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Plastics — Determination of Izod impact strength

Plastiques — Détermination de la résistance au choc Izod

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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.

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).

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For an explanation of 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 2, *Mechanical behavior*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 249, *Plastics*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This fifth edition cancels and replaces the fourth edition (ISO 180:2019), which has been technically revised.

The main changes are as follows:

- results of an interlaboratory test for unnotched specimens (see [Annex A](#)) have been added;
- reference to standard ISO 16012 (see the Bibliography and [5.2](#)) has been added;
- symbols used in [Formulae \(1\)](#) and [\(2\)](#) have been reviewed and updated;
- method designation in [Clause 10 b\)](#) have been reviewed and updated.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The Izod impact strength determination method is suitable for use with the following range of materials:

- rigid thermoplastic moulding and extrusion materials, including filled and reinforced compounds in addition to unfilled types; rigid thermoplastics sheets;
- rigid thermosetting moulding materials, including filled and reinforced compounds; rigid thermosetting sheets, including laminates;
- fibre-reinforced thermosetting and thermoplastic composites incorporating unidirectional or non-unidirectional reinforcements such as mat, woven fabrics, woven rovings, chopped strands, combination and hybrid reinforcements, rovings and milled fibres and sheet made from pre-impregnated materials (prepregs);
- thermotropic liquid-crystal polymers.

The method is not normally suitable for use with rigid cellular materials and sandwich structures containing cellular material. Notched specimens are also not normally used for long-fibre-reinforced composites or thermotropic liquid-crystal polymers.

The method is suited to the use of specimens which can be either moulded to the chosen dimensions, machined from the central portion of a standard multipurpose test specimen (see ISO 20753) or machined from finished or semi-finished products such as mouldings, laminates and extruded or cast sheet.

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Plastics — Determination of Izod impact strength

1 Scope

This document specifies a method for determining the Izod impact strength of plastics under defined conditions. A number of different types of specimen and test configurations are defined. Different test parameters are specified according to the type of material, the type of test specimen and the type of notch.

The method is used to investigate the behaviour of specified types of specimen under the impact conditions defined and for estimating the brittleness or toughness of specimens within the limitations inherent in the test conditions.

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 291, *Plastics — Standard atmospheres for conditioning and testing*

ISO 293, *Plastics — Compression moulding of test specimens of thermoplastic materials*

ISO 294-1, *Plastics — Injection moulding of test specimens of thermoplastic materials — Part 1: General principles, and moulding of multipurpose and bar test specimens*

ISO 295, *Plastics — Compression moulding of test specimens of thermosetting materials*

ISO 1268 (all parts), *Fibre-reinforced plastics — Methods of producing test plates.*

ISO 2818, *Plastics — Preparation of test specimens by machining*

ISO 10724-1, *Plastics — Injection moulding of test specimens of thermosetting powder moulding compounds (PMCs) — Part 1: General principles and moulding of multipurpose test specimens*

ISO 13802, *Plastics — Verification of pendulum impact-testing machines — Charpy, Izod and tensile impact-testing*

3 Terms and definitions

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

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

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

3.1

Izod impact strength of unnotched specimen

a_{iU}

impact energy absorbed in breaking an unnotched specimen, referred to the original cross-sectional area of the specimen

Note 1 to entry: It is expressed in kilojoules per square metre (kJ/m²).

3.2 Izod impact strength of notched specimen

a_{iN}
impact energy absorbed in breaking a notched specimen, referred to the original cross-sectional area of the specimen at the notch, with the pendulum striking the face containing the notch

Note 1 to entry: It is expressed in kilojoules per square metre (kJ/m²).

3.3 parallel -direction of blow

p
<laminar-reinforced plastics> impact with the direction of blow parallel to the plane of reinforcement

Note 1 to entry: The direction of the blow in the Izod test is usually “edgewise parallel” (ep) (see [Figure 1](#)).

3.4 normal direction of blow

n
<laminar-reinforced plastics> impact with the direction of blow normal to the plane of reinforcement

Note 1 to entry: This kind of impact is not usually used with the Izod test, but is indicated for the sake of completion (see also [Figure 1](#)).

4 Principle

The test specimen, supported as a vertical cantilever beam, is broken by a single impact of a striker, with the line of impact a fixed distance from the specimen clamp and, in the case of notched specimens, from the centreline of the notch (see [Figure 2](#)).

