INTERNATIONAL STANDARD

ISO 1268-10

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Fibre-reinforced plastics — Methods of producing test plates —

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

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Partie 10: Moulage par injection de BMC et d'autres mélanges à mouler à longues fibres — Principes généraux et moulage d'éprouvettes à usages multiples

Reference number
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Foreword

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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 1268-10 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 13, *Composites and reinforcement fibres*.

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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*:

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— *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*

— *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*

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Introduction

Many factors in the injection-moulding process can influence the properties of moulded test specimens and hence the measured values obtained when the specimens are used in a test method. The thermal and mechanical properties of such specimens are in fact strongly dependent on the conditions of the moulding process used to prepare the specimens. Exact definition of each of the main parameters of the moulding process is a basic requirement for reproducible and comparable operating conditions.

It is important in defining moulding conditions to consider any influence the conditions may have on the properties to be determined. Thermosets may show differences in orientation and length of anisotropic fillers such as long fibres and in curing. Residual ("frozen-in") stresses in the moulded test specimens may also influence properties. Due to the crosslinking of thermosets, molecular orientation is of less influence on mechanical properties than it is for thermoplastics. Each of these phenomena must be controlled to avoid fluctuation of the numerical values of the measured properties.

The principles described in this part of ISO 1268 are the same as those in ISO 10724-1. Only a few details of the moulds have changed, as has specimen thickness, because of the use of long-fibre reinforcements. It is therefore possible to compare the properties of long-fibre moulding compounds with those of thermosetting powder moulding compounds (PMCs) and thermoplastics.

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Fibre-reinforced plastics — Methods of producing test plates —

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

1 Scope

This part of ISO 1268 specifies the general principles to be followed while injection moulding test specimens of bulk moulding compound (BMC) and gives details of mould designs for preparing one type of specimen for use in establishing reproducible moulding conditions. Where appropriate, this part of ISO 1268 may be applied to sheet moulding compound (SMC) formulated for injection moulding. Its purpose is to promote uniformity in describing the main parameters of the moulding process and also to establish uniform practice in reporting moulding conditions. The particular conditions required for the reproducible preparation of test specimens which will give comparable results will vary for each material used. These conditions are given in the International Standard for the relevant material or are to be agreed upon between interested parties.

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NOTE Tests have shown that mould design in an important factor in the reproducible preparation of test specimens.

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This part of ISO 1268 is intended to be read in conjunction with ISO 1268-1.

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

ISO 1268-11, *Fibre-reinforced plastics — Methods of producing test plates — Part 11: Injection moulding of BMC and other long-fibre moulding compounds — Small plates*

ISO 2577, *Plastics — Thermosetting moulding materials — Determination of shrinkage*

ISO 3167, *Plastics — Multipurpose test specimens*

ISO 10350-2, *Plastics — Acquisition and presentation of comparable single-point data — Part 2: Long-fibre-reinforced plastics*

ISO 10724-1, *Plastics — Injection moulding of test specimens of thermosetting powder moulding compounds (PMCs) — Part 1: General principles and moulding of multipurpose test specimens*

ISO 10724-2, *Plastics — Injection moulding of test specimens of thermosetting powder moulding compounds (PMCs) — Part 2: Small plates*

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ISO 11403-1, *Plastics — Acquisition and presentation of comparable multipoint data — Part 1: Mechanical properties*

ISO 11403-2, *Plastics — Acquisition and presentation of comparable multipoint data — Part 2: Thermal and processing properties*

ISO 11403-3, *Plastics — Acquisition and presentation of comparable multipoint data — Part 3: Environmental influences on properties*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 472 and the following apply.

3.1
mould temperature
T_C
average temperature of the mould cavity surfaces measured after the system has attained thermal equilibrium and immediately after opening the mould

NOTE It is expressed in degrees Celsius (°C).

3.2
temperature of material
T_M
temperature of the plasticized material in a free shot

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NOTE 1 It is given by the temperature of the wall of the screw cylinder.

NOTE 2 It is expressed in degrees Celsius (°C).

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3.3
pressure on material
p
pressure on the plasticized material in front of the screw at any time during the moulding process (see Figure 1)

NOTE 1 It is expressed in megapascals (MPa).

