INTERNATIONAL STANDARD

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Plastics — Impact-resistant polystyrene (PS-I) moulding and extrusion materials —

Part 2: Preparation of test specimens and determination of properties

Plastiques — Polystyrènes résistants au choc (PS-I) pour moulage et extrusion —

Partie 2: Préparation des éprouvettes et détermination des propriétés

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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 2.

The main task of technical committees is to prepare International Standards. 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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 2897-2 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 9, *Thermoplastic materials*.

This third edition cancels and replaces the second edition (ISO 2897-2:1994), which has been technically revised.

ISO 2897 consists of the following parts, under the general title *Plastics — Impact-resistant polystyrene (PS-I) moulding and extrusion materials*:

— *Part 1: Designation system and basis for specifications*

— *Part 2: Preparation of test specimens and determination of properties*

Plastics — Impact-resistant polystyrene (PS-I) moulding and extrusion materials —

Part 2: Preparation of test specimens and determination of properties

1 Scope

1.1 This part of ISO 2897 specifies the methods of preparation of test specimens and the test methods to be used in determining the properties of PS-I moulding and extrusion materials. Requirements for handling test material and for conditioning both the test material before moulding and the specimens before testing are given here.

1.2 Procedures and conditions for the preparation of test specimens and procedures for measuring properties of the materials from which these specimens are made are given. Properties and test methods which are suitable and necessary to characterize PS-I moulding and extrusion materials are listed.

1.3 The properties have been selected from the general test methods in ISO 10350. Other test methods in wide use for, or of particular significance to, these moulding and extrusion materials are also included in this part of ISO 2897, as are the designatory properties specified in Part 1.

1.4 In order to obtain reproducible and comparable test results, it is necessary to use the methods of specimen preparation and conditioning, the specimen dimensions and the test procedures specified herein. Values determined will not necessarily be identical to those obtained using specimens of different dimensions or prepared using different procedures.

2 Conformance

In Clause 3, the year of publication of each normative reference has been specifically stated. In order to be able to claim conformity with this part of ISO 2897, it is essential that the user use only those editions given, and not earlier or more recent editions.

3 Normative references

The following referenced documents are indispensable for the application 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 62:1980, *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 179:1993, *Plastics — Determination of Charpy impact strength*

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 306:1994, *Plastics — Thermoplastic materials — Determination of Vicat softening temperature (VST)*

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

ISO 527-4:1997, *Plastics — Determination of tensile properties — Part 4: Test conditions for isotropic and orthotropic fibre-reinforced plastic composites*

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 2561:1974, *Plastics — Determination of residual styrene monomer in polystyrene by gas chromatography*

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

ISO 2897-1:1997, *Plastics — Impact-resistant polystyrene (PS-I) moulding and extrusion materials — Part 1: Designation system and basis for specifications*

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 10350:1993, *Plastics — Acquisition and presentation of comparable single-point data*

ISO11357-2:1999, *Plastics — Differential scanning calorimetry (DSC) — Part 2: Determination of glass transition temperature*

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*

IEC 60695-11-10:1999, *Fire hazard testing — Part 11-10: Test flames — 50 W horizontal and vertical flame test methods*

IEC 60695-11-20:1999, *Fire hazard testing — Part 11-20: Test flames — 500 W flame test methods*

4 Preparation of test specimens

4.1 General

It is essential that specimens always be prepared by the same procedure (either injection moulding or compression moulding), using the same processing conditions. The procedure to be used for each test method is indicated in Tables 3 and 4.

The material shall be kept in moisture-proof containers until it is required for use. The moisture content of filled or reinforced materials shall be expressed as a percentage of the total mass of the compound.

4.2 Treatment of the material before moulding

No pretreatment of the material sample is normally necessary before processing.

4.3 Injection moulding

Injection-moulded specimens shall be prepared in accordance with ISO 294-1, using the conditions specified in Table 1, in which the temperature values given are target values (see ISO 294-1 for tolerances).

Table 1 — Conditions for injection moulding of test specimens

Material	Melt temperature °C	Mould temperature °C	Injection velocity mm/s
All grades	220	45	200 ± 100
NOTE Flame-retardant grades may show discoloration if moulded at a melt temperature of 220 °C. In such cases, a melt temperature of 210 °C may be used.			

4.4 Compression moulding

Compression-moulded sheets shall be prepared in accordance with ISO 293, using the conditions specified in Table 2, in which the moulding temperature given is a target value (see ISO 293 for tolerances).

The test specimens required for the determination of the properties shall be machined from the compression-moulded sheets in accordance with ISO 2818 or stamped.

Table 2 — Conditions for compression moulding of test specimens

Material	Moulding temperature °C	Average cooling rate °C/min	Demoulding temperature °C	Full pressure MPa	Full pressure time min	Preheating time min
All grades	200	10	⩽ 60	4 ± 0,5	5 ± 1	5 ± 1

5 Conditioning of test specimens

Test specimens shall be conditioned for at least 16 h at (23 ± 2) °C and (50 ± 10) % relative humidity.

