INTERNATIONAL STANDARD

ISO 180

Third edition
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Plastics — Determination of Izod impact strength

Plastiques — Détermination de la résistance au choc Izod

Reference number
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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 180 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 2, *Mechanical properties*.

This third edition cancels and replaces the second edition (ISO 180:1993), which has been technically revised.

Plastics — Determination of Izod impact strength

1 Scope

1.1 This International Standard 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.

1.2 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.

1.3 The 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.

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

1.5 The method is suited to the use of specimens which may be either moulded to the chosen dimensions, machined from the central portion of a standard multipurpose test specimen (see ISO 3167) or machined from finished or semifinished products such as mouldings, laminates and extruded or cast sheet.

1.6 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 must be carefully controlled and recorded.

1.7 The method should not 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.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard 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 291:1997, *Plastics — Standard atmospheres for conditioning and testing*.

ISO 293:1986, *Plastics — Compression moulding test specimens of thermoplastic materials.*

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 295:1991, *Plastics — Compression moulding of test specimens of thermosetting materials*.

ISO 1268:1974[1)], *Plastics — Preparation of glass fibre reinforced, resin bonded, low pressure laminated plates or panels for test purposes*.

ISO 2602:1980, *Statistical interpretation of test results — Estimation of the mean — Confidence interval*.

ISO 2818:1994, *Plastics — Preparation of test specimens by machining*.

ISO 3167:—[2)], *Plastics — Multipurpose test specimens.*

ISO 10724-1:1998, *Plastics — Injection moulding of test specimens of thermosetting powder moulding compounds (PMCs) — Part 1: General principles and moulding of multipurpose test specimens.*

ISO 13802:1999, *Plastics — Verification of pendulum impact-testing machines — Charpy, Izod and tensile impact-testing.*

3 Terms and definitions

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

3.1
Izod unnotched impact strength
a_{iU}
impact energy absorbed in breaking an unnotched specimen, referred to the original cross-sectional area of the specimen

NOTE It is expressed in kilojoules per square metre (kJ/m^2).

3.2
Izod notched impact strength
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 It is expressed in kilojoules per square metre (kJ/m^2).

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1) Under revision as a series of 11 parts.

2) To be published. (Revision of ISO 3167:1993)

3.3
parallel impact
p
⟨laminar-reinforced plastics⟩ impact with the direction of blow parallel to the plane of reinforcement

NOTE The direction of the blow in the Izod test is usually “edgewise parallel” (ep) (see Figure 1).

3.4
normal impact
n
⟨laminar-reinforced plastics⟩ impact with the direction of blow normal to the plane of reinforcement

NOTE 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).

