INTERNATIONAL STANDARD

ISO 294-3

Second edition
2002-06-01

Plastics — Injection moulding of test specimens of thermoplastic materials —

Part 3: Small plates

Plastiques — Moulage par injection des éprouvettes de matériaux thermoplastiques —

Partie 3: Plaques de petites dimensions

Reference number
ISO 294-3:2002(E)

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Printed in Switzerland

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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.

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 part of ISO 294 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 294-3 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 9, *Thermoplastic materials*.

This second edition cancels and replaces the first edition (ISO 294-3:1996), which has been technically revised.

ISO 294 consists of the following parts, under the general title *Plastics — Injection moulding of test specimens of thermoplastic materials*:

— *Part 1: General principles, and moulding of multipurpose and bar test specimens*

— *Part 2: Small tensile bars*

— *Part 3: Small plates*

— *Part 4: Determination of moulding shrinkage*

— *Part 5: Preparation of standard specimens for investigating anisotropy*

Annex A of this part of ISO 294 is for information only.

Plastics — Injection moulding of test specimens of thermoplastic materials —

Part 3:
Small plates

1 Scope

This part of ISO 294 specifies two two-cavity moulds, the type D1 and D2 ISO moulds, for the injection moulding of small plates measuring 60 mm × 60 mm with a preferred thickness of 1 mm (type D1) or 2 mm (type D2), which can be used for a variety of tests. The moulds may additionally be fitted with inserts for studying the effects of weld lines on the mechanical properties (see annex A).

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 294. 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 294 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 294-1:1996, *Plastics — Injection moulding of test specimens of thermoplastic materials — Part 1: General principles, and moulding of multipurpose and bar test specimens*

ISO 294-4:2001, *Plastics — Injection moulding of test specimens of thermoplastic materials — Part 4: Determination of moulding shrinkage*

ISO 6603-1:2000, *Plastics — Determination of puncture impact behaviour of rigid plastics — Part 1: Non-instrumented impact testing*

ISO 6603-2:2000, *Plastics — Determination of puncture impact behaviour of rigid plastics — Part 2: Instrumented impact testing*

3 Terms and definitions

For the purposes of this part of ISO 294, the terms and definitions given in ISO 294-1:1996 apply.

4 Apparatus

4.1 Type D1 and D2 ISO moulds

Type D1 and D2 ISO moulds are two-cavity moulds (see Figure 1) intended for the preparation of plates measuring 60 mm × 60 mm. The plates produced using these moulds shall have the dimensions shown in Figure 2 and given in Table 1.

The main constructional details of type D1 and D2 ISO moulds shall be as shown in Figures 1 and 2 and shall meet the following requirements:

a) See ISO 294-1:1996, subclause 4.1.1.4, item a).

b) Not applicable.

c) See ISO 294-1:1996, subclause 4.1.1.4, item c).

d) and e) Not applicable.

f) See ISO 294-1:1996, subclause 4.1.1.4, item f).

g) See ISO 294-1:1996, subclause 4.1.1.4, item g), but with reference to ISO 6603.

The main dimensions, in millimetres, of the cavities shall be as follows (see also Figure 2):

— length: 60 to 62;

— width: 60 to 62;

— depth: type D2 mould 2,0 to 2,1
type D1 mould 1,0 to 1,1.

h) to j) See ISO 294-1:1996, subclause 4.1.1.4, items h) to j).

k) Figure 2 shows the position of a pressure sensor P within the cavity, which is mandatory for the measurement of moulding shrinkage only (see ISO 294-4). It may be useful, however, in controlling the injection period with any ISO mould [see ISO 294-1:1996, subclause 4.1.1.4, item k)]. The pressure sensor shall be flush with the cavity surface in order to avoid interference of the melt flow.

