

INTERNATIONAL STANDARD

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Plastics — Injection moulding of test specimens of thermoplastic materials —

Part 1:

General principles, and moulding of
multipurpose and bar test specimens

*Plastiques — Moulage par injection des éprouvettes de matériaux
thermoplastiques —*

*Partie 1: Principes généraux, et moulage des éprouvettes à usages
multiples et des barreaux*



Reference number
ISO 294-1:1996(E)

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.

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.

International Standard ISO 294-1 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 9, *Thermoplastic materials*.

Together with the other parts, this part of ISO 294 cancels and replaces the second edition of ISO 294 (ISO 294:1995) which has been revised to improve the definition of the injection-moulding parameters and has been restructured to specify four types of ISO mould for the production of the basic specimen types required for the acquisition of comparable test data.

Care has been taken to ensure that the ISO moulds described can all be fitted in existing injection-moulding equipment and have interchangeable cavity plates.

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*

Annexes A to C of this part of ISO 294 are for information only.

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Introduction

Many factors in the injection-moulding process may influence the properties of moulded test specimens and hence the measured values obtained when the specimens are used in a test method. The 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. Thermoplastics may show differences in molecular orientation (important mainly with amorphous polymers), in crystallization morphology (for crystalline and semicrystalline polymers), in phase morphology (for heterogeneous thermoplastics) as well as in the orientation of anisotropic fillers such as short fibres. Residual ("frozen-in") stresses in the moulded test specimens and thermal degradation of the polymer during moulding may also influence properties. Each of these phenomena must be controlled to avoid fluctuation of the numerical values of the properties measured.

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Plastics — Injection moulding of test specimens of thermoplastic materials —

Part 1:

General principles and moulding of multipurpose and bar test specimens

1 Scope

This part of ISO 294 specifies the general principles to be followed when injection moulding test specimens of thermoplastic materials and gives details of mould designs for preparing two types of specimen for use in acquiring reference data, i.e. multipurpose test specimens as specified in ISO 3167 and 80 mm × 10 mm × 4 mm bars. It provides a basis for establishing reproducible moulding conditions. 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 the interested parties.

NOTE — ISO round-robin tests with acrylonitrile/butadiene/styrene (ABS), styrene/butadiene (SB) and poly(methyl methacrylate) (PMMA) have shown that mould design is an important factor in the reproducible preparation of test specimens.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 294. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 294 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 179:1993, *Plastics — Determination of Charpy impact strength*.

ISO 294-2:1996, *Plastics — Injection moulding of test specimens of thermoplastic materials — Part 2: Small tensile bars*.

ISO 294-3:1996, *Plastics — Injection moulding of test specimens of thermoplastic materials — Part 3: Small plates*.

ISO 294-4:—¹⁾, *Plastics — Injection moulding of test specimens of thermoplastic materials — Part 4: Determination of moulding shrinkage*.

1) To be published. (Revision in part of ISO 294:1995)

ISO 3167:1993, *Plastics — Multipurpose test specimens*.

ISO 10350:1993, *Plastics — Acquisition and presentation of comparable single-point data*.

ISO 11403-1:1994, *Plastics — Acquisition and presentation of comparable multipoint data — Part 1: Mechanical properties*.

ISO 11403-2:1995, *Plastics — Acquisition and presentation of comparable multipoint data — Part 2: Thermal and processing properties*.

ISO 11403-3:—²⁾, *Plastics — Acquisition and presentation of comparable multipoint data — Part 3: Environmental influences on properties*.

3 Definitions

For the purposes of the various parts of ISO 294, the following definitions apply.

3.1 mould temperature, T_C : The average temperature of the mould cavity surfaces measured after the system has attained thermal equilibrium and immediately after opening the mould (see 4.2.5 and 5.3).

It is expressed in degrees Celsius (°C).

3.2 melt temperature, T_M : The temperature of the molten plastic in a free shot (see 4.2.5 and 5.4).

It is expressed in degrees Celsius (°C).

3.3 melt pressure, p : The pressure of the plastic material in front of the screw at any time during the moulding process (see figure 1).

It is expressed in megapascals (MPa).

The melt pressure, which is generated hydraulically for instance, can be calculated from the force F_S acting longitudinally on the screw using equation (1):

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

where

p is the melt pressure, in megapascals;

F_S is the longitudinal force, in kilonewtons, acting upon the screw;

D is the screw diameter, in millimetres.

3.4 hold pressure, p_H : The melt pressure (see 3.3) during the hold time (see figure 1).

It is expressed in megapascals (MPa).

3.5 moulding cycle: The complete sequence of operations in the moulding process required for the production of one set of test specimens (see figure 1).

²⁾ To be published.