INTERNATIONAL STANDARD

ISO 294-1

First edition
1996-12-15

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.

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.*

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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):

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

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.

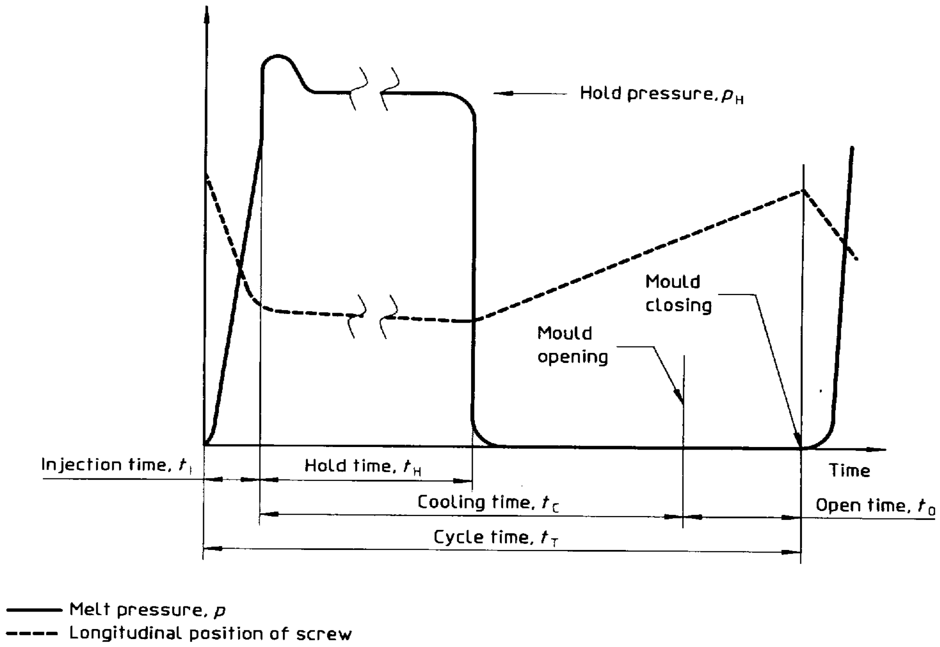


Figure 1 — Schematic diagram of an injection-moulding cycle, showing the melt pressure (full line) and the longitudinal position of the screw (dashed line) as a function of time

3.6 cycle time, t_T: The time required to carry out a complete moulding cycle (see 3.5).

It is expressed in seconds (s).

The cycle time is the sum of the injection time t_I, the cooling time t_C and the mould-open time t_O (see 3.7, 3.8 and 3.10).

3.7 injection time, t_I: The time from the instant the screw starts to move forward until the switchover point between the injection period and the hold period.

It is expressed in seconds (s).

3.8 cooling time, t_C: The time from the end of the injection period until the mould starts to open.

It is expressed in seconds (s).

3.9 hold time, t_H: The time during which the pressure is maintained at the hold pressure (see 3.4).

It is expressed in seconds (s).

3.10 mould-open time, t_O: The time from the instant the mould starts to open until the mould is closed and exerts the full locking force.

It is expressed in seconds (s).

It includes the time required to remove the mouldings from the mould.

3.11 cavity: That part of the hollow space in a mould that produces one specimen.

3.12 single-cavity mould: A mould with one cavity only (see figure 4).

3.13 multi-cavity mould: A mould that has two or more identical cavities in a parallel-flow arrangement (see figures 2 and 3).

Identical flow-path geometries and symmetrical positioning of the cavities in the mould ensure that all test specimens from one shot are equivalent in their properties.

3.14 family mould: A mould that contains more than one cavity which have different geometries (see figure 5).

3.15 ISO mould: Any one of several standard moulds (designated type A, B, C, D1 and D2) intended for the reproducible preparation of test specimens with comparable properties. The moulds have a fixed plate with a central sprue, plus a multi-cavity cavity plate as described in 3.13.

Additional details are given in 4.1.1.4. An example of a complete mould is shown in annex C.

3.16 critical cross-sectional area, A_C: The cross-sectional area of the cavity in a single- or multi-cavity mould at the position where the critical portion of the test specimen, i.e. that part on which the measurement will be made, is moulded.

It is expressed in square millimetres (mm^2).

For tensile-bar test specimens, for instance, the critical portion of the test specimen is the narrow section which is subjected to the greatest stress during testing.