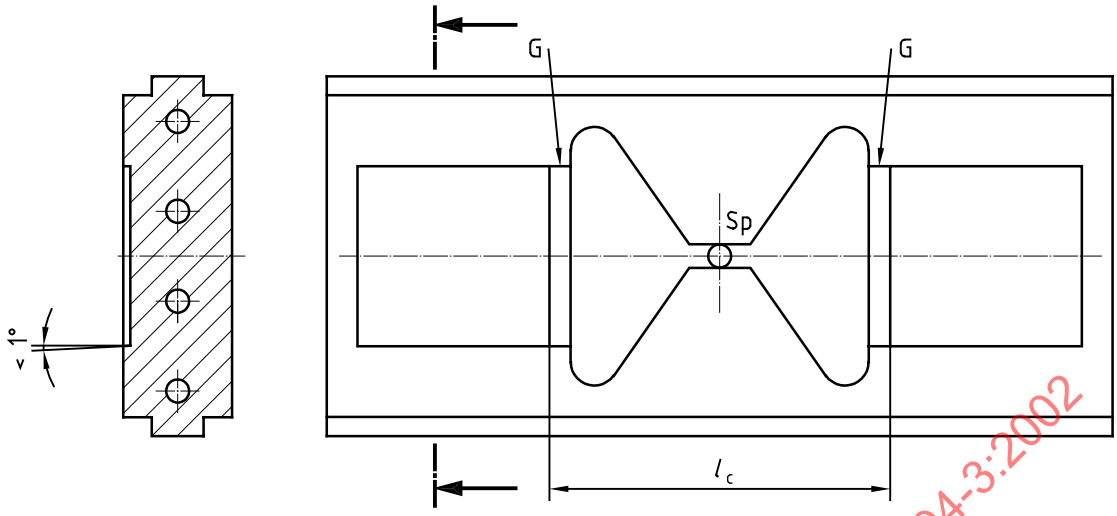
l) to n) See ISO 294-1:1996, subclause 4.1.1.4, items l) to n).

NOTE 1 Gates which are severely limited in height have a great influence on the orientation of the material within the cavity, even at large distances from the gate. The change in height at the gate has therefore been fixed at a value which facilitates subsequent measurement of the moulding shrinkage (see ISO 294-4).

NOTE 2 The height and length of the gate strongly influence the process of solidification of the melt as it flows into the cavity, and hence the moulding shrinkage (see ISO 294-4). The dimensions of the gate are therefore defined with tight tolerances.

NOTE 3 The value specified for the gate length l_G allows the two test specimens to be cut from the runners with a fixed distance l_C between the cuts (see Figure 1), even when the moulding shrinkage varies from one material to another.

NOTE 4 The distance l_C between the lines along which the test specimens are cut from the runners (see Figure 1) is given by $l_C = 2(l_G + l_R + l^*)$ (see Figure 2). Taking this distance as 80 mm gives the advantage that the same cutting machine can be used to cut 80 mm × 10 mm × 4 mm bars from the central sections of multipurpose test specimens [see ISO 294-1:1996, subclause 4.1.1.4, item l)].



Key

Sp Sprue

G Gate

l_C is the distance between the lines along which the test specimens are cut from the runners (see 4.1, notes 3 and 4)

Moulding volume $V_M \approx 23\,000$ mm^3 (at 2 mm thickness)

Projected area $A_P \approx 11\,000$ mm^2

Figure 1 — Cavity plate for type D1 and D2 ISO moulds

Table 1 — Dimensions of plates produced with type D1 and D2 ISO moulds

Dimensions in millimetres

l	Length of plate		60 ± 2 [a]
b	Width of plate		60 ± 2 [a]
h	Thickness of plate:	type D1 mould	$1{,}0 \pm 0{,}1$
		type D2 mould	$2{,}0 \pm 0{,}1$ [a]
l_G	Length of gate		$4{,}0 \pm 0{,}1$ [b]
h_G	Height of gate		$(0{,}75 \pm 0{,}05) \times h$ [c]
l_R	Length of runner		25 to 30 [d]
b_R	Width of runner at gate		$\geqslant (b + 6)$
h_R	Depth of runner		h
l^*	Unspecified distance		—
l_P	Distance of pressure sensor from gate		5 ± 2 $l_P + r_P \leqslant 10$ [e] $l_P - r_P \geqslant 0$

NOTE The dimensions of the plates given in this table differ from the cavity dimensions given in 4.1 g), because shrinkage may be accounted for by larger mould dimensions compared to the final part dimensions.

