SLOVENSKI STANDARD
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Polimerni materiali - Strojna priprava preskušancev

Plastics -- Preparation of test specimens by machining

Plastiques -- Préparation des éprouvettes par usinage

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INTERNATIONAL STANDARD

ISO 2818

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Plastics — Preparation of test specimens by machining

Plastiques — Préparation des éprouvettes par usinage

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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 2818 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 2, *Mechanical properties*.

This third edition cancels and replaces the second edition (ISO 2818:1980), which has been revised with respect to the following points:

— normative references for the geometry of cutting tools and abrasive tools and products;

— introduction of notching;

— extension of the table for recommended machining conditions.

Annex A of this International Standard is for information only.

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Introduction

The preparation of test specimens by machining influences the finished surfaces and, in some cases, even the internal structure of the specimens. Since test results are strongly dependent on both of these parameters, exact definitions of tools and machining conditions are required for reproducible test results with machined specimens.

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Plastics — Preparation of test specimens by machining

1 Scope

This International Standard establishes the general principles and procedures to be followed when machining and notching test specimens from compression-moulded and injection-moulded plastics, extruded sheets, plates and partially finished or wholly finished products.

In order to establish a basis for reproducible machining and notching conditions, the following general standardized conditions should be applied. It is assumed, however, that the exact procedures to be used will be selected or specified by the relevant material specification or by the standards on the particular test methods. If sufficiently detailed procedures are not thus specified, it is essential that the interested parties agree on the conditions to be used.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard 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 3002-1:1982, *Basic quantities in cutting and grinding — Part 1: Geometry of the active part of cutting tools — General terms, reference systems, tool and working angles, chip breakers.*

ISO 3017:1981, *Abrasive discs — Designation, dimensions and tolerances — Selection of disc outside diameter/centre hole diameter combinations.*

ISO 3855:1977, *Milling cutters — Nomenclature.*

ISO 6104:1979, *Abrasive products — Diamond or cubic boron nitride grinding wheels and saws — General survey, designation and multilingual nomenclature.*

ISO 6106:1979, *Abrasive products — Grain sizes of diamond or cubic boron nitride.*

ISO 6168:1980, *Abrasive products — Diamond or cubic boron nitride grinding wheels — Dimensions.*

3 Definitions

For the purposes of this International Standard, the following definitions apply:

3.1 Milling

In this machining operation, the tool has a circular primary motion and the workpiece a suitable feed motion. The axis of rotation of the primary motion retains its position with respect to the tool, independently of the feed motion (see ISO 3855). Complete dumb-bell and rectangular test specimens, as well as notches in finished specimens, may be prepared by milling.

3.1.1 Geometry (see 3002-1 and figure 1)

Only a few details of the exact geometrical conditions of the milling tool and its position with respect to the workpiece given in ISO 3002-1 are relevant to this standard, as follows:

3.1.1.1 tool-cutting-edge angle, α_r: The angle between the tool-cutting-edge plane P_s and the assumed working plane P_f, measured in the tool back plane P_r.

3.1.1.2 tool back clearance, α_p: The angle between the flank A_α of the cutter and the tool-cutting-edge plane P_s, measured in the tool back plane P_p.

3.1.1.3 tool side clearance, α_f: The angle between the flank A_α of the cutter and the tool-cutting-edge plane P_s, measured in the assumed working plane P_f.

3.1.1.4 tool radius, R: The distance between the axis of the circular primary motion of the tool and its cutting edge.

3.1.1.5 number of cutting teeth, z: The number of cutting edges on the outer periphery of the rotating milling tool.

3.1.2 Tool and workpiece motions (see ISO 3002-1 and figure 2)

3.1.2.1 rotational speed of tool, n: The speed, in revolutions per minute, of the circular primary motion of the tool.

3.1.2.2 cutting speed, v_c: The instantaneous velocity, in metres per minute, of the primary motion of a selected point on the cutting edge relative to the workpiece. The relationship between v_c and n is given by the equation $v_c = n \cdot 2\pi R$.

3.1.2.3 feed speed, v_f: The instantaneous velocity, in metres per minute, of the feed motion of a selected point on the cutting edge relative to the workpiece.

3.1.2.4 feed path, λ: The distance, in millimetres, at any given point on the surface of the workpiece covered during the time between two successive cutting operations. The feed path is given by the equation $\lambda = v_f / z \cdot n$.

3.1.2.5 cutting depth, a: The (mean) distance, in millimetres, between the surfaces of the workpiece before and after one complete milling run.

3.2 Cutting of rectangular test specimens

In this machining operation, rectangular test specimens are cut by means of a circular or band saw, made from hardened steel or coated with diamond or cubic boron nitride powder, or cut with the aid of an abrasive disc of which the cutting edge may be coated with diamond or boron nitride powder. For further details on abrasive discs and abrasive products, see ISO 3017 and ISO 6104.

3.2.1 Geometry

3.2.1.1 tool radius, R: The distance, in millimetres, between the rotary axis of a circular saw or an abrasive disc and the cutting edges of the tool.

