TC 61

International Standard ISO 2557/2

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Plastics — Amorphous thermoplastic moulding materials — Part 2 : Preparation of test specimens with a defined level of shrinkage in the form of rectangular plates by injection moulding

Plastiques — Matières à mouler thermoplastiques amorphes — Partie 2 : Préparation d'éprouvettes à niveau défini de retrait sous forme de plaques rectangulaires par moulage par injection

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 2557/2 was developed by Technical Committee ISO/TC 61, *Plastics*, and was circulated to the member bodies in March 1978.

It has been approved by the member bodies of the following countries :

Australia	Iran	South Africa, Rep. of
Austria	Israel	Spain
Brazil	Italy	Sweden
Canada	Japan	Switzerland
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Belgium
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Plastics — Amorphous thermoplastic moulding materials — Part 2 : Preparation of test specimens with a defined level of shrinkage in the form of rectangular plates by injection moulding

1 Scope and field of application

This International Standard specifies the procedure for the preparation of test specimens with predominantly monoaxial orientation in the form of rectangular plates, made from rigid amorphous thermoplastic material. Cellular plastic materials and fibre-containing plastic materials are excluded.

The rectangular plates may be used for impact testing by the falling weight method.

Bars cut from the plate in different directions may serve as test specimens for the determination of the dependence of mechanical strength upon the degree and direction of the predominant orientation in the plate.

2 References

ISO 2557/1, *Plastics — Amorphous thermoplastic moulding materials — Part 1 : Preparation of test specimens with a defined level of shrinkage.* [1)]

ISO 2818, *Plastics — Preparation of test specimens by machining.*

3 Definitions

The definitions of state of a specimen and shrinkage given in ISO 2557/1 also apply to this International Standard.

4 Moulding conditions

The moulding conditions for the rectangular plate shall be set in such a way that in the specimen a predominantly monoaxial orientation results parallel to the longitudinal axis of the mould. For this purpose the mould shall consist of two parts, viz. the relaxation area and the cavity. The uncontrolled orientations of the melt due to flow through the nozzle of the moulding machine relax in the relaxation area. The relaxation area and the cavity are connected by a film gate (see figure 1). The flow through the film gate determines the final orientation of the melt. The degree of orientation of the melt depends upon its temperature, viscosity, velocity of injection and other specific properties of the melt. The state of the specimen also depends on the subsequent cooling.

The velocity of the front of the melt in the cavity shall be within the range 150 to 300 mm/s. The selected injection velocity and the corresponding injection time shall be kept constant for a given material. Any change in shrinkage of the specimen will then be due to a change in the moulding temperature. For the comparison of samples of different materials of the same type it is essential that the injection time shall be the same for all materials.

The values of shrinkage of the specimens cut lengthwise or crosswise shall differ by no more than ± 2 % absolute. In addition the shrinkage of the specimen cut crosswise shall be zero or negative. Positive shrinkage of these specimens indicates biaxial orientation due to incomplete relaxation in the relaxation area, for example by low melt temperatures.

Rectangular plates in the basic state can be prepared according to ISO 2557/1, by thermal relaxation in a mould cavity with dimensions identical to those of the injection mould. In the basic state, bars cut from the plate in different directions shall have the same mechanical properties.

5 Design and shape of the plate

5.1 An example of a test plate 50 mm × 80 mm with predominantly monoaxial orientation is shown in figure 1. The injection moulded specimen is composed of a triangular relaxation area which is connected by a film gate to the rectangular test plate. The thickness of the relaxation area increases from the vertex to the base. The moulding material is injected near the vertex either by a pin-point gate ($\phi \approx 1{,}1$ mm) or a sprue ($\phi \approx 4$ mm, i.e. corresponding to the thickness of the specimen).

5.2 To ensure a continuous filling of the mould, the film gate is situated flush with one surface of the plate over the complete length of the narrow side. The film gate shall be thick enough to avoid sink marks. In the example given in figure 1, the thickness of the gate shall be $1{,}0\ ^{+\ 0{,}1}_{-\ 0{,}0}$ mm.

5.3 The surfaces of the plate have slightly different states of orientation and accordingly different mechanical properties due to the position of the film gate. The ejector pins of the mould shall be positioned on the opposite side from the film gate so that the markings from these ejector pins will identify one side of the specimen.

1) At present ISO 2557-1976, *Plastics — Amorphous thermoplastic moulding materials — Preparation of test specimens with a defined level of shrinkage.*

6 Injection mould

6.1 The mould can be used with a normal sprue or with a hot-runner with a pin-point gate. It is recommended that only single-cavity moulds are used, in order to facilitate production of identical specimens by exact reproduction of the moulding conditions.

6.2 Depending on the moulding material, it may be advantageous to reduce the thickness of the test specimen, for example to 2 mm, by inserting appropriate plates in the mould.