3.17 moulding volume, V_M: The ratio of the mass of the moulding to the density of the solid plastic.

It is expressed in cubic millimetres (mm^3).

3.18 projected area, A_P: The overall profile of the moulding projected on to the parting plane.

It is expressed in square millimetres (mm^2).

3.19 Locking force, F_M: The force holding the plates of the mould closed.

It is expressed in kilonewtons (kN).

The minimum locking force necessary may be calculated from the inequality:

$$F_M \geqslant A_P \cdot p_{max} \times 10^{-3} \quad \ldots (2)$$

where

F_M is the locking force, in kilonewtons;

A_P is the projected area (see 3.18), in square millimetres;

p_{max} is the maximum value of the melt pressure (see 3.3), in megapascals.

3.20 injection velocity, v_I: The average velocity of the melt as it passes through the critical cross-sectional area A_C (see 3.16).

It is expressed in millimetres per second (mm/s).

It is applicable to single- and multi-cavity moulds only, and may be calculated from equation (3):

$$v_I = \frac{V_M}{t_I \cdot A_C \cdot n} \qquad \text{. . . (3)}$$

where

- v_I is the injection velocity, in millimetres per second;
- n is the number of cavities;
- A_C is the critical cross-sectional area (see 3.16), in square millimetres;
- V_M is the moulding volume (see 3.17), in cubic millimetres;
- t_I is the injection time (see 3.7), in seconds.

3.21 shot capacity, V_S: The product of the maximum metering stroke of the injection-moulding machine and the cross-sectional area of the screw.

It is expressed in cubic millimetres (mm^3).

4 Apparatus

4.1 Moulds

4.1.1 ISO (multi-cavity) moulds

4.1.1.1 ISO moulds (see 3.15) are strongly recommended for producing test specimens for the acquisition of data which is intended to be comparable (see ISO 10350, ISO 11403-1, ISO 11403-2 and ISO 11403-3), as well as for use in the case of disputes involving International Standards.

4.1.1.2 Multipurpose test specimens as specified in ISO 3167 shall be moulded in a two-cavity type A ISO mould using a Z- or T-runner (see annex A). The mould shall be as shown in figure 2 and meet the requirements specified in 4.1.1.4. Of the two types of runner, the Z-runner is preferred owing to the more symmetrical closure force obtained. The bar mouldings produced shall have the dimensions of the type A specimen specified in ISO 3167.

4.1.1.3 Rectangular 80 mm × 10 mm × 4 mm bars shall be moulded in a four-cavity type B ISO mould with a double-T runner. The mould shall be as shown in figure 3 and meet the requirements specified in 4.1.1.4. The bars produced shall have the same cross-sectional dimensions along their central section as multipurpose test specimens (see ISO 3167) and a length of 80 mm ± 2 mm.

4.1.1.4 The main constructional details of type A and B ISO moulds shall be as shown in figures 2 and 3 and shall meet the following requirements:

a) The sprue diameter on the nozzle side shall be at least 4 mm.

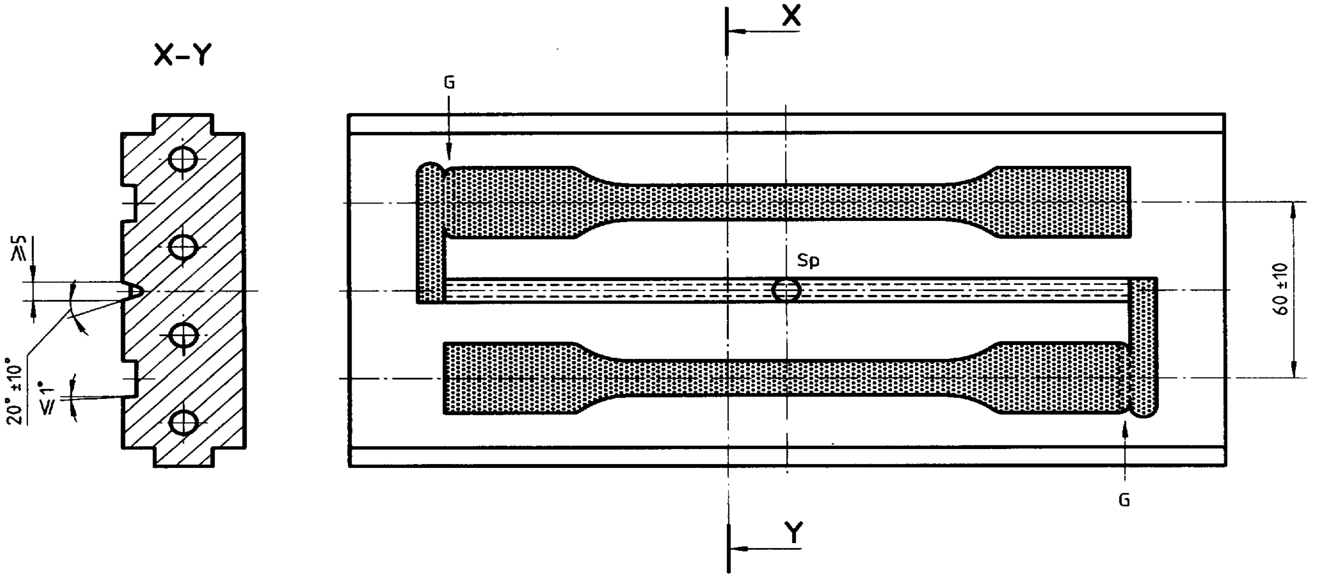
b) The width and height (or the diameter) of the runner system shall be at least 5 mm.