5 Apparatus

5.1 Test machine

5.1.1 The principles, characteristics and verification of suitable test machines are detailed in ISO 13802.

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

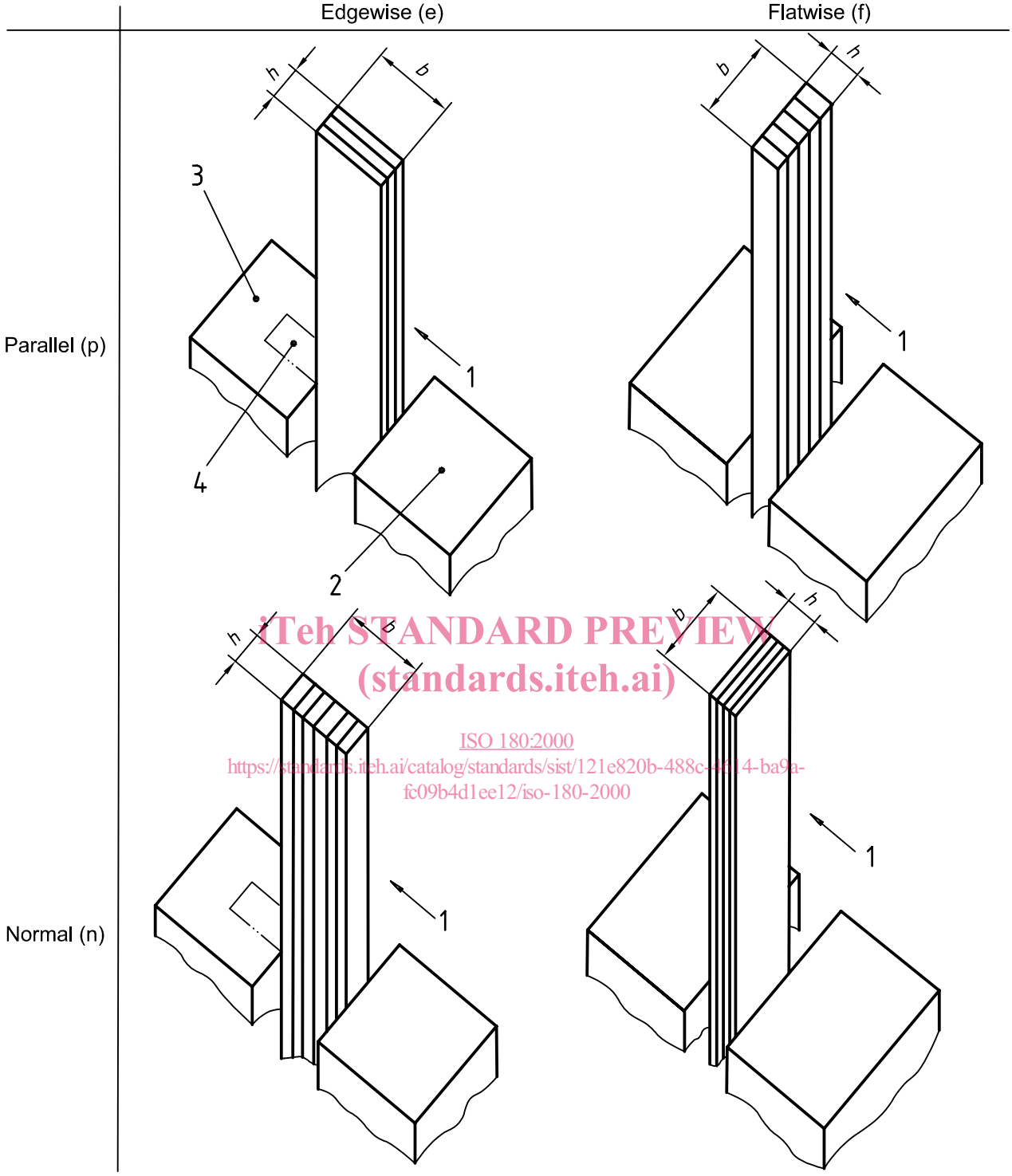
Micrometers and gauges capable of measuring the essential dimensions of test specimens to an accuracy of 0,02 mm are required. For measuring the dimension b_N of notched specimens, the micrometer shall be fitted with an anvil of width 2 mm to 3 mm and of suitable profile to fit the shape of the notch.

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 may also be cut from multipurpose test specimens complying with ISO 3167, type A.



Key

1	Direction of blow	3	Fixed vice jaw
2	Movable vice jaw	4	Optional groove

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.

The usual Izod test is "edgewise parallel". When $h = b$, parallel as well as normal impact testing is possible.

Figure 1 — Scheme of designations describing the direction of blow

Radius of notch base
r_N = 0,25 mm ± 0,05 mm

a) Type A

Radius of notch base
r_N = 1,00 mm ± 0,05 mm

b) Type B

Figure 2 — Notch types

6.1.2 Sheets

Specimens shall be machined from sheets in accordance with ISO 2818. Whenever possible, specimens with notch A shall be used. The machined surface of unnotched specimens shall not be tested under tension.

6.1.3 Long-fibre-reinforced materials

A panel shall be prepared in accordance with ISO 1268 or another specified or agreed upon preparation procedure. Specimens shall be machined in accordance with ISO 2818.

6.1.4 Checking

The specimens shall be free of twist and shall have mutually perpendicular parallel surfaces. The surfaces and edges shall be free from scratches, pits, sink marks and flash.

The specimens shall be checked for conformity with these requirement by visual observation against straightedges, squares and flat plates, and by measuring with micrometer callipers.

Specimens showing measurable or observable departure from one or more of these requirements shall be rejected or machined to proper size and shape before testing.

6.1.5 Notching

6.1.5.1 Machined notches shall be prepared in accordance with ISO 2818. The profile of the cutting tooth shall be such as to produce in the specimen a notch of the contour and depth shown in Figure 2, at right angles to its principal axes. The notch profile shall be checked at regular intervals.

6.1.5.2 Specimens with moulded-in notches may be used if specified for the material being tested. Specimens with moulded-in notches do not give results comparable to those obtained from specimens with machined notches. The notch profile shall be checked at regular intervals.

6.2 Anisotropy

Certain types of sheet or panel material may show different impact properties depending on the direction in the plane of the sheet or panel. In such cases, it is customary to cut groups of test specimens with their major axes respectively parallel and perpendicular to the direction of some feature of the sheet or panel which is either visible or inferred from knowledge of the method of manufacture.