INTERNATIONAL STANDARD

ISO 10350

First edition
1993-12-15

Plastics — Acquisition and presentation of comparable single-point data

Plastiques — Acquisition et présentation de caractéristiques intrinsèques comparables

Reference number
ISO 10350:1993(E)

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 10350 was prepared by Technical Committee ISO/TC 61, *Plastics*, Sub-Committee SC 1, *Terminology*.

Annex A of this International Standard is for information only.

International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

Introduction

This International Standard has been prepared because users of plastics find sometimes that available data cannot be used readily to compare the properties of similar materials, especially when the data have been supplied by different sources. Even when the same standard tests have been used, they often allow the adoption of a wide range of alternative test conditions, and the data obtained are not necessarily comparable. The purpose of this International Standard is to identify specific methods and conditions of test to be used for the acquisition and presentation of data in order that valid comparisons between materials can be made.

The present International Standard is concerned with tests employed to present "single-point" data on the limited range of properties commonly included in data sheets and used for the preliminary selection of materials. Such data represent the most basic approach to the specification of properties of materials and this International Standard thus facilitates the first steps towards more efficient selection and use of plastics in the many applications to which they are suited.

A complementary International Standard (to be published as ISO 11403, in several parts) will be concerned with the standardized acquisition and presentation of "multi-point" data, to demonstrate how properties vary with important factors such as time, temperature and the presence of particular natural and chemical environments. In that standard, some additional properties will be included. Its use will provide a more substantial database than one containing only single-point data, and so will enable improved assessment of the fitness of a material for any particular application. In addition, ISO11403-1, which deals with mechanical properties, assists predictions of the performance of components and ISO 11403-2, covering thermal and processing properties, aids predictions of melt-flow behaviour during manufacturing. ISO 11403-3 will be concerned with environmental influences on properties, and other parts may be prepared to cover additional properties.

Plastics — Acquisition and presentation of comparable single-point data

1 Scope

This International Standard identifies specific test procedures for the acquisition and presentation of comparable data for certain basic properties of plastics. In general, each property is specified by a single experimental value although in certain cases properties are represented by two values obtained under different test conditions. The properties included are those presented conventionally in manufacturers' data sheets. The test methods and test conditions apply predominantly to those plastics that may be injection- or compression-moulded or prepared as sheets of specified thickness.

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 62:1980, *Plastics — Determination of water absorption.*

ISO 75-1:1993, *Plastics — Determination of temperature of deflection under load — Part 1: General test method.*

ISO 75-2:1993, *Plastics — Determination of temperature of deflection under load — Part 2: Plastics and ebonite.*

ISO 75-3:1993, *Plastics — Determination of temperature of deflection under load — Part 3: High-strength thermosetting laminates and long-fibre-reinforced plastics.*

ISO 178:1993, *Plastics — Determination of flexural properties.*

ISO 179:1993, *Plastics — Determination of Charpy impact strength.*

ISO 291:1977, *Plastics — Standard atmospheres for conditioning and testing.*

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

ISO 294:—[1], *Plastics — Injection moulding of test specimens of thermoplastic materials.*

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

ISO 306:1987, *Plastics — Thermoplastic materials — Determination of Vicat softening temperature.*

ISO 527-1:1993, *Plastics — Determination of tensile properties — Part 1: General principles.*

ISO 527-2:1993, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics.*

ISO 899-1:1993, *Plastics — Determination of creep behaviour — Part 1: Tensile creep.*

ISO 1133:1991, *Plastics — Determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics.*

ISO 1183:1987, *Plastics — Methods for determining the density and relative density of non-cellular plastics.*

1) To be published. (Revision of ISO 294:1975)

ISO 1210:1992, *Plastics — Determination of the burning behaviour of horizontal and vertical specimens in contact with a small-flame ignition source.*

ISO 2577:1984, *Plastics — Thermosetting moulding materials — Determination of shrinkage.*

ISO 2818:1980, *Plastics — Preparation of test specimens by machining.*

ISO 3146:1985, *Plastics — Determination of melting behaviour (melting temperature or melting range) of semi-crystalline polymers.*

ISO 3167:1993, *Plastics — Multipurpose test specimens.*

ISO 4589:1984, *Plastics — Determination of flammability by oxygen index.*

ISO 8256:1990, *Plastics — Determination of tensile-impact strength.*

ISO 10724:—[2], *Plastics — Thermosetting moulding materials — Injection moulding of multipurpose test specimens.*