c) The cavities shall be one-end gated as shown in figures 2 and 3.

d) The height of the gate shall be at least two-thirds the height of the cavity, and the width of the gate shall be equal to that of the cavity at the point where the gate enters the cavity.

e) The gate shall be as short as possible, in any case not exceeding 3 mm.

Dimensions in millimetres

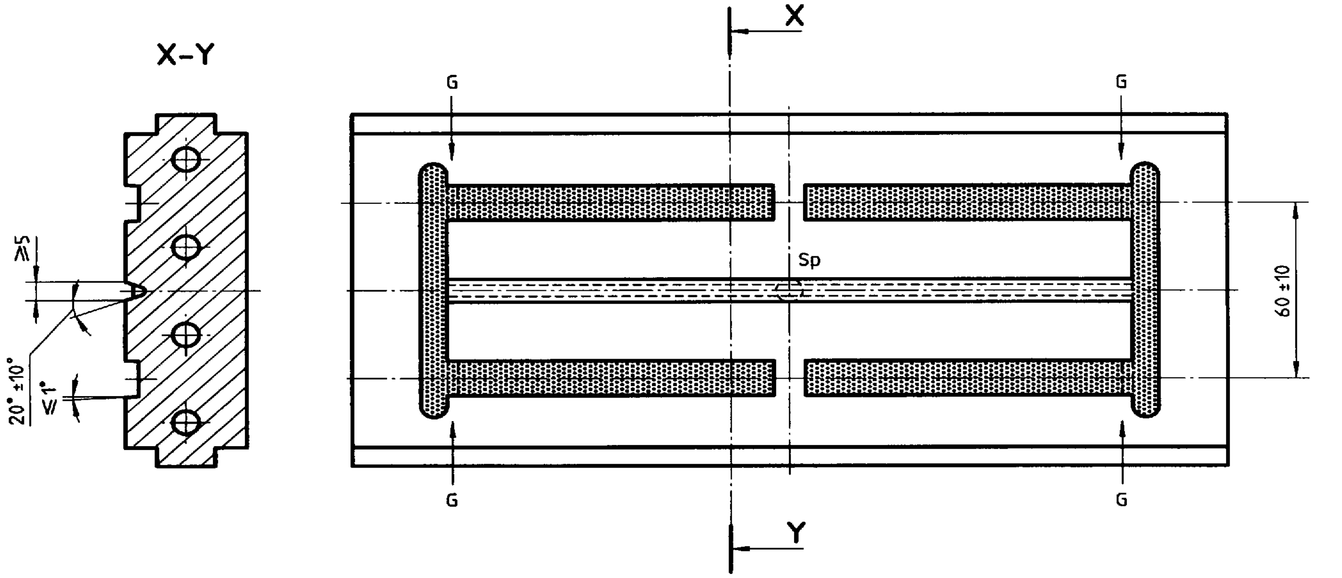


Key

Sp	Sprue	Moulding volume $V_M \approx$ 30 000 mm^3
G	Gates	Projected area $A_P \approx$ 6 300 mm^2

Figure 2 — Cavity plate for a type A ISO mould

Dimensions in millimetres



Key

Sp	Sprue	Moulding volume $V_M \approx$ 30 000 mm^3
G	Gates	Projected area $A_P \approx$ 6 500 mm^2

