INTERNATIONAL STANDARD

ISO 10350-1

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Plastics — Acquisition and presentation of comparable single-point data —

Part 1:
Moulding materials

Plastiques — Acquisition et présentation des caractéristiques intrinsèques comparables —

Partie 1: Matériaux pour moulage

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 10350-1 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 2, *Mechanical properties*.

Together with part 2, this part of ISO 10350 cancels and replaces ISO 10350:1993, which has been technically revised.

ISO 10350 consists of the following parts, under the general title *Plastics — Acquisition and presentation of comparable single-point data*:

— *Part 1: Moulding materials*

— *Part 2: Reinforced plastics*

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Introduction

ISO 10350 has been prepared because users of plastics find that available data cannot always be readily used 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 ISO 10350 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.

ISO 10350 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 the standard thus facilitates the first steps towards more efficient selection and use of plastics in the many applications to which they are suited.

Complementary International Standard*s* (ISO 11403, parts 1, 2 and 3)[1)] are 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 these standard*s*, some additional properties are included. Their 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, ISO 11403-1, 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 is concerned with environmental influences on properties, and other parts may be prepared to cover additional properties.

1) ISO 11403-1:1994, *Plastics — Acquisition and presentation of comparable multipoint data — Part 1: Mechanical properties.*

ISO 11403-2:1995, *Plastics — Acquisition and presentation of comparable multipoint data — Part 2: Thermal and processing properties.*

ISO 11403-3 (to be published), *Plastics — Acquisition and presentation of comparable multipoint data — Part 3: Environmental influences on properties.*

1 Scope

ISO 10350 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. This part of ISO 10350 applies predominantly to unreinforced and reinforced thermoplastic and thermosetting materials that may be injection- or compression-moulded or prepared as sheets of specified thickness. Part 2 deals specifically with long- or continuous-fibre-reinforced plastics. For the purposes of ISO 10350, long-fibre-reinforced plastics are considered to have fibre lengths greater than 7,5 mm prior to moulding.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 10350. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 10350 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:—[2)], *Plastics — Determination of water absorption.*

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

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

ISO 179-1:—[3)], *Plastics — Determination of Charpy impact properties — Part 1: Non-instrumented impact test*.

ISO 179-2:1997, *Plastics — Determination of Charpy impact properties — Part 2: Instrumented impact test*.

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 294-3:1996, *Plastics — Injection moulding of test specimens of thermoplastic materials — Part 3: Small plates.*

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2) To be published. (Revision of ISO 62:1980)

3) To be published. (Revision of ISO 179:1993)

ISO 294-4:1997, *Plastics — Injection moulding of test specimens of thermoplastic materials — Part 4: Determination of moulding shrinkage.*

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

ISO 306:1994, *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 1133:1997, *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.*

ISO 1210/IEC 60695-11-10:—[4], *Determination of the burning behaviour of horizontal and vertical specimens in contact with a small-flame (50 W) ignition source.*

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

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

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

ISO 4589-2:1996, *Plastics — Determination of burning behaviour by oxygen index — Part 2: Ambient-temperature test.*

ISO 6603-2:—[5], *Plastics — Determination of puncture impact behaviour of rigid plastics — Part 2: Instrumented puncture test.*

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

ISO 10351/IEC 60695-11-20:—[6], *Determination of the burning behaviour of specimens using a 500 W flame source.*

ISO 10724-1:1998, *Plastics — Injection moulding of test specimens of thermosetting materials — Part 1: General principles and moulding of multipurpose test specimens.*

ISO 10724-2:1998, *Plastics — Injection moulding of test specimens of thermosetting materials — Part 2: Small plates.*

ISO 11357-2:—[7], *Plastics — Differential scanning calorimetry (DSC) — Part 2: Determination of glass transition temperature.*

ISO 11357-3:—[7], *Plastics — Differential scanning calorimetry (DSC) — Part 3: Determination of temperature and enthalpy of melting and crystallization.*

ISO 11359-2:—[7], *Plastics — Thermomechanical analysis (TMA) — Part 2: Determination of coefficient of linear thermal expansion and glass transition temperature.*

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4) To be published. (Revision of ISO 1210:1992)

5) To be published. (Revision of ISO 6603-2:1989)

6) To be published. (Revision of ISO 10351:1992)

7) To be published.

IEC 60093:1980, *Methods of test for volume resistivity and surface resistivity of solid electrical insulating materials.*

IEC 60112:1979, *Method for determining the comparative and the proof tracking indices of solid insulating materials under moist conditions.*

IEC 60243-1:1998, *Electrical strength of insulating materials — Test methods — Part 1: Tests at power frequencies.*

IEC 60250:1969, *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 60296:1982, *Specification for unused mineral insulating oils for transformers and switchgear*.

3 Definition

For the purposes of this part of ISO 10350, 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 single-value results.

4 Specimen preparation and conditioning

In the preparation of specimens by injection moulding or compression moulding, the procedures described in ISO 293, ISO 294-1 and -3, ISO 295 or ISO 10724-1 and -2 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 part of ISO 10350. 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 compression-moulded 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.