6.3 Ejector pins shall be placed on the opposite side from the film gate (see 5.3 and figure 1).

7 Preparation of test specimens

7.1 Test side

The test side of the plate or specimens cut from the plate is the side flush with the film gate. Stresses shall be applied to the opposite side marked by the ejector pins, thus producing strain in the test side (see figure 1) when the plates or specimens cut from them are subjected to such mechanical tests as impact and flexure.

When there are different shrinkages on the two sides of the plate, the mechanical properties shall be related to the shrinkage of the test side.

7.2 Test plate

The rectangular plate can be used without any trimming (for example for impact testing) as long as the force is applied to the centre of the plate.

7.3 Test bars

In the region of the plate near the film gate, at the dead end and at the edges, the orientation of the material is usually disturbed and indefinable. The useful area with predominantly uniform monoaxial orientation depends to a small degree on the moulding conditions and the moulding material. Before cutting the plate into specimens of 6 mm width for example, testing and appropriate trimming (see ISO 2818) are necessary.

The plate shown in figures 1 and 2 with the dimensions 80 mm × 50 mm × 4 mm can be cut lengthwise into six specimens with uniform shrinkage after removal of 5 mm of width from each long side and 10 mm of the length from the gate end and the dead end.

The same plate can be cut crosswise into eight specimens after removal of approximately one-fifth of the length from the gate end and the dead end.

NOTE — The shrinkage of the six specimens cut lengthwise will normally meet the requirements defined in clause 4, whereas it may happen that not all of the eight specimens cut crosswise have the shrinkage required in clause 4, depending on material and moulding conditions. In this case it is necessary to remove more than one-fifth of the gate end and/or the dead end accordingly before cutting the plate crosswise.

8 Test report

The test report shall include reference to this International Standard and the following particulars :

a) the moulding material (type, designation);

b) the type of mould and moulding conditions (melt temperature, injection time, injection rate, cooling conditions);

c) the dimensions of the test specimens;

1) rectangular plates :
the method of trimming (position of parts removed);

2) bars :
the method of cutting and/or milling, and direction (length- or crosswise); if necessary a sketch shall be provided;

d) shrinkage :

— values lengthwise and mean value;

— values crosswise and mean value.