Figure 3 — Cavity plate for a type B ISO mould

f) The draft angle of the runners shall be at least 10°, but not more than 30°. The cavity shall have a draft angle not greater than 1°, except in the area of tensile-specimen shoulders where the draft angle shall not be greater than 2°.

g) The dimensions of the cavities shall be such that the dimensions of the test specimens produced conform to the requirements given in the relevant test standard. To allow for different degrees of moulding shrinkage, the dimensions of the cavities shall be chosen so that they are between the nominal value and the upper limit of the dimensions specified for the specimen concerned. In the case of type A and B ISO moulds, the main cavity dimensions, in millimetres, shall be as follows (see ISO 3167):

— depth: 4,0 to 4,2;

— width of central section: 10,0 to 10,2;

— length (type B mould): 80 to 82.

h) Ejector pins, if used, shall be located outside the test area of the specimen, i.e. at the shoulders of dumbbell specimens produced from type A and type C ISO moulds (for type C, see ISO 294-2), outside the central 20 mm section of bar specimens from type B ISO moulds and outside the 60-mm-square section of plate specimens from type D ISO moulds (see ISO 294-3).

i) The heating/cooling system for the mould plates shall be designed so that, under operating conditions, the difference in temperature between any point on the surface of a cavity and either plate is less than 5 °C.

j) Interchangeable cavity plates and gate inserts are recommended to permit rapid changes in production from one type of test specimen to another. Such changes are facilitated by using shot capacities V_S which are as similar as possible. An example is shown in annex A.

k) It is recommended that a pressure sensor be fitted in the central runner, to give proper control of the injection period (the sensor is mandatory for ISO 294-4). A sensor position suitable for the various types of ISO mould is given in subclause 4.1, item k) and in figure 2 of ISO 294-3:1996.

l) To ensure that cavity plates are interchangeable between different ISO moulds, it is important to note the following constructional details in addition to those shown in figures 2 and 3 and those given in ISO 294-2 and ISO 294-3:

1) It is recommended that a cavity length of 170 mm be used for multipurpose test specimens moulded in the type A ISO mould. This gives a maximum length of 180 mm for the space between the cavity plates.

2) The width of the mould plates may be affected by the minimum distance required between the connection points for the heating/cooling channels. In addition, space may need to be provided in type B ISO moulds for the fitting of a special insert enabling notched bars for use in ISO 179 to be moulded.

3) Lines along which the test specimens can be cut from the runners may be defined e.g. 170 mm apart for type A, B and C ISO moulds (for type C, see ISO 294-2). A second pair of lines 80 mm apart may be defined for cutting bars from multipurpose test specimens from a type A mould and may be used as well for cutting off small-plate mouldings (see ISO 294-3).

m) To make it easier to check that all the specimens from a mould are identical, it is recommended that the individual cavities be marked, but outside the test area of the specimen [see item h) above]. This can be done very simply by engraving suitable symbols on the heads of the ejector pins, thus avoiding any damage to the surface of the cavity plate.

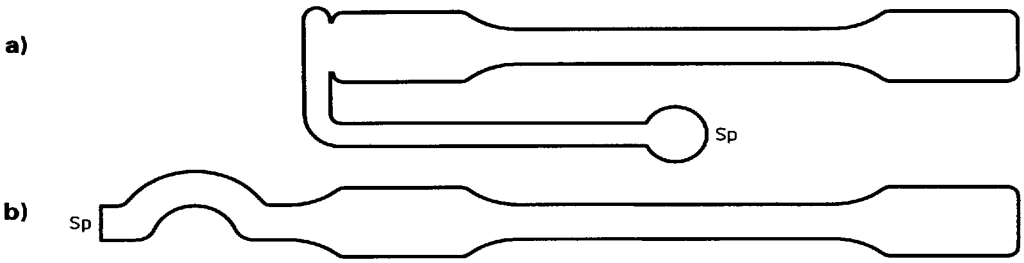
n) Surface imperfections can influence the results, especially those of mechanical tests. Where appropriate, the surfaces of the mould cavities shall be highly polished therefore, the direction of polishing corresponding to the direction in which the test specimen will be placed under load when it is tested.

4.1.1.5 For more information on those mould components described in other International Standards, the reader is referred to annex B.

4.1.2 Single-cavity moulds

The cavity of a single-cavity mould (see figure 4 and 3.12) may be that of a dumbbell, a disc or any other shape. Test specimens from a single-cavity mould generally give values for certain properties which are different from those obtained with specimens from ISO moulds.