NOTE 2 The pressure on the material, which is generated hydraulically, can be calculated from the force F_s acting longitudinally on the screw using Equation (1):

$$p = \frac{4 \times 10^3 \times F_s}{\pi \times D^2} \quad (1)$$

where

p is the pressure on the material, in megapascals (MPa);

F_s is the longitudinal force, in kilonewtons (kN), acting on the screw;

D is the screw diameter, in millimetres (mm).

3.4
maximum pressure on the material
p_{max}
maximum value of the pressure on the material

NOTE It is expressed in megapascals (MPa).

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3.5
hold pressure
p_H
pressure on the material during the hold time (see Figure 1)

NOTE It is expressed in megapascals (MPa).

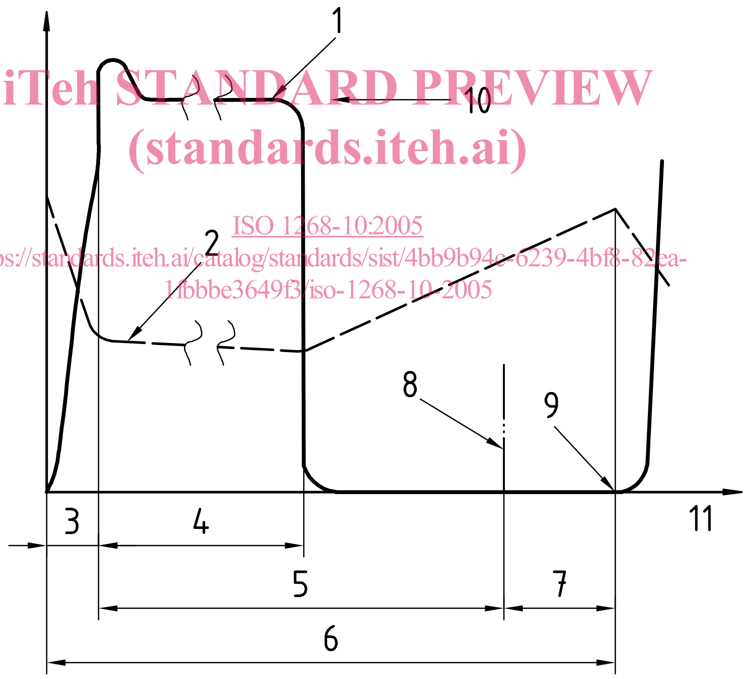
3.6
moulding cycle
complete sequence of operations in the moulding process required for the production of one set of test specimens (see Figure 1)

NOTE It is expressed in seconds (s).

3.7
cycle time
t_T
time required to carry out a complete moulding cycle

NOTE 1 It is expressed in seconds (s).

NOTE 2 The cycle time is the sum of the injection time t_I, the cure time t_{CR} and the mould open time t_O.



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Key

1 pressure on material, p
2 longitudinal position of the screw
3 injection time, t_I
4 hold time, t_H
5 cure time, t_{CR}
6 cycle time, t_T
7 open time, t_O
8 mould opening
9 mould closing
10 hold pressure, p_H
11 time

Figure 1 — Schematic diagram of an injection-moulding cycle, showing the pressure on the material (full line) and the longitudinal position of the screw (dashed line) as a function of time

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3.8
injection time
t_I
time from the instant the screw starts to move forward until the switchover point between the injection period and the hold period

NOTE It is expressed in seconds (s).

3.9
cure time
t_{CR}
time from the end of the injection period until the mould starts to open

NOTE It is expressed in seconds (s).

3.10
hold time
t_H
time from the end of the injection period until the hold pressure p_H is released

NOTE It is expressed in seconds (s).

3.11
mould-open time
t_O
time from the instant the mould starts to open until the mould is closed and exerts the full locking force

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NOTE It is expressed in seconds (s) and includes the time required to remove the mouldings from the mould.

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3.12
cavity
that part of the hollow space in a mould which produces one specimen

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3.13
two-cavity mould
mould that contains two identical cavities in a parallel-flow arrangement (see Figure 2)

NOTE Identical flowpath geometries and symmetrical positioning of the cavities in the cavity plate ensure that all test specimens from one shot are equivalent in their properties.

