
**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*

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Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Apparatus	6
4.1 Moulds.....	6
4.1.1 ISO (multi-cavity) moulds.....	6
4.1.2 Single-cavity moulds.....	9
4.2 Injection-moulding machine.....	10
4.2.1 General.....	10
4.2.2 Moulding volume.....	10
4.2.3 Control system.....	10
4.2.4 Screw.....	10
4.2.5 Clamping force.....	11
4.2.6 Thermometers.....	11
5 Procedure	11
5.1 Conditioning of material.....	11
5.2 Injection moulding.....	12
5.3 Measurement of mould temperature.....	13
5.4 Measurement of the melt temperature.....	13
5.5 Post-moulding treatment of test specimens.....	13
6 Report on test-specimen preparation	13
Annex A (informative) Examples of runner configurations	15
Annex B (informative) Standardized injection-moulding mould components	16
Annex C (informative) Example of an injection mould	17
Annex D (informative) Methods for setting the injection moulding parameters	18
Annex E (informative) Methods of determining the hold pressure and hold time	23
Bibliography	29

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 9, *Thermoplastic materials*.

This second edition cancels and replaces the first edition (ISO 294-1:1996), which has been technically revised with the following changes:

- the types of test specimen have been replaced according to ISO 20753;
- [Annex D](#) has been added to clarify the methods for setting the operation parameters on injection machine;
- the original Annex D has been renamed as [Annex E](#).

It also incorporates the Amendments ISO 294-1:1996/Amd.1:2001 and ISO 294-1:1996/Amd.2:2005.

A list of all the parts in the ISO 294 series can be found on the ISO website.

Introduction

Many factors in the injection-moulding process 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 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 exhibit differences in molecular orientation 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 also influence properties. Each of these phenomena must be controlled to minimize variability of the numerical values of the properties measured.

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.

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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 document 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. type A1 and type B1 test specimens as specified in ISO 20753, and provides a basis for establishing reproducible moulding conditions. Its purpose is to provide consistent descriptions of the main parameters of the moulding process and to establish a uniform practice in reporting moulding conditions. The particular conditions required for the reproducible preparation of test specimens will vary for each material used and are given in the International Standard for the relevant material or are to be agreed upon between the interested parties.

NOTE Interlaboratory 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 documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 179-1, *Plastics — Determination of Charpy impact properties — Part 1: Non-instrumented impact test*

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

ISO 294-3:2002, *Plastics — Injection moulding of test specimens of thermoplastic materials — Part 3: Small plates*

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

ISO 20753, *Plastics — Test specimens*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

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 1 to entry: It is expressed in degrees Celsius (°C).

3.2
melt temperature

T_M
temperature of the molten plastic in a free shot

Note 1 to entry: It is expressed in degrees Celsius (°C).

3.3
melt pressure

p
pressure of the plastic material in front of the screw at any time during the moulding process

Note 1 to entry: It is expressed in megapascals (MPa).

3.4
hold pressure

p_H
melt pressure ([3.3](#)) during the *hold time* ([3.9](#))

Note 1 to entry: It is expressed in megapascals (MPa).

3.5
moulding cycle
complete sequence of operations in the moulding process required for the production of one set of test specimens

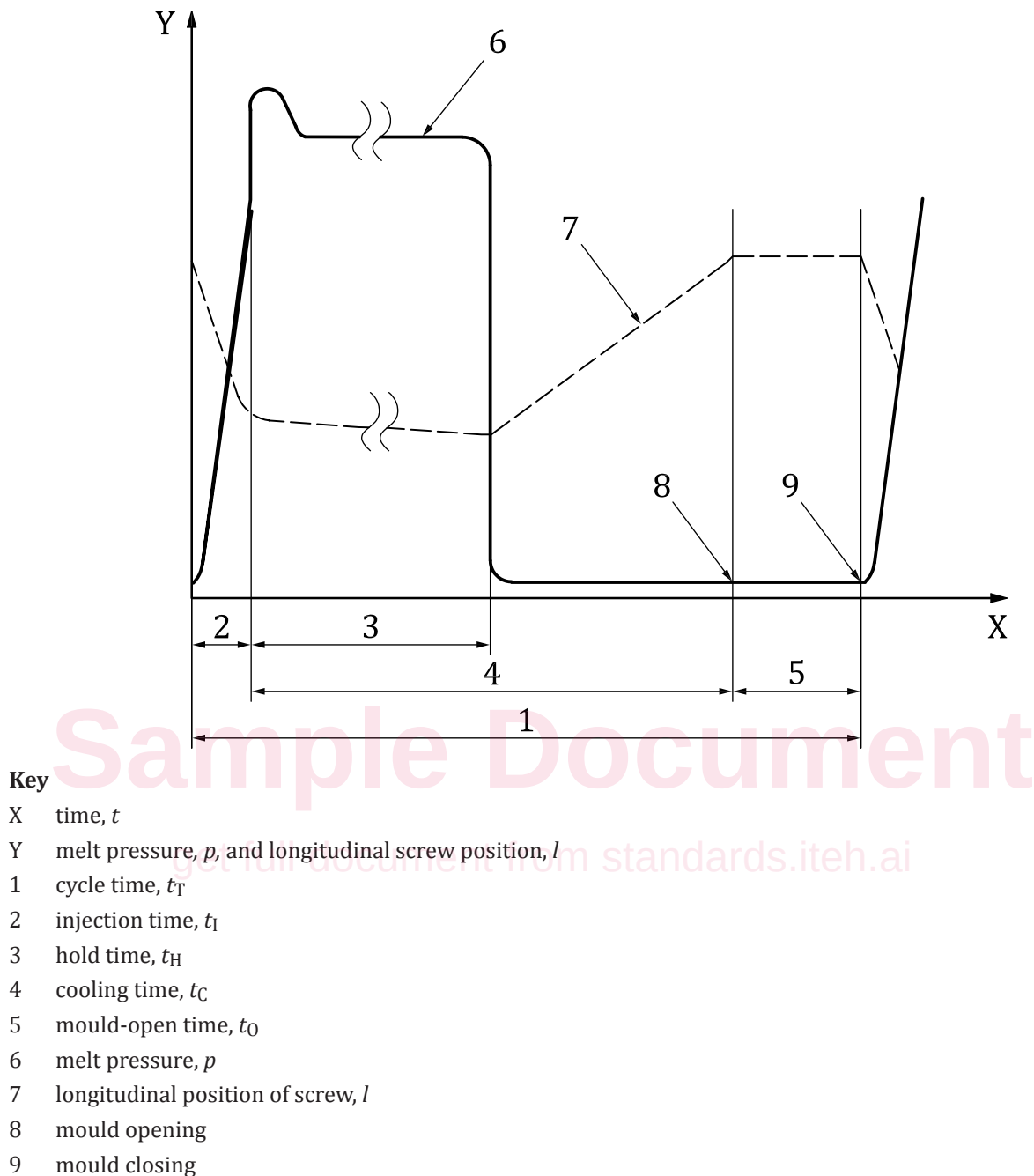
Note 1 to entry: See [Figure 1](#).

3.6
cycle time

t_T
time required to carry out a complete *moulding cycle* ([3.5](#))

Note 1 to entry: The cycle time is the sum of the injection time, t_I , the cooling time, t_C , and the mould-open time, t_O .

Note 2 to entry: It is expressed in seconds (s).



NOTE The melt pressure during the cooling phase is not zero due to back pressure effects.

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

3.7 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 1 to entry: It is expressed in seconds (s).