Dimensions in millimetres

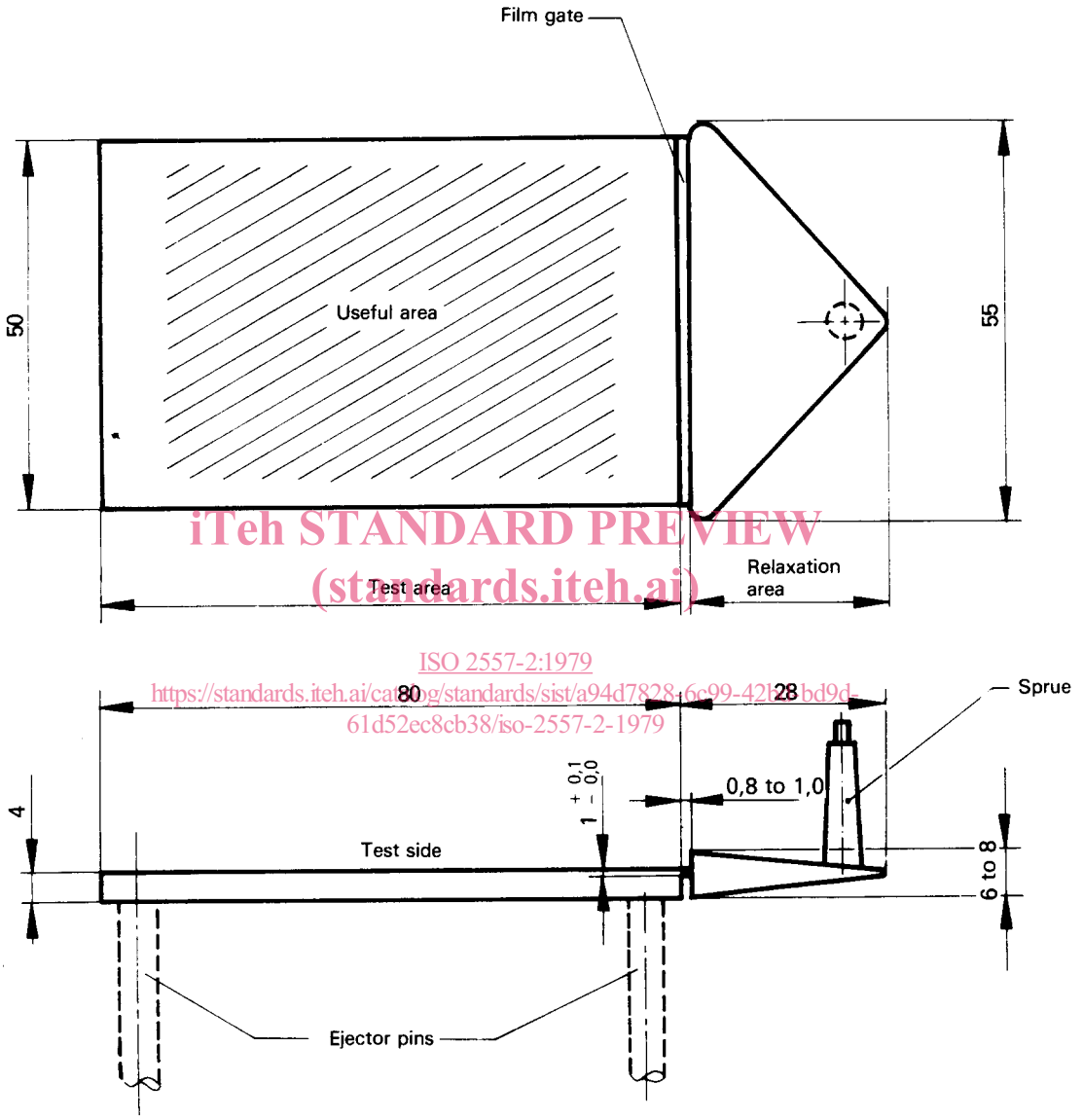

Figure 1 — Test specimen with rectangular test plate

Dimensions in millimetres

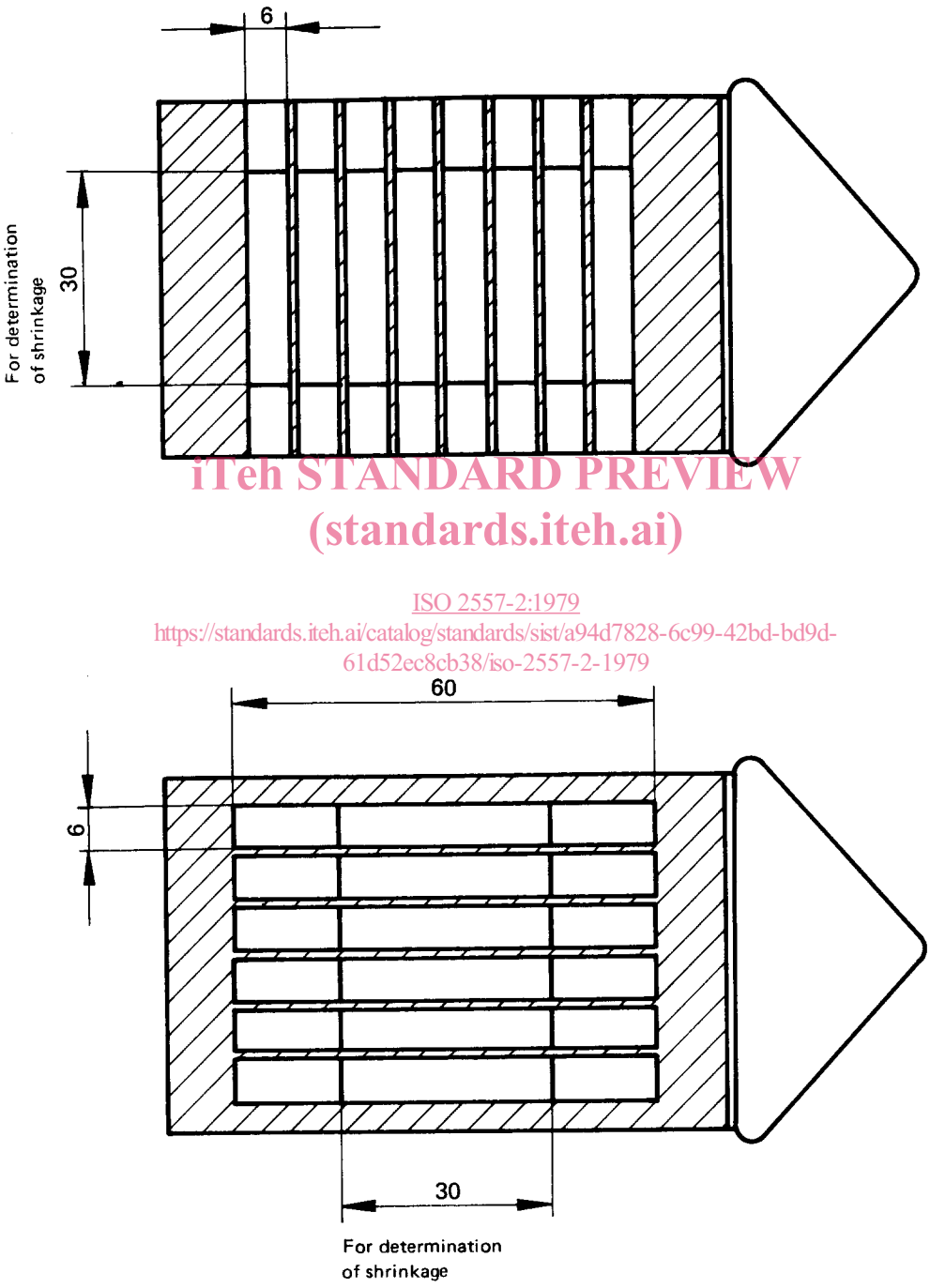

Figure 2 — Test bars cut length- and crosswise