NOTE — This difference may occur because the ratio of the volume of the cavity to the volume of the moulding V_M may be different from that for ISO moulds. Also, the smaller volume of the moulding produced by a single-cavity mould makes conformance with the volume-ratio requirements of 4.2.1 different, and failure to conform to these requirements may contribute to erratic values of properties.



a) Sprue (Sp) normal to moulding plate

b) Sprue parallel to the parting plane (the bend in the runner prevents jetting)

Figure 4 — Examples of single-cavity moulds

4.1.3 Family moulds

A family mould (see figure 5 and 3.13) may be used to produce, for example, flat bars plus dumbbells and discs. A family mould may be used when the properties of the test specimens obtained correspond to those obtained from ISO moulds.

NOTE — In most cases, steady, simultaneous filling of the different cavities is not possible with a family mould under more than one set of moulding conditions. Thus this type of mould is not suitable for the preparation of referee test specimens. In addition, the injection velocity v_I (see 3.20) cannot be defined precisely for a family mould.

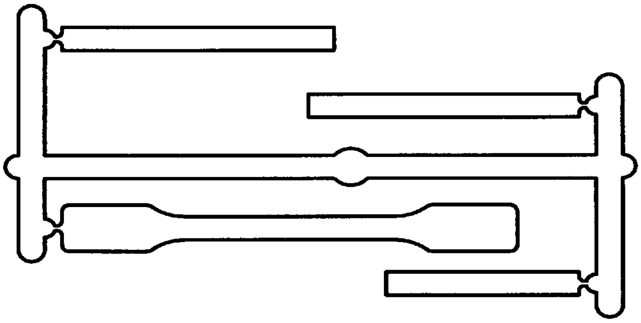


Figure 5 — Example of a family mould

4.2 Injection-moulding machine[3)]

For the reproducible preparation of test specimens capable of giving comparable results, only reciprocating-screw injection-moulding machines equipped with all the necessary devices for the control of the moulding conditions shall be used.

3) For further information, the reader is referred to JOHANNABER, F. *Kunststoffe (German Plastics)*, 79 (1989), 1, pp. 15-28.

4.2.1 Shot volume

The ratio of the moulding volume V_M (see 3.17) to the shot capacity V_S (see 3.21) shall be between 20 % and 80 % unless a higher ratio is required by the relevant material standard or is recommended by the manufacturer.

4.2.2 Control system

The control system of the machine shall be capable of maintaining the operating conditions within the following tolerance limits:

Injection time, t_I (see 3.8)	±0,1 s
Hold pressure, p_H (see 3.4)	±5 %
Hold time, t_H (see 3.9)	±5 %
Melt temperature, T_M (see 3.2)	±3 °C
Mould temperature, T_C (see 3.1)	±3 °C up to 80 °C ±5 °C above 80 °C
Mass of moulding	±2 %

4.2.3 Screw

The screw shall be of a type suitable for the moulding material (e.g. length, diameter, thread height, compression ratio).

It is recommended that a screw with a diameter in the range between 18 mm and 40 mm is used.

4.2.4 Locking force

The mould-locking force F_M shall be high enough to prevent flash forming under any operating conditions.

The recommended minimum locking force F_M for type A and B ISO moulds is given by $F_M \geqslant 6\,500 \times p_{max} \times 10^{-3}$ (see 3.19), i.e. 520 kN for a maximum melt pressure of 80 MPa.

An injection-moulding system with interchangeable cavity plates will need to take into account the type D1 and D2 ISO moulds for which $A_P \approx 11\,000$ mm^2, thus requiring a significantly higher mould-locking force.

4.2.5 Thermometers

A needle-probe thermometer accurate to ±1 °C shall be used to measure the melt temperature T_M (see 3.2). A surface thermometer accurate to ±1 °C shall be used to measure the temperature of the surface of the mould cavity, which gives the mould temperature T_C (see 3.1).

5 Procedure

5.1 Conditioning of material

Prior to moulding, condition the pellets or granules of the thermoplastic material as required in the relevant material standard or as recommended by the manufacturer if no standard covers this subject.

Avoid exposing the material to an atmosphere at a temperature significantly below the temperature of the workshop to avoid condensation of moisture on to the material.

5.2 Injection moulding

5.2.1 Set the machine to the conditions specified in the relevant material standard or agreed between the interested parties if no standard covers this subject.