3.2.1.2 number of cutting teeth, z: The number of cutting teeth on the periphery of a circular saw.

3.2.2 Tool and workpiece motions

3.2.2.1 rotational speed of tool, n: The speed of rotation, in revolutions per minute, of a circular saw or an abrasive disc.

3.2.2.2 cutting speed, v_c: The instantaneous velocity, in metres per minute, of the cutting tip of a saw tooth, or of a selected point on the cutting edge of an abrasive disc, relative to the workpiece. For a circular saw or an abrasive disc, the relationship between v_c and n is given by the equation $v_c = n \cdot 2\pi R$.

3.2.2.3 feed speed, v_f: The instantaneous velocity, in metres per minute, of the tool feed parallel to the saw or disc plane and perpendicular to the cutting direction relative to the workpiece.

3.3 Cutting of disc-shaped test specimens (see figure 4)

In this machining operation, disc-shaped test specimens are cut from sheet material with the aid of a circular cutter with a saw-toothed edge of hardened steel or which may be coated with diamond or cubic boron nitride powder. The test specimens may also be cut by means of a milling cutter with one or more teeth, as described in 3.1, which moves in a circular orbit. Furthermore, the test specimens may also be cut from a roughly preshaped pack of individual sheets with the aid of a turning lathe.

3.3.1 Geometry

3.3.1.1 tool radius, R: The distance, in millimetres, between the rotary axis of the circular cutter and the inner limit of the cutting edge. The tool radius is equal to the radius of the finished test specimen.

3.3.1.2 number of cutting teeth, z: The number of teeth on the sawtooth cutting edge of a circular cutter. If a lathe is used for cutting circular test specimens, the geometrical definitions of the cutting tool are the same as those given in 3.1.

3.3.2 Tool and workpiece motions

3.3.2.1 rotational speed of tool, n: The speed of rotation, in revolutions per minute, of a circular cutter.

3.3.2.2 cutting speed, v_c: The instantaneous velocity, in metres per minute, of a selected point on the cutting edge relative to the workpiece. The relation-

ship between v_c and n is given by the equation $v_c = n \cdot 2\pi R$.

3.3.2.3 feed speed, v_f: The instantaneous velocity, in metres per minute, of the tool feed parallel to the rotary axis of the circular cutter and perpendicular to the cutting direction relative to the workpiece.

3.4 Planing of rectangular bars and planing or broaching of notches in finished test specimens

In this machining operation, sawed or sliced rectangular bars are finished by planing. Also, notches in finished specimens can be cut by planing or broaching.

3.4.1 Geometry

3.4.1.1 tool-cutting-edge angle, α_r: As defined in 3.1.1.1.

3.4.1.2 tool back clearance, α_p: As defined in 3.1.1.2.

3.4.1.3 tool side clearance, α_f: As defined in 3.1.1.3.

3.4.2 Tool and workpiece motions

3.4.2.1 cutting speed, v_c: The instantaneous velocity, in metres per minute, of the primary motion of a selected point on the cutting edge relative to the workpiece.

3.4.2.2 cutting depth, a: The (mean) distance, in millimetres, between the surfaces of the workpiece before and after one planing run.

3.5 Stamping of arbitrarily shaped test specimens fabricated from thin sheets

In this operation, arbitrarily shaped test specimens are stamped under high pressure from thin sheets by means of a tool with a sharp edge made from hardened steel and located in a plane parallel to the plane of the sheet.

3.5.1 Geometry

3.5.1.1 shape of the stamping tool: The geometric shape of the stamping edge in a plane parallel to the sheet plane. The shape of the stamping tool depends on the shape of the test specimen to be stamped, along with its required dimensions and tolerances.

3.5.2 Forces on the tool and tool motion

3.5.2.1 contact force, F_c: The force, in newtons, applied to the stamping tool in the direction perpendicular to the sheet plane.

3.5.2.2 feed speed, v_f: The instantaneous velocity, in metres per minute, of the feed motion of the edge plane of the stamping tool in a direction perpendicular to the sheet plane.

4 Test specimens

4.1 Shape and state of the test specimens

The following types of test specimen can be prepared by the machining processes described in this International Standard:

— rectangular bars;
— notched rectangular bars;
— rectangular plates;
— curvilinear test specimens (e.g. dumb-bells);
— discs.

The exact shape, dimensions and tolerances of the test specimens shall conform to the standard for the particular test method in question. The machined surfaces and edges of the finished specimens shall be free of visible flaws, scratches or other imperfections when viewed with a low-power magnifying glass (approximately ×5 magnification).

Rectangular bars shall be free of twist and shall have perpendicular pairs of parallel surfaces. The surfaces and edges shall be free from scratches, pits, sink marks and flashes. Each specimen shall be checked for conformity with these requirements by visual observation against straight-edges, squares and flat plates, and by measuring with micrometer callipers.

The requirements on the quality of the edges of disc-shaped specimens used for impact-penetration tests are less rigorous than those for tensile-test specimens.

Any specimen showing a measurable or observable departure from the requirements given above shall be rejected or machined to proper size and shape before testing.