ISO 11403-1:—[2], *Plastics — Acquisition and presentation of comparable multipoint data — Part 1: Mechanical properties.*

ISO 11403-2:—[2], *Plastics — Acquisition and presentation of comparable multipoint data — Part 2: Thermal and processing properties.*

IEC 93:1980, *Methods of test for volume resistivity and surface resistivity of solid electrical insulating materials.*

IEC 112:1979, *Method for determining the comparative and the proof tracking indices of solid insulating materials under moist conditions.*

IEC 243-1:1988, *Methods of test for electric strength of solid insulating materials — Part 1: Tests at power frequencies.*

IEC 250:1969, *Recommended methods for the determination of the permittivity and dielectric dissipation factor of electrical insulating materials at power, audio and radio frequencies including metre wavelengths.*

IEC 296:1982, *Specification for unused mineral insulating oils for transformers and switchgear.*

IEC 1006:1991, *Methods of test for the determination of the glass transition temperature of electrical insulating materials.*

3 Definition

For the purposes of this International Standard, the following definition applies.

3.1 single-point data: Data characterizing a plastics material by means of those property tests in which important aspects of performance can be described with a single-value result.

4 Specimen preparation and conditioning

In the preparation of specimens by injection- or compression-moulding, the procedures described in ISO 293, ISO 294 or ISO 295 shall be used. The moulding method and the conditions will depend upon the material being moulded. If these conditions are specified in the International Standard appropriate to the material then they shall be adopted for the preparation of every specimen on which data are obtained using this International Standard. For those plastics for which moulding conditions have not yet been standardized, the conditions employed shall be within the range recommended by the polymer manufacturer and shall, for each of the processing methods, be the same for every specimen.

Where moulding conditions are not stipulated in any International Standard, the values used for the parameters in table 1 shall be recorded with the single-point data for that material. Where specimens are prepared by machining from sheet, the machining shall be performed in accordance with ISO 2818 and the dimensions of the specimen shall comply with those for the appropriate specimen in table 2.

Specimen conditioning, including any post-moulding treatment, shall be carried out at 23 °C ± 2 °C and (50 ± 5) % R.H. for a minimum length of time of 88 h, except where special conditioning is required as specified by the appropriate material standard.

2) To be published.

Table 1 — Moulding parameters

Moulding-material type	Moulding method and standard (where applicable)	Moulding parameters
Thermoplastic	Injection ISO 294	Melt temperature Mould temperature Average melt velocity Hold pressure[1)]
	Compression ISO 293	Moulding temperature Moulding time Cooling rate Demoulding temperature
Thermosetting	Injection ISO 10724	Temperature at nozzle Mould temperature Average injection velocity Hold pressure[1)] Post-cure temperature Post-cure time
	Compression ISO 295	Mould temperature Dwell time Post-cure temperature Post-cure time

1) The hold pressure mainly influences the shrinkage of the specimen, and is recorded principally for this reason.

5 Test requirements

The test methods, test conditions and units specified in table 2 shall be used in determining data. All tests shall be conducted at 23 °C ± 2 °C and (50 ± 5) % relative humidity (see ISO 291) unless otherwise stated in table 2 or in the International Standard appropriate to the material.

6 Presentation of results

The presentation of data shall be as shown in table 2, and the data shall be preceded by information that identifies the material together with the information required by clause 4 where appropriate.

Table 2 — Test conditions and format for the presentation of single-point data (see note 1)