5.2.2 For many thermoplastics, the most suitable range for the injection velocity v_I is 200 mm/s ± 100 mm/s when using type A or B ISO moulds. Note that, for a given value of the injection velocity v_I, the injection time t_I is inversely proportional to the number of cavities n in the mould [see equation (3) in subclause 3.20]. Keep any changes in the injection velocity during the injection period as small as possible.

5.2.3 To determine the hold pressure p_H, a parameter which is frequently not specified, carry out the following procedure:

Starting from zero, gradually increase the melt pressure until the mouldings are free from sink marks, voids and other visible faults and have minimal flash. Use this pressure as the hold pressure.

5.2.4 Ensure that the hold pressure is maintained constant until the material in the gate region has solidified, i.e. until the mass of the moulding has reached an upper limiting value under these conditions.

5.2.5 Discard the mouldings until the machine has reached steady-state operation. Then record the operating conditions and begin test-specimen collection.

During the moulding process, maintain the steady-state conditions by suitable means, e.g. by checking the mass of the moulding.

5.2.6 In the event of any change in material, empty the machine and clean it thoroughly. Discard at least 10 mouldings made using the new material before beginning test-specimen collection again.

5.3 Measurement of mould temperature

Determine the mould temperature T_C after the system has attained thermal equilibrium and immediately after opening the mould. Measure the temperature of the mould-cavity surface at several points on each side of the mould cavity using a surface thermometer. Between each pair of readings, cycle the mould for a minimum of ten cycles before continuing with the next pair of measurements. Record each measurement and calculate the mould temperature as the average of all the measurements.

5.4 Measurement of the melt temperature

Measure the melt temperature T_M by one of the following methods:

5.4.1 After thermal equilibrium has been attained, inject a free shot of at least 30 cm^3 into a non-metallic container of a suitable size and immediately insert the probe of a preheated rapid-response needle thermometer into the centre of the molten mass, moving it about gently until the reading of the thermometer has reached a maximum. Ensure that the preheating temperature is close to the melt temperature. Use the same injection conditions for the free shot as those to be used to mould the specimens, allowing the appropriate cycle time to elapse between each free shot.

5.4.2 The melt temperature may alternatively be measured by means of a suitable temperature sensor, provided the result obtained can be shown to be the same as that obtained using the free-shot method. The sensor shall cause only low heat losses and shall respond rapidly to melt-temperature changes. Mount the sensor in a suitable place, such as in the nozzle of the injection-moulding machine. In case of doubt, use the method described in 5.4.1.

5.5 Post-moulding treatment of test specimens

Once removed from the mould, allow the test specimens to cool gradually and at the same rate to room temperature in order to avoid any differences in the history of individual test specimens. Protect test specimens made from thermoplastics sensitive to atmospheric exposure by keeping them in airtight containers, together with a desiccant if necessary.

6 Report on test-specimen preparation

The report shall include the following information:

a) a reference to this part of ISO 294;

b) the date, time and place the specimens were moulded;

c) a full description of the material used (type, designation, manufacturer, lot number);

d) details of any conditioning of the material carried out prior to moulding;

e) the type of mould used (type A, type B or, in the case of another type of mould, the type of specimen produced, the relevant standard, the number of cavities and the gate size and location);

f) details of the injection-moulding machine used (manufacturer, shot capacity, mould-locking force, control systems);

g) the moulding conditions:

