Plastics - Injection moulding of test specimens of thermoplastic materials - Part 5: Preparation of standard specimens for investigating anisotropy (ISO 294-5:2011)

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NATIONAL FOREWORD

See Eesti standard EVS-EN ISO 294-5:2013 sisaldab Euroopa standardi EN ISO 294-5:2013 ingliskeelset teksti.	This Estonian standard EVS-EN ISO 294-5:2013 consists of the English text of the European standard EN ISO 294-5:2013.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 16.01.2013.	Date of Availability of the European standard is 16.01.2013.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

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Foreword

The text of ISO 294-5:2011 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 294-5:2013 by Technical Committee CEN/TC 249 “Plastics” the secretariat of which is held by NBN.

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of an identical text or by endorsement, at the latest by July 2013, and conflicting national standards shall be withdrawn at the latest by July 2013.

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Endorsement notice

The text of ISO 294-5:2011 has been approved by CEN as a EN ISO 294-5:2013 without any modification.

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Introduction

Reinforced and self-reinforcing injection-mouldable thermoplastics are used in a wide variety of applications, some of which can be safety-related. During the injection-moulding process, reinforcement fibres can preferentially align with the flow of the molten material and not across the flow direction. This preferential alignment causes an imbalance in the properties of the moulded thermoplastic so that, in the flow direction, the alignment of the reinforcing fibres causes a higher strength and stiffness than in the cross direction with fewer aligned fibres. This difference in properties is termed anisotropy, and it may result in an injection-moulded component having less than the desired or designed strength. To aid designers in understanding the potential strength of an injection-moulded component, it is desirable to know about the anisotropy of an injection-moulded component.

During the development of this part of ISO 294, it was found that injection-moulded test specimens do not exhibit the same fibre alignment across their thickness, but that the outer layers have fibres preferentially aligned in the mould filling direction while the core has randomly oriented fibres (i.e. no preferential alignment). The ratio of the cross-sectional area of aligned-fibre orientation (i.e. “skin” layer thickness) to that of random-fibre orientation (i.e. “core” thickness) is affected by the specimen thickness and the mould filling rate, i.e. the average injection velocity. Thicker specimens exhibit a lower proportion of aligned fibres than do thinner specimens. Slower mould fill speeds lead to thicker “skin” layers with aligned fibres. As a result, to obtain meaningful data on a particular design of moulding, an investigator should prepare specimens with the maximum anisotropic properties, as this data will best represent the upper and lower bounds of a composite structure. Since the specimen thickness and injection velocity have a significant influence on the final anisotropy, this part of ISO 294 should only be used for determining information that is useful in designing mouldings, and not as a quality control test for the plastic material itself.

Plastics — Injection moulding of test specimens of thermoplastic materials —

Part 5: Preparation of standard specimens for investigating anisotropy

1 Scope

This part of ISO 294 specifies a two-cavity mould (designated the type F ISO mould) for the injection moulding of 80 mm × 90 mm plates with a preferred thickness of 2 mm for single-point data acquisition because 2 mm has been found to provide the maximum anisotropic properties, with only a slight sensitivity to the rate of injection. For the design of plastic parts, this will provide upper and lower bounds for the tensile properties. Matching the plate thickness to a given part thickness is not a suitable criterion because of the effect of mould filling rate and part geometry on anisotropy. Suitable test specimens [ISO 527-2 type 1BA tensile test specimens or type 1 (80 mm × 10 mm) bars] are then machined or die-cut from the plates (see Annex A) and used to obtain information on the anisotropy of thermoplastic parts.

Investigation of the anisotropy of materials is a special procedure intended to provide guidance in the design of mouldings for end-use applications and is not intended as a quality control tool.

In the injection moulding of thermoplastic materials, the flow of molten polymer may influence the orientation of fillers such as fibreglass or the orientation of polymer chains. This can result in anisotropic behaviour. The knowledge of anisotropic behaviour is valuable in designing plastic parts.

For the purposes of this part of ISO 294, the flow direction is defined as the direction from the gate to the far end of the mould cavity, and the cross direction as the direction perpendicular to the flow direction.

The type F mould is not intended to replace the type D mould used to determine the moulding shrinkage of thermoplastics.

2 Normative references

The following referenced documents are indispensable for the application 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 294-1:1996, *Plastics — Injection moulding of test specimens of thermoplastic materials — Part 1: General principles, and moulding of multipurpose and bar test specimens*

ISO 527-2, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 294-1 apply.