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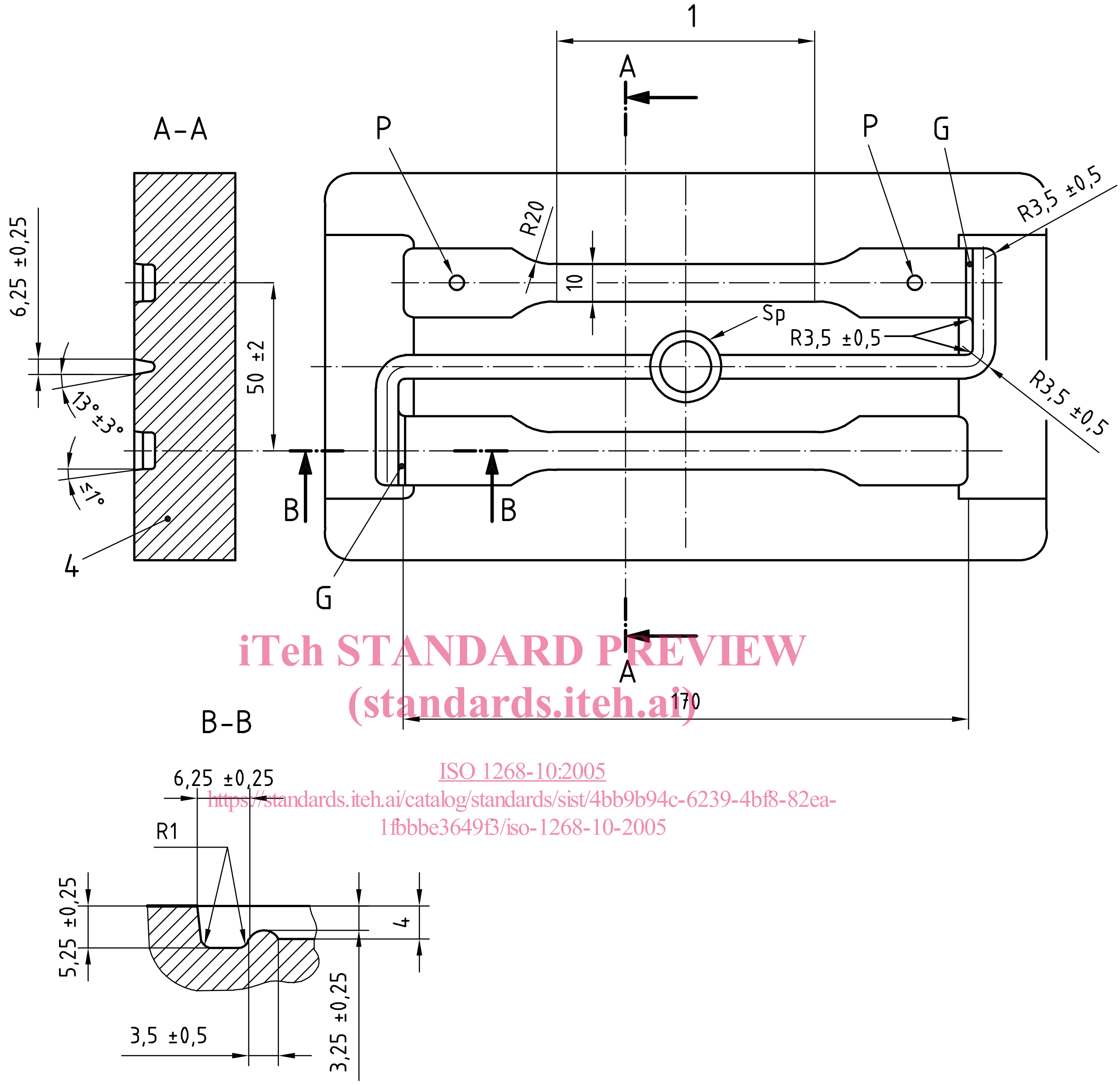
Dimensions in millimetres



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Key

1 preferably 82 mm

Sp sprue

G gate

P pressure sensor (optional)

shot capacity V_S = 30 000 mm^3

projected area A_p = 6 500 mm^2

Figure 2 — Two-cavity plate for a type A ISO mould

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