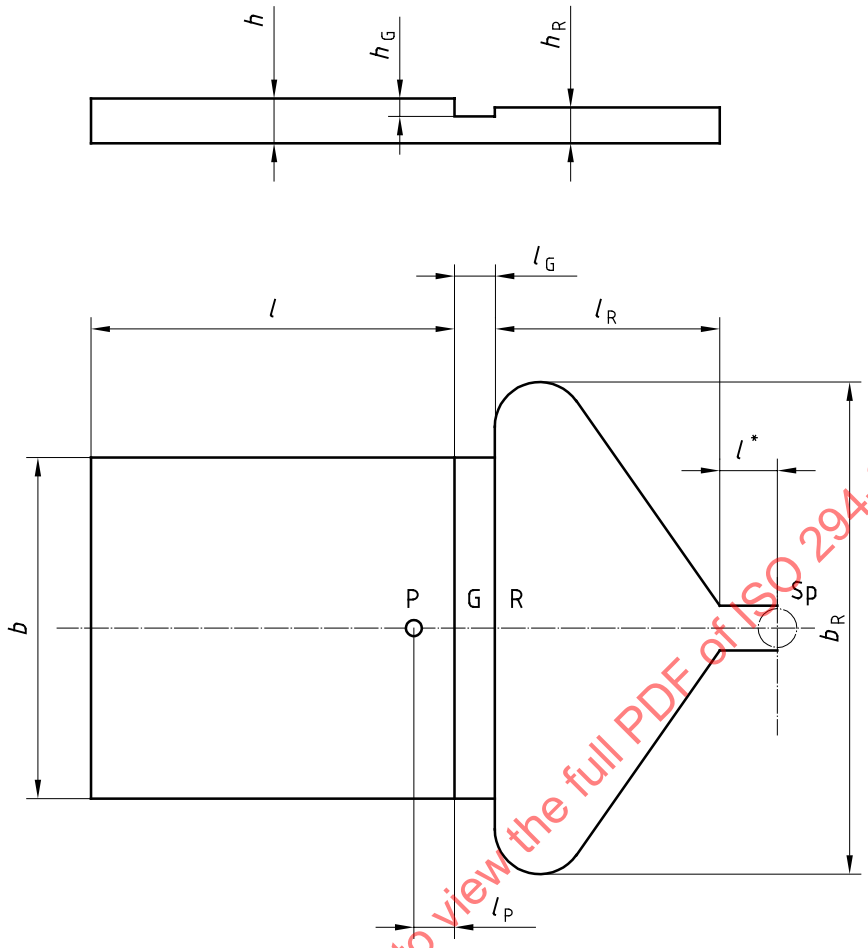
[a] These dimensions are for the preferred test specimen used in ISO 6603.

[b] See 4.1, notes 2 and 3.

[c] See 4.1, notes 1 and 2.

[d] See 4.1, note 4.

[e] Where r_P is the radius of the sensor.



Key

Sp	Sprue	R	Runner
G	Gate	P	Pressure sensor

For the other symbols, see Table 1.

Figure 2 — Details of type D1 and D2 ISO moulds

4.2 Injection-moulding machine

As specified in ISO 294-1:1996, subclause 4.2, with the following exception:

In 4.2.4, the recommended minimum locking force F_M for type D1 and D2 ISO moulds is given by

$F_M \geqslant 11\,000 \times p_{max} \times 10^{-3}$, i.e. 880 kN for a maximum melt pressure of 80 MPa.

5 Procedure

5.1 Conditioning of material

As specified in ISO 294-1:1996, subclause 5.1.

5.2 Injection moulding

As specified in ISO 294-1:1996, subclause 5.2, but with the following new text for 5.2.2.

For type D1 and D2 ISO moulds, it is recommended that the injection time is chosen to give a flow front velocity comparable to that used for the type A ISO mould.

6 Report on test-specimen preparation

The report shall include the following information:

a) a reference to this part of ISO 294;

b to h) see ISO 294-1:1996, clause 6, items b) to h).

Annex A
(informative)

Weld lines

The effects of weld lines on mechanical properties can be studied by fitting suitable inserts in the mould cavities (see Figures A.1 and A.2).

Figure A.1 shows a single insert (hatched) near the gate, the weld line (full line) from which is formed between the two parallel melt flows produced. Type 4 tensile-bar specimens as specified in ISO 8256[7] can be machined from the moulding (shown by dashed lines) allowing the effect of the weld line to be studied, using tensile or tensile-impact testing in accordance with ISO 527-1[3] and ISO 8256[7], as a function of the distance from the insert.

Figure A.2 shows the use of a multiple insert (hatched) which generates weld lines (full lines) from opposed melt flows, each weld line representing a flow path of a different length.

The parallel melt flows shown in Figure A.1 and the opposed ones in Figure A.2 represent the two basic types of weld-line formation. In each case, only symmetrical arrangements of the two-cavity mould should be used.

NOTE For some materials, the data which can be obtained from the mould configurations shown in Figures A.1 and A.2 may only be valid if flow distance is factored into the results, due to the drop in the pressure of the molten plastic as the distance from the gate increases. Other factors such as packing uniformity and crystallization rate of semi-crystalline materials may also have an influence. As a result, the strength of the weld line may vary with distance from the gate.