For materials that have properties that are not significantly sensitive to any absorbed water, specimens shall be conditioned in accordance with the International Standard appropriate to the material concerned. If no materials standard is available, condition test specimens at 23 °C ± 2 °C and (50 ± 10) % RH for a minimum length of time of 88 h (see ISO 291).

For those materials having properties that are significantly dependent upon the concentration of any absorbed water, data shall be presented both for material that is dry and also for material that is in equilibrium with an atmosphere of 50 % RH at 23 °C but with the following exceptions (see table 2).

Rheological properties 1.1 to 1.6	-	dry only
Creep modulus 2.8 and 2.9	-	50 % RH only
Thermal properties 3.1 to 3.8	-	dry only
Surface resistivity and comparative tracking index 4.6 and 4.9	-	50 % RH only

For these materials, consult the relevant materials standard for procedures for conditioning specimens to achieve material that is dry or in equilibrium under 50 % RH. Following such conditioning, all test specimens shall be stored at 23 °C ± 2 °C for a minimum of 16 h before testing. The storage atmosphere shall then be either dry or at 50 % RH, depending upon the condition of the specimen.

Table 1 — Moulding parameters

Moulding-material type	Moulding method and standard (where applicable)	Moulding parameters
Thermoplastic	Injection ISO 294-1 and -3	Melt temperature Mould temperature Injection velocity[1)] Cavity pressure at hold [2)]
	Compression ISO 293	Moulding temperature Moulding time Cooling rate Demoulding temperature
Thermosetting	Injection ISO 10724-1 and -2	Injection temperature Mould temperature Injection velocity Cure time
	Compression ISO 295	Mould temperature Mould pressure Cure time

1) Values specified in materials standards refer to the preparation of the multipurpose test specimen only (ISO 294-1, mould type A). For the preparation of standard specimens of the 80 mm × 10 mm × 4 mm bar (ISO 294-1, mould type B) and of the plate (ISO 294-3, mould types D1 and D2), values for the injection velocity shall be chosen to give an injection time comparable to that achieved with the multipurpose test specimen.

2) Only to be recorded for the 60 mm × 60 mm × 2 mm plate specimen in ISO 294-3 and -4 when used for the determination of moulding shrinkage.

5 Test requirements

The test methods, test conditions and units specified in table 2 shall be used when determining data.

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. Indicate also whether the specimens tested were dry, in equilibrium with an atmosphere of 50 % RH at 23 °C or whether properties are insensitive to the presence of water.

Test the minimum number of specimens that is specified for each property in the associated test method standard (see note). Record the mean value for each property (or the central value if this is stipulated in the test method standard) in the "value" column.

NOTE — In order that the value recorded for each property is as representative as possible of the material being tested, it is recommended that test specimens are prepared from at least three samples of the material taken from the production of the material over an extended timescale.

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

	Property	Symbol	Standard	Specimen type (dimensions in mm)	Value	Unit	Test conditions and supplementary instructions	
1	**Rheological properties** (for properties 1.1 to 1.6, see statement in clause 4)							
1.1	Melt mass-flow rate	MFR	ISO 1133	Moulding compound		g/10 min	Use and record test conditions for temperature and load specified in the appropriate materials standard	
1.2	Melt volume-flow rate (see note 2)	MVR				cm^3/10 min		
1.3	Moulding shrinkage of thermosetting polymers	S_{Mp}	ISO 2577			%	Parallel	See note 3
1.4		S_{Mn}					Normal	
1.5	Moulding shrinkage of thermoplastics	S_{Mp}	ISO 294-4	60 × 60 × 2 ISO 294-3 type D2 (see note 4)		%	Parallel	See note 3
1.6		S_{Mn}					Normal	
2	**Mechanical properties** (for properties 2.8 and 2.9, see statement in clause 4)							
2.1	Tensile modulus	E_t	ISO 527-1 and 527-2	ISO 3167 (see note 5)		MPa	See note 6 and figure 1	Test speed 1 mm/min
2.2	Yield stress	σ_y						Failure with yielding: test speed 50 mm/min (see note 7)
2.3	Yield strain	ε_y				%		
2.4	Nominal strain at break	ε_{tB}						Failure without yielding $\varepsilon_B \leqslant 10$ %: test speed 5 mm/min $\varepsilon_B > 10$ %: test speed 50 mm/min (see note 8)
2.5	Stress at 50 % strain	σ_{50}				MPa		
2.6	Stress at break	σ_B						
2.7	Strain at break	ε_B				%		
2.8	Tensile creep modulus	$E_{tc}1$	ISO 899-1			MPa	At 1 h	Strain < 0,5 %
2.9		$E_{tc}10^3$					At 1 000 h	
2.10	Flexural modulus	E_f	ISO 178	80 × 10 × 4 (see note 5)		MPa	Test speed 2 mm/min Optional extra information for brittle materials (see note 9)	
2.11	Flexural strength	σ_{fM}						
2.12	Charpy impact strength	a_{cU}	ISO 179-1 or ISO 179-2	80 × 10 × 4 (see note 5)		kJ/m^2	Edgewise impact Also record type of failure (see note 10)	
2.13	Charpy notched impact strength	a_{cA}		Machined V-notch, $r = 0,25$				
2.14	Tensile-impact strength	a_{t1}	ISO 8256	80 × 10 × 4 (see note 5) Machined double V-notch, $r = 1$				