Plastics – Injection moulding of test specimens of thermoplastic materials –
Part 4: Determination of moulding shrinkage
(ISO 294-4:2001)


Dokumentet består av 16 sidor.

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EN ISO 294-4


This European Standard was approved by CEN on 27 December 2002.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

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Foreword

The text of ISO 294-4:2001 has been prepared by Technical Committee ISO/TC 61 "Plastics" of the International Organization for Standardization (ISO) and has been taken over as EN ISO 294-4:2003 by Technical Committee CEN/TC 249 "Plastics", the secretariat of which is held by IBN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 2003, and conflicting national standards shall be withdrawn at the latest by August 2003.


According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

Endorsement notice

The text of ISO 294-4:2001 has been approved by CEN as EN ISO 294-4:2003 without any modifications.

NOTE Normative references to International Standards are listed in Annex ZA (normative).
Introduction

See ISO 294-1.

In the injection moulding of thermoplastics, the difference between the dimensions of the mould cavity and those of the moulded articles produced from it may vary with the design and operation of the mould. Such differences may depend on the size of the injection-moulding machine, the shape and dimensions of mouldings including any restrictive action this may have on the shrinkage, the degree and direction of flow or movement of the material in the mould, the sizes of the nozzle, sprue, runner and gate, the cycle on which the machine is operated, the temperature of the melt and the mould, and the magnitude and duration of the hold pressure. Moulding and post-moulding shrinkage are caused by crystallization, volume relaxation and orientation relaxation of the material and by thermal contraction of both the thermoplastic material and the mould. Post-moulding shrinkage may also be influenced by humidity uptake.

The measurement of moulding and post-moulding shrinkage is useful in making comparisons between thermoplastics and in checking uniformity of manufacture.

The method is not intended as a source of data for design calculations of components. Information on the typical behaviour of a material can be obtained, however, by carrying out measurements at different melt and mould temperatures, injection velocities and hold pressures, as well as at different values of other injection-moulding parameters. The information thus obtained is important in establishing the suitability of the moulding material for the production of moulded articles with accurate dimensions.
Plastics — Injection moulding of test specimens of thermoplastic materials —
Part 4: Determination of moulding shrinkage

1 Scope

This part of ISO 294 specifies a method of determining the moulding shrinkage and post-moulding shrinkage of injection-moulded test specimens of thermoplastic material in the directions parallel to and normal to the direction of melt flow.

For the determination of shrinkage of thermosets see ISO 2577[2].

Moulding shrinkage as defined in this part of ISO 294 excludes the effects of humidity uptake. This is included in post-moulding shrinkage and thus in total shrinkage. For cases when post-moulding shrinkage is caused by the uptake of humidity only, see ISO 175[1].

Moulding shrinkage as defined in this part of ISO 294 represents the so-called free shrinkage with unrestricted deformation of the cooling plates in the mould during the hold period. It may be considered therefore as the maximum value of any restricted shrinkage.

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 294-3:—1), Plastics — Injection moulding of test specimens of thermoplastic materials — Part 3: Small plates

1) To be revised. (Revision of ISO 294-3:1996)
3 Terms and definitions

For the purposes of this part of ISO 294, the terms and definitions given in ISO 294-1 together with the following apply.

3.1 moulding shrinkage

$S_M$
difference in dimensions between a dry test specimen and the mould cavity in which it was moulded, both the mould and the test specimen being at room temperature when measured

NOTE 1 It is expressed as a percentage (%) of the mould cavity dimension concerned.

NOTE 2 The moulding shrinkage $S_{Mp}$ parallel to the melt flow direction is determined at the mid-point of the width of the test specimen, and the moulding shrinkage $S_{Mn}$ normal to the flow direction at the mid-point of the length.

3.2 post-moulding shrinkage

$S_P$
difference in the dimensions of a moulded test specimen before and after a post-moulding treatment, measured at room temperature

NOTE 1 It is expressed in percent (%).

NOTE 2 The post-moulding shrinkage $S_{Pp}$ parallel to the melt flow direction and the post-moulding shrinkage $S_{Pn}$ normal to the flow direction are defined in analogous fashion to $S_{Mp}$ and $S_{Mn}$ in 3.1.

3.3 total shrinkage

$S_T$
difference in dimensions between a test specimen after a post-moulding treatment and the mould cavity in which it was moulded, measured at room temperature

NOTE 1 It is expressed in percent (%).

NOTE 2 The total shrinkage $S_{Tp}$ parallel to the melt flow direction and the total shrinkage $S_{Tn}$ normal to the flow direction are defined in analogous fashion to $S_{Mp}$ and $S_{Mn}$ in 3.1.

3.4 cavity pressure

$p_C$
presure of the thermoplastic material in the cavity at any time during the moulding process, measured centrally near the gate

NOTE It is expressed in megapascals (MPa).

3.5 cavity pressure at hold

$p_{CH}$
cavity pressure (3.4) 1 s after the end of the injection time $t_i$ (see Figure 1)

NOTE It is expressed in megapascals (MPa).