The method specifies preferred dimensions for the test specimen. Tests which are carried out on specimens of different dimensions or with different notches, or specimens which are prepared under different conditions, may produce results which are not comparable. Other factors, such as the energy capacity of the apparatus, its impact velocity and the conditioning of the specimens can also influence the results. Consequently, when comparative data are required, these factors are to be carefully controlled and recorded.

The method is not intended to be used as a source of data for design calculations. Information on the typical behaviour of a material can be obtained, however, by testing at different temperatures, by varying the notch radius and/or the thickness and by testing specimens prepared under different conditions.

5 Apparatus

5.1 Test machine

5.1.1 The principles, characteristics and verification of suitable test machines are detailed in ISO 13802. ISO 13802 describes partial verification and full verification. In the case of full verification, some items are difficult to verify when the apparatus is assembled. Such verifications are assumed to be incumbent on the manufacturer.

5.1.2 Some plastics are sensitive to clamping pressure. When testing such materials, a means of standardizing the clamping force shall be used and the clamping force shall be recorded in the test report. The clamping force can be controlled by using a calibrated torque wrench or a pneumatic or hydraulic device on the vice clamping screw.

5.2 Micrometers and gauges

Micrometers and gauges capable of measuring the essential dimensions of test specimens to an accuracy of 0,02 mm are required. For measuring the dimension b_N of notched specimens, the micrometer shall be fitted with an anvil of width 2 mm to 3 mm and of suitable profile to fit the shape of the notch. For general information on the determination of test specimen dimensions, see ISO 16012.