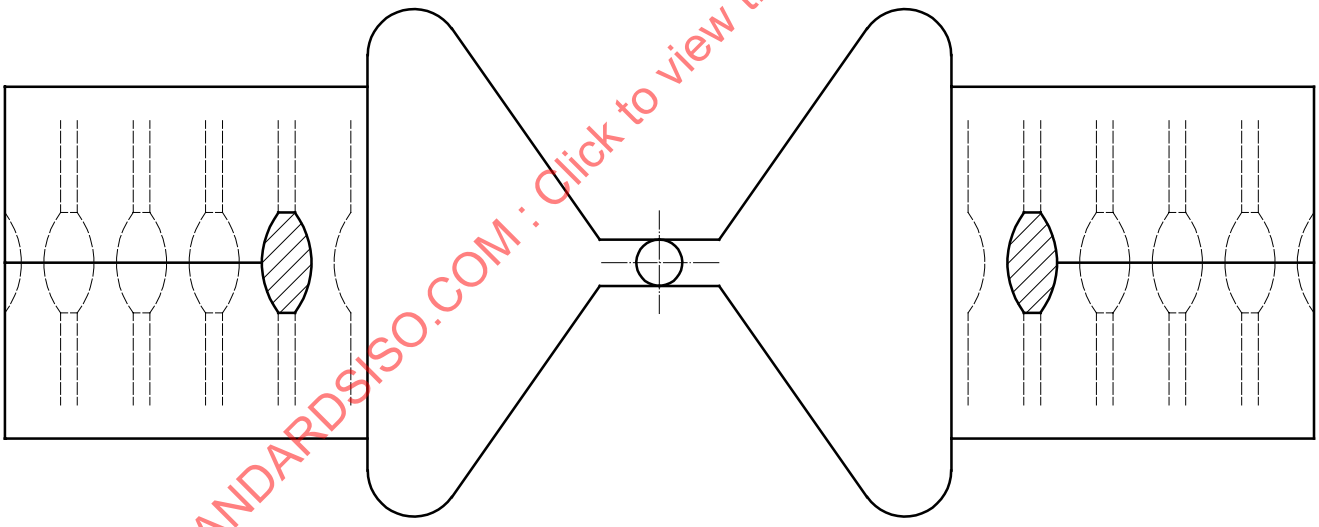


Figure A.1 — Moulding produced using single inserts (hatched), showing the locations from where tensile test specimens can be taken (dashed lines)

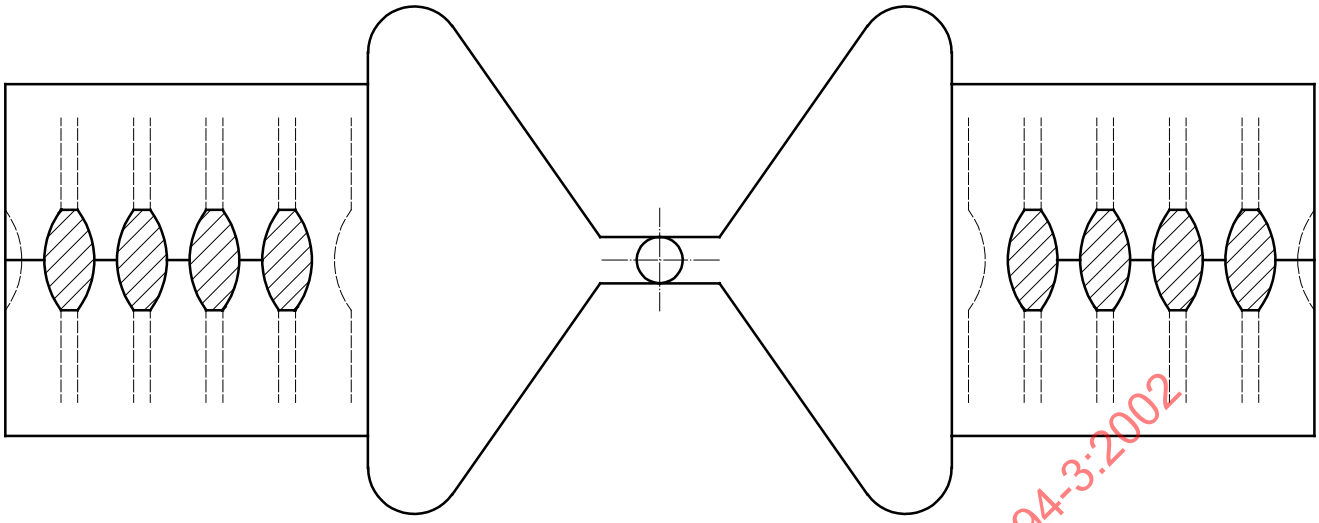


Figure A.2 — Moulding produced using multiple inserts (hatched), showing the locations from where tensile test specimens can be taken (dashed lines)