plastics — Determination of temperature of deflection under load — Part 3: High-strength thermosetting laminates and long-fibre-reinforced plastics*

ISO 11359-2, *Plastics — Thermomechanical analysis (TMA) — Part 2: Determination of coefficient of linear thermal expansion and glass transition temperature*