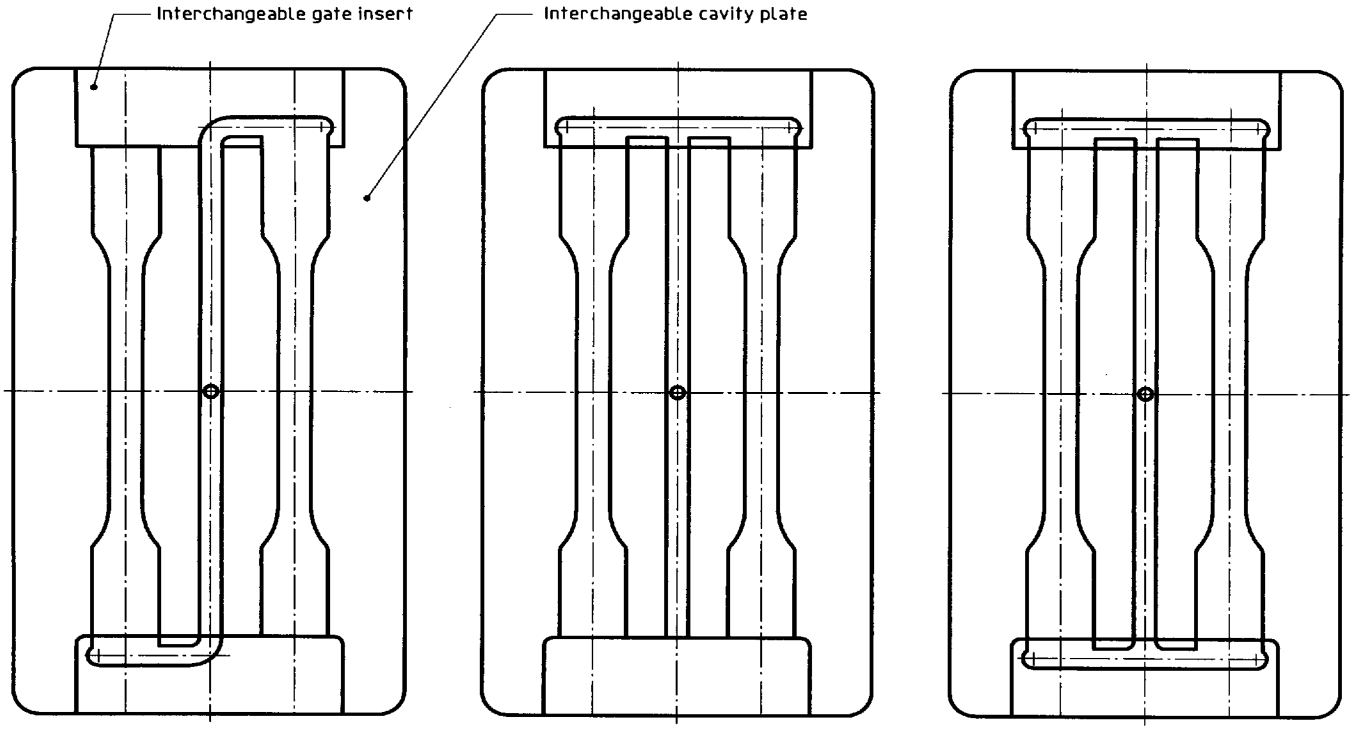
- melt temperature T_M (see 3.2), in degrees Celsius,
- mould temperature T_C (see 3.1), in degrees Celsius,
- injection velocity v_I (see 3.20), in millimetres per second,
- injection time t_I (see 3.7), in seconds,
- hold pressure p_H (see 3.4), in megapascals,
- hold time t_H (see 3.9), in seconds,
- cooling time t_C (see 3.8), in seconds,
- cycle time t_T (see 3.6), in seconds,
- mass of the moulding, in grams;

h) any other relevant details (e.g. the number of mouldings initially discarded, the number retained, any post-moulding treatment).

Annex A
(informative)

Examples of runner configurations

The layout of a mould may be changed by means of gate inserts as shown in figure A.1.



a) Injection mould with Z-runner

b) Variant with T-runner

c) Variant with double-T runner (e.g. for studying weld strength)

Figure A.1 — Different types of runner configuration

Annex B
(informative)

Standardized injection-moulding mould components

ISO 6751:1986[4], *Ejector pins with cylindrical head — Dimensions.*

ISO 6753-2:—[5], *Tools for pressing and moulding — Machined plates — Part 2: Machined plates for moulds.*

ISO 8017:1985, *Mould guide pillars, straight and shouldered, and locating guide pillars, shouldered.*

ISO 8018:1985, *Mould guide bushes, headed, and locating guide bushes, headed.*

ISO 8404:1986, *Angle pins — Basis dimensions.*

ISO 8405:1986[4], *Ejector sleeves with cylindrical head — Basic series for general purposes.*

ISO 8406:1991, *Mould bases — Locating elements.*

ISO 8693:1987[4], *Tools for moulding — Flat ejector pins.*

ISO 8694:1987[4], *Tools for moulding — Shouldered ejector pins.*

ISO 9449:1990, *Tools for moulding — Centring sleeves.*

ISO 10072:1993, *Tools for moulding — Sprue bushes — Dimensions.*

ISO 10073:1991, *Tools for moulding — Support pillars.*

ISO 10907-1:1996, *Tools for moulding — Locating rings — Part 1: Locating rings for mounting without thermal insulating sheets in small or medium moulds — Types A and B.*

ISO 12165:—[5], *Tools for moulding — Compression moulds, injection moulds and die-casting dies — Terms and symbols.*

4) Under revision.
5) To be published.