	Property	Standard	Specimen type (dimensions in mm)	Value	Unit	Test conditions and supplementary instructions
1	**Rheological properties**					
1.1	Melt mass-flow rate	ISO 1133	Moulding compound		g/10 min	Use and record test conditions for temperature and load specified in the appropriate material standard
1.2	Melt volume-flow rate (see note 2)				cm^3 /10 min	
1.3	Moulding shrinkage	ISO 2577 (see note 3)	(see note 3)		%	
2	**Mechanical properties**					
2.1	Tensile modulus	ISO 527-1 and 527-2	ISO 3167 (see note 4)		MPa	See note 5
2.2	Yield stress					Ductile failure: Test speed 50 mm/min (see notes 5 and 6)
2.3	Yield strain				%	
2.4	Nominal strain at break					
2.5	Stress at 50 % strain				MPa	
2.6	Stress at break					Brittle failure: Test speed 5 mm/min (see notes 5 and 7)
2.7	Strain at break				%	
2.8	Tensile creep modulus	ISO 899-1			MPa	At 1 h; Strain < 0,5 %
2.9						At 1 000 h; Strain < 0,5 %
2.10	Flexural modulus	ISO 178	80 × 10 × 4		MPa	Test speed 2 mm/min (see also note 8)
2.11	Flexural strength					
2.12	Charpy impact strength	ISO 179	80 × 10 × 4		kJ/m^2	Edgewise impact
2.13	Charpy notched impact strength		Machined V-notch, $r = 0,25$			
2.14	Tensile-impact strength	ISO 8256	80 × 10 × 4 Machined double V-notch, $r = 1$			Record if fracture cannot be obtained with notched Charpy test
3	**Thermal properties**					
3.1	Melting temperature	ISO 3146	Moulding compound		°C	Method C (DSC or DTA) Use 10 °C/min
3.2	Glass transition temperature	IEC 1006				Method A (DSC or DTA) Use 10 °C/min
3.3	Temperature of deflection under load	ISO 75-1 and 75-2	110 × 10 × 4 or 80 × 10 × 4 (see note 9)		°C	1,8; 0,45; 8 — Maximum surface stress (MPa) Use 1,8 MPa and one other value
3.4						
3.5						
3.6		ISO 75-3	Variable (see ISO 75-3)			
3.7	Vicat softening temperature (see note 10)	ISO 306	10 × 10 × 4 (see note 11)			Heating rate 50 °C/h Load 50 N

Property		Standard	Specimen type (dimensions in mm)	Value	Unit	Test conditions and supplementary instructions	
3.8	Coefficient of linear thermal expansion	Thermo-mechanical analysis (see note 12)	Prepared from ISO 3167 (see note 11)		$°C^{-1}$	Parallel	Record the secant value over the temperature range 23 °C to 55 °C
3.9						Normal	
3.10	Flammability	ISO 1210	125 × 13 × 3		mm/min	Method A: linear burning rate of horizontal specimens	
3.11			Additional thickness (see note 13)				
3.12			125 × 13 × 3	a)	s	Method B: a) after-flame and b) after-glow times of vertical specimens	
3.13				b)			
3.14			Additional thickness (see note 13)	a)			
3.15				b)			
3.16	Ignitability	ISO 4589	80 × 10 × 4		%	Use procedure A: top surface ignition	
4	**Electrical properties**						
4.1	Relative permittivity	IEC 250	⩾ 80 × ⩾ 80 × 1 (see note 14)			100 Hz	Compensate for electrode edge effects
4.2						1 MHz	
4.3	Dissipation factor					100 Hz	
4.4						1 MHz	
4.5	Volume resistivity	IEC 93			Ω·m	Voltage 100 V	
4.6	Surface resistivity				Ω		
4.7	Electric strength	IEC 243-1	⩾ 80 × ⩾ 80 × 1 (see note 15)		kV/mm	Use 25 mm/75 mm coaxial-cylinder electrode configuration Immersion in transformer oil in accordance with IEC 296 Use 20 s step-by-step test	
4.8			⩾ 80 × ⩾ 80 × 3 (see note 15)				
4.9	Comparative tracking index	IEC 112	⩾ 15 × 15 × 4 (see note 16)			Use solution A	
5	**Other properties**						
5.1	Water absorption	ISO 62	50 square or diameter × 3		%	24 h immersion in water at 23 °C	
5.2			Thickness ⩽ 1			Saturation value in water at 23 °C	
5.3						Saturation value at 23 °C , 50 % R.H.	
5.4	Density	ISO 1183	Use part of the centre of the multipurpose test specimen		kg/m^3	See note 17	

Notes to table 2

1 Use of the parameters in table 2 is essentially for the comparison of data, and certain of the instructions listed may not be appropriate for all polymers.

2 The ratio of melt mass-flow rate to melt volume-flow rate gives an estimate of the melt density.

3 There is no International Standard for measuring the moulding shrinkage of thermoplastics. ISO 2577 describes how to measure the reaction shrinkage of thermosetting materials.

4 ISO 3167 describes two types of specimen for tensile tests. The type A specimen has a lower value for the radius of the shoulders of 20 mm to 25 mm which thereby enables a central region to be obtained of length at least 80 mm. The standard ISO bar having