6 Determination of properties

In the determination of properties and the presentation of data, the standards, supplementary instructions and notes given in ISO 10350 shall be applied. All tests shall be carried out in the standard atmosphere of (23 ± 2) °C and (50 ± 10) % relative humidity, unless specifically stated otherwise in Table 3.

Table 3 is compiled from ISO 10350, and the properties listed are those which are appropriate to impact-resistant polystyrene moulding and extrusion materials. These properties are those considered useful for comparisons of data generated for different thermoplastics.

Table 4 contains those properties, not found specifically in Table 3, which are in wide use or of particular significance in the practical characterization of impact-resistant polystyrene moulding and extrusion materials.

Table 3 — General properties and test conditions (selected from ISO 10350)

Property	Unit	Test method	Specimen type (dimensions in mm)	Specimen preparation	Test conditions and supplementary instructions	
Rheological properties						
Melt mass-flow rate	g/10 min	ISO 1133	Moulding compound	—	200 °C, load 5 kg.	
Melt volume-flow rate	cm^3/10 min					
Mechanical properties						
Tensile modulus	MPa	ISO 527-2, ISO 527-4	ISO 3167	Injection moulding	Test speed 1 mm/min.	
Yield stress					Test speed 50 mm/min.	
Yield strain	%				Test speed 50 mm/min.	
Strain at break					Test speed 50 mm/min.	
Stress at 50 % strain	MPa				Test speed 50 mm/min. Only to be quoted if no yielding is observed up to 50 % nominal strain.	
Tensile creep modulus	MPa	ISO 899-1			At 1 h	Strain ⩽ 0,5 %
					At 1 000 h	
Flexural modulus	MPa	ISO 178	80 × 10 × 4		Test speed 2 mm/min.	
Flexural strength						
Charpy impact strength	kJ/m^2	ISO 179	80 × 10 × 4		Edgewise impact. Also record type of failure.	
Charpy notched impact strength			80 × 10 × 4 V-notch, r = 0,25			
Tensile notched impact strength		ISO 8256	80 × 10 × 4 double V-notch, r = 1		Only to be quoted if fracture cannot be obtained with notched Charpy impact test.	

Table 3 (*continued*)

Property	Unit	Test method	Specimen type (dimensions in mm)	Specimen preparation	Test conditions and supplementary instructions	
Thermal properties						
Glass transition temperature	°C	ISO 11357-2	Moulding compound	—	Record midpoint temperature. Use 10 °C/min.	
Temperature of deflection under load	°C	ISO 75-2	80 × 10 × 4	Injection moulding	0,45 MPa and 1,8 MPa.	
Vicat softening temperature	°C	ISO 306	10 × 10 × 4		Heating rate 50 °C /h, load 50 N.	
Burning behaviour	mm/min	IEC 60695-11-10	125 × 13 × 3		Record one of classifications V-0, V-1, V-2, HB40, HB75.	
		IEC 60695-11-20	150 × 150 × 3		Record one of classifications 5VA, 5VB, N.	
Oxygen Index	%	ISO 4589	80 × 10 × 4		Procedure A — top surface ignition.	
Electrical properties						
Relative permittivity	—	IEC 60250	⩾ 80 × ⩾ 80 × 1	Compression moulding	100 Hz	Compensate for electrode edge effects.
					1 MHz	
Dissipation factor	—				100 Hz	
					1 MHz	
Volume resistivity	Ω·m	IEC 60093			Voltage 100 V	1-minute value.
Surface resistivity	Ω					Use contacting line electrodes 1 mm to 2 mm wide, 50 mm long and 5 mm apart.
Electric strength	kV/mm	IEC 60243-1	⩾ 80 × ⩾ 80 × 1	Compression moulding	Use 25 mm/75 mm coaxial-cylinder electrodes. Immerse in transformer oil in accordance with IEC 60296. Use a 20 s step-by-step test.	
			⩾ 80 × ⩾ 80 × 3	Injection moulding		
Comparative tracking index	—	IEC 60112	⩾ 15 × ⩾ 15 × 4	Injection moulding	Use solution A.	
Other properties						
Water absorption	%	ISO 62	Thickness ⩽ 1	Compression moulding	Saturation value in water at 23 °C.	
					Equilibrium value at 23 °C, 50 % relative humidity.	
Density	kg/m^3	ISO 1183	10 × 10 × 4	Injection moulding	Specimen to be taken from moulded product.	

Table 4 — Additional properties and test conditions of particular utility to PS-I moulding and extrusion materials

Property	Unit	Test method	Specimen type (dimensions in mm)	Specimen preparation	Test conditions and supplementary instructions
Residual styrene monomer content	%	ISO 2561	Moulding compound	—	

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