Annex C
(informative)

Example of an injection mould

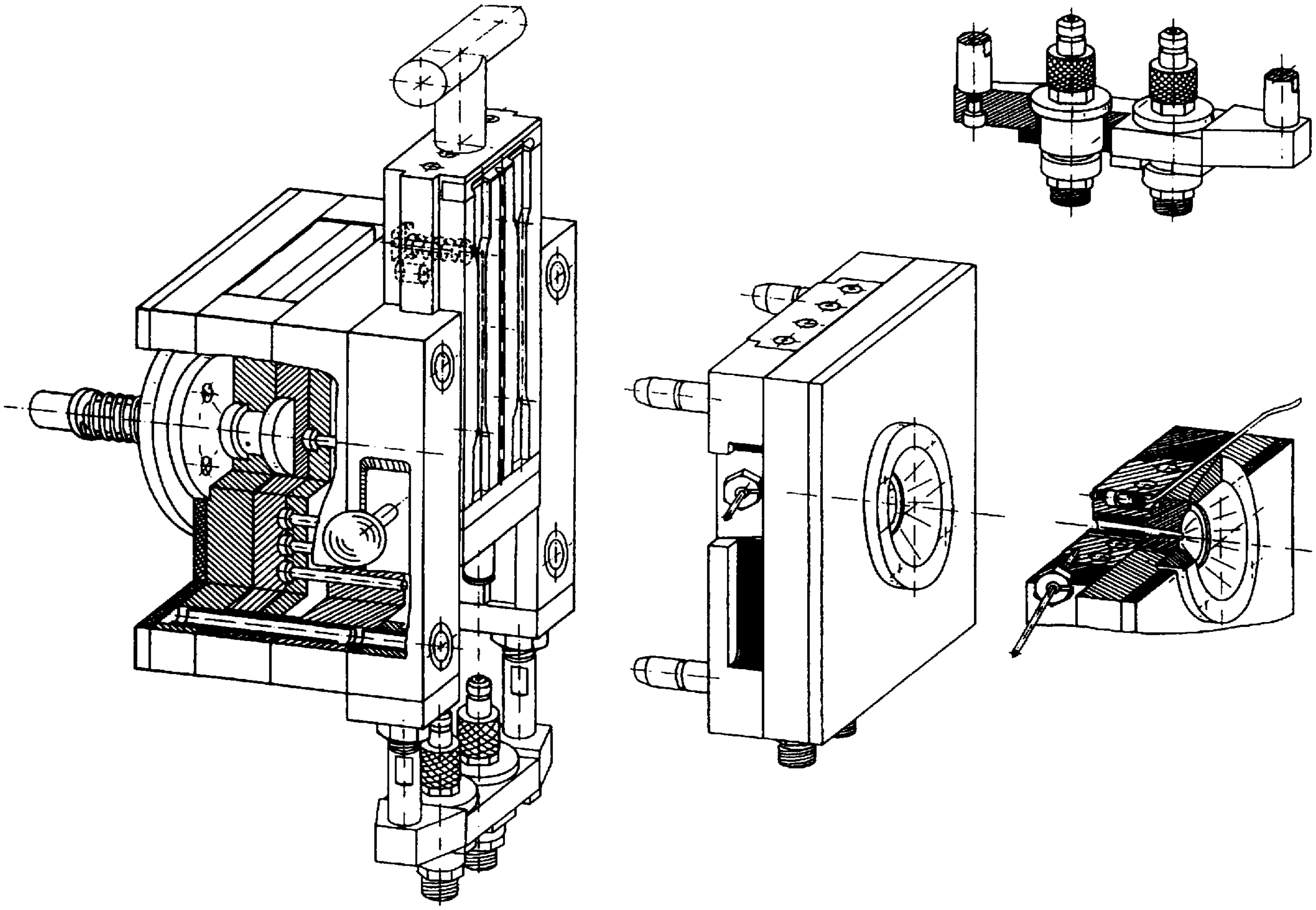


Figure C.1 — Exploded view of an injection mould with an interchangeable two-cavity plate for a type A ISO mould

ICS 83.080.20

Descriptors: plastics, thermoplastic resins, injection moulding, moulding materials, test specimens, bars (materials), specimen preparation, reference data, generalities.

Price based on 14 pages