6 Test specimens

6.1 Preparation

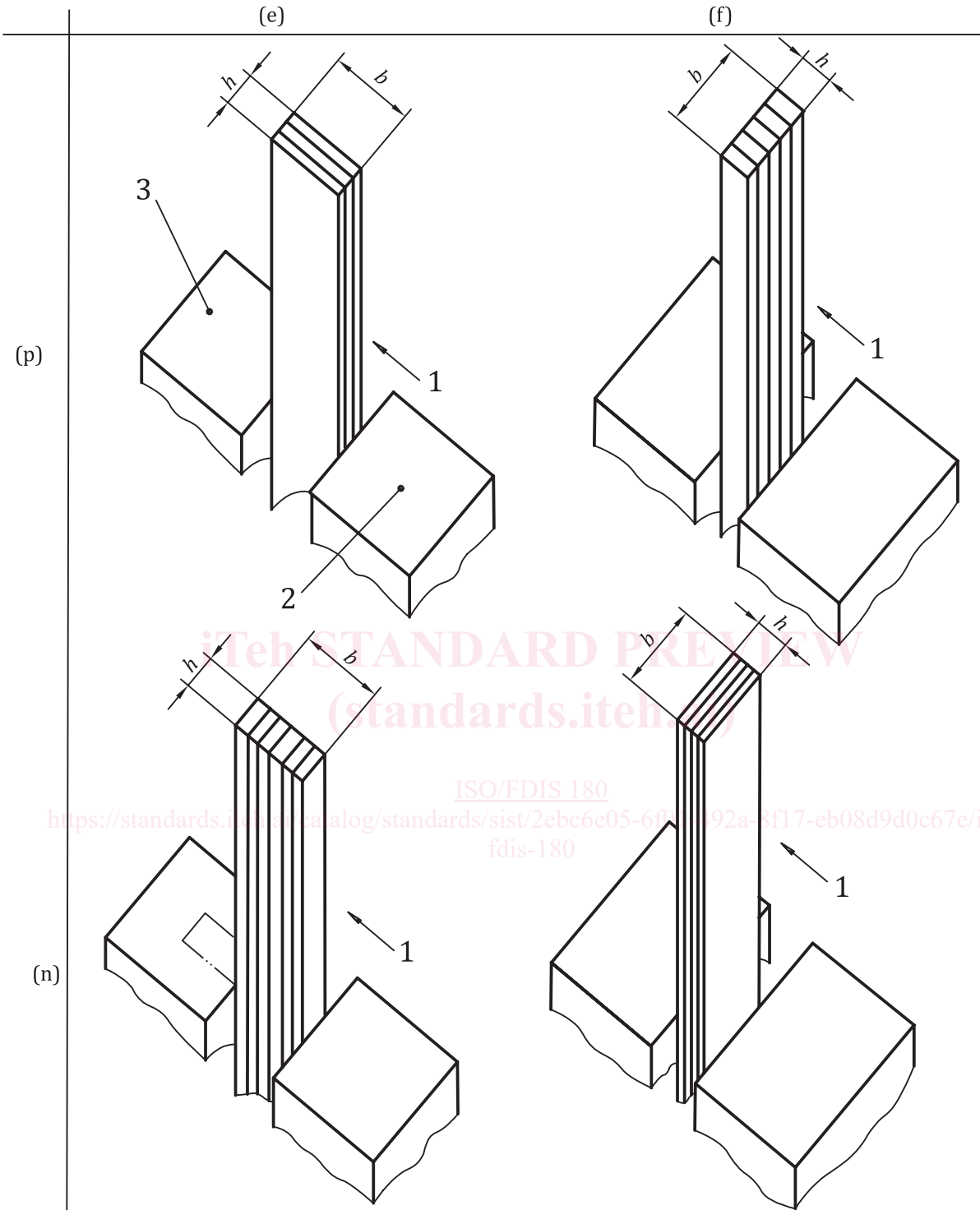
6.1.1 Moulding and extrusion compounds

Specimens shall be prepared in accordance with the relevant material specification. When none exists, and unless otherwise specified, specimens shall be either directly compression-moulded or injection-moulded from the material in accordance with ISO 293, ISO 294-1, ISO 295 or ISO 10724-1 as appropriate, or machined in accordance with ISO 2818 from sheet that has been compression- or injection-moulded from the compound. Specimens can also be cut from multipurpose test specimens complying with ISO 20753, type A.

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Key

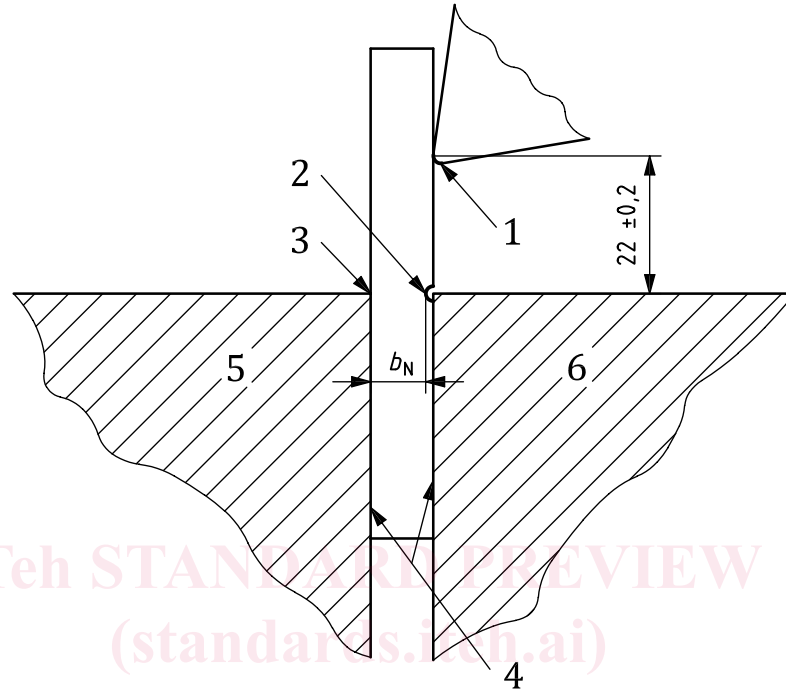
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|---|-------------------|---|----------|
| 1 | direction of blow | e | edgewise |
| 2 | movable vice jaw | f | flatwise |
| 3 | fixed vice jaw | n | normal |
| | | p | parallel |

NOTE 1 Edgewise (e) and flatwise (f) indicate the direction of the blow with respect to the specimen thickness h and specimen width b . Normal (n) and parallel (p) indicate the direction of the blow with respect to the laminate plane.

NOTE 2 The usual Izod test is “edgewise parallel”. When $h = b$, parallel direction of blow as well as normal impact testing is possible.

Figure 1 — Scheme of designations describing the direction of blow

Dimensions in millimetres



Key

- 1 striking edge (for radius, see ISO 13802)
- 2 notch
- 3 vice jaw edge about which bending takes place (for radius, see ISO 13802)
- 4 faces of jaws in contact with the specimen
- 5 fixed vice jaw
- 6 movable vice jaw
- b_N remaining width at notch base ($8 \text{ mm} \pm 0,2 \text{ mm}$)

Figure 2 — Vice jaws, test specimen (notched) and striking edge shown at impact