Australian Standard®

Methods for impact tests on plastics

Part 1: Izod impact resistance

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The following interests are represented on Committee PL/10/2:

CSIRO, Division of Building, Construction and Engineering
Gas & Fuel Corporation of Victoria
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PREFACE

This Australian Standard was prepared by Standards Australia Committee PL/10/2, Mechanical Testing of Plastics, under the authority of the Plastics Standards Board to supersede the 1972 edition.

The Standard differs considerably from the previous edition in that two types of notched specimens, and unnotched specimens, are permitted in lieu of a single notched specimen. The subject matter dealing with equipment and specimen preparation, is technically similar to ISO 180, *Plastics—Determination of Izod impact strength of rigid materials*, which is currently under review by ISO.

This Australian Standard takes cognizance of several draft revisions of ISO 180 — 1982 but as these are yet to be finalized the text of this Standard differs editorially from the proposed ISO drafts.

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FOREWORD

The excess energy pendulum impact tests indicate the energy to break standard test specimens of specified size under stipulated conditions of specimen mounting, notching (stress concentration) and rate of loading.

The energy indicated by the apparatus after breaking a standard test piece is the sum of—

(a) the energy to deform the specimen;

(b) the energy to initiate fracture of the specimen;

(c) the energy to propagate the fracture across the specimen;

(d) the energy to throw the free end of the broken specimen (toss factor); and

(e) the energy lost through friction and through vibration of the apparatus and its base.

The notch, which is always present in the standard Izod test specimen, serves to concentrate the stress and largely prevents plastic deformation.

Friction losses are largely eliminated by careful design and proper operation of the testing machine. Energy losses due to vibration of the apparatus are generally assumed to be negligible for plastics, but may be considerable if the machine is not correctly designed with sufficient mass for the specified range and is not of rigid construction.

Thus, the indicated impact strength of a material for all practical purposes is based on items (a), (b), (c) and (d) as indicated above. In the case of relatively brittle materials, the tearing energy is small compared with the fracture energy, whereas in the case of tough ductile fibre filled or cloth laminated materials, the reverse is true. The toss factor may represent a very large fraction of the total energy absorbed when testing relatively brittle materials (impacts where energy levels are less than 2 kJ/m^2).

Compared with AS 1462.2 (Charpy test) the range of applicability of the Izod method is limited in many respects. This especially holds for materials with interlaminate shear fracture and for the testing of surface influences.

STANDARDS AUSTRALIA

Australian Standard
Methods for impact tests on plastics

Part 1—Izod impact resistance

1 SCOPE. This Standard specifies a method for the determination of the Izod impact strength of rigid plastics using a pendulum type testing machine.

Different test parameters are specified according to the type of material, type of test specimen and the type of notch (see Clause 7.1).

The method is used for investigating the behaviour of specified specimens under specified impact conditions, and for estimating the brittleness or the toughness of specimens within the limitations inherent in the test conditions.

This Standard is applicable, inter alia, to the following materials:

(a) Rigid thermoplastic moulding and extrusion materials, including filled and reinforced compounds, and rigid thermoplastic sheet.

(b) Rigid thermosetting moulding materials, including filled and reinforced compounds.

(c) Rigid thermosetting sheet, including laminates.

(d) Fibre reinforced materials (composites), incorporating mat, woven fabric, woven rovings, chopped strands, chopped rovings, rovings and milled fibres, including pre-impregnated materials (prepregs).

(e) Unidirectional fibre reinforced materials (composites), including pre-impregnated materials (prepregs).

NOTE: The use of notched specimens is unsuitable for long fibre reinforced plastics. The method may not be suitable for foamed materials.

The method is applicable to specimens prepared from moulding materials or to specimens taken from finished and semi-finished products i.e. mouldings, laminates, extruded or cast sheets.

The method is suitable for production control, as well as for the acceptance and rejection of materials according to specifications for moulding materials and products.

The results obtained by testing specimens prepared under different conditions are generally not comparable.

NOTE: The method is not suitable as a source of data for design calculations of components. Information on the typical behaviour of a material can be obtained, however, by testing at different temperatures, by varying the notch radius, and by testing specimens prepared under different conditions.

2 REFERENCED DOCUMENTS. The following documents are referred to in this Standard:

AS
1146 Methods for impact tests on plastics
1146.2 Part 2: Charpy impact resistance
1146.3 Part 3: Calibration of the testing machine
1327 Plastics—Standard environments for conditioning and testing plastics materials

ISO
293 Plastics—Compression moulding test specimens of thermoplastic materials
294 Plastics—Injection moulding test specimens of thermoplastic materials
295 Plastics—Compression moulding test specimens of thermosetting materials
1268 Plastics—Preparation of glass fibre reinforced, resin bonded, low-pressure laminated plates or panels for test purposes
2557 Plastics—Amorphous thermoplastic moulding materials—Preparation of test specimens with a defined level of shrinkage
2557-1 Part 1: Test specimens in the form of parallelepipedic bars
(Injection moulding and compression moulding)
2557-2 Part 2: Plates
2818 Plastics—Preparation of test specimens by machining
3167 Plastics—Preparation and use of multi-purpose test specimens

3 DEFINITIONS. For the purpose of this Standard the definitions below apply.

3.1 Break.

3.1.1 *Complete break (Type C)*—a break in which the specimen separates into two or more pieces.

3.1.2 *Hinge break (Type H)*—an incomplete break such that one part of the specimen cannot support itself above the horizontal when the other part is held vertically (less than 90° included angle).

3.1.3 *Partial break (Type P)*—an incomplete break that does not meet the definition for a hinge break but has fractured at least 90% of the distance between the vertex of the notch and the opposite side.

3.1.4 *Non-break (Type NB)*—an incomplete break where the fracture extends less than 90% of the distance between the vertex of the notch and the opposite side.

3.2 Izod impact strength of unnotched specimens—the impact energy absorbed in breaking an unnotched specimen, referred to the original cross-sectional area of the specimen.

NOTE: In this Standard the units kilojoules per square metre are used.

3.3 Izod impact strength of notched specimens—the impact energy absorbed in breaking a notched specimen, referred to the original cross-sectional area of the specimen at the notch.

NOTE: In this Standard the units kilojoules per square metre are used.

3.4 Izod impact strength of reversed notch specimens—the impact energy absorbed in breaking a