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Plastics — Polyoxymethylene (POM) moulding and extrusion materials —

Part 2:

Preparation of test specimens and determination of properties

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Plastiques — Thermoplastiques à base de polyoxyméthylène (POM) pour moulage et extrusion —

Partie 2: Préparation des éprouvettes et détermination des caractéristiques

Reference number
ISO 9988-2:1991(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 9988-2 was prepared by Technical Committee ISO/TC 61, *Plastics*.

ISO 9988 consists of the following parts, under the general title *Plastics — Polyoxymethylene (POM) moulding and extrusion materials*:

— *Part 1: Designation*

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

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Plastics — Polyoxymethylene (POM) moulding and extrusion materials —

Part 2:
Preparation of test specimens and determination of properties

1 Scope

1.1 This part of ISO 9988 describes the preparation of test specimens from polyoxymethylene (POM) thermoplastics and specifies the conditions of test for determining the properties of such materials.

1.2 The properties of finished products made from polyoxymethylene thermoplastic materials depend on the material used, the shape of the product, the physical and morphological state of the material resulting from the moulding conditions, and the test conditions. Therefore, to obtain reproducible test results, the methods of preparation of test specimens and the test conditions defined in this part of ISO 9988 shall be applied.

1.3 Agreements between vendor and purchaser should preferably be based on properties measured using the specimens and test conditions described in this part of ISO 9988.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 9988. 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 9988 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 75:1987, *Plastics and ebonite — Determination of temperature of deflection under load.*

ISO 178:1975, *Plastics — Determination of flexural properties of rigid plastics.*

ISO 179:1982, *Plastics — Determination of Charpy impact strength of rigid materials.*

ISO 180:1982, *Plastics — Determination of Izod impact strength of rigid materials.*

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

ISO 294:1975, *Plastics — Injection moulding test specimens of thermoplastic materials.*

ISO/R 527:1966, *Plastics — Determination of tensile properties.*

ISO 537:1989, *Plastics — Testing with the torsion pendulum.*

ISO 899:1981, *Plastics — Determination of 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.*

ISO 2039-1:1987, *Plastics — Determination of hardness — Part 1: Ball indentation method.*

ISO 2039-2:1987, *Plastics — Determination of hardness — Part 2: Rockwell hardness.*

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

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

3 Preparation of test specimens by injection moulding

The instructions given in ISO 294 with regard to the mould design, the injection-moulding machine and the moulding operation shall be followed.

3.1 Mould temperatures

The mould temperatures presented in table 1 are recommended. The mould temperature shall be measured, in accordance with ISO 294, as the temperature of the mould cavity surface.

Table 1 — Recommended mould temperatures

Raw material	Grade	Temperature °C
Homopolymer	All grades	90 ± 10
Copolymer	All grades	85 ± 5

3.2 Other processing conditions

Other recommended processing conditions are given in table 2.

3.3 Uniformity of the mouldings

The uniformity of the mouldings shall be checked by weighing; the masses shall not deviate by more than 0,1 % from each other. The test specimens shall have a smooth surface and be free from streaks, excessive sink marks, chatter marks and voids.

4 Determination of properties

The properties shall be determined in accordance with the International Standards listed in table 3. Test specimens for the determination of mechanical properties, electrical properties and density shall be conditioned before testing for at least 16 h in the standard atmosphere 23 °C ± 2 °C and (50 ± 5) % relative humidity (ISO 291).

Table 2 — Recommended processing conditions

Raw Material	Plastic melt temperature °C	Cycle time s	Average injection velocity mm/s	Hold pressure Time s	Hold pressure Pressure MPa	Cooling time s	Back pressure MPa
Homopolymer	215 ± 5	35 to 45	200 ± 100	25 to 35	85 to 95	10 to 15	0,0 to 1,0
Homopolymer, modified	210 ± 5	35 to 45	200 ± 100	25 to 35	70 to 90	10 to 15	0,0 to 1,0
Copolymer	195 ± 5	35 to 45	200 ± 100	25 to 35	85 to 95	10 to 15	0,0 to 1,0

Table 3 — Properties of polyoxymethylene-based thermoplastics for moulding and extrusion

Properties	Units	Specimen dimensions mm	Test method	Test conditions
Mechanical properties				
Tensile properties				
Stress at yield	MPa	150 × 10 × 4 (Type 2)	ISO/R 527	Speed C (50 mm/min ± 10 %)[1]
Stress at break	MPa	150 × 10 × 4 (Type 2)	ISO/R 527	Speed C (50 mm/min ± 10 %)[1]
Elongation at yield	%	150 × 10 × 4 (Type 2)	ISO/R 527	Speed C (50 mm/min ± 10 %)[1]
Elongation at break	%	150 × 10 × 4 (Type 2)	ISO/R 527	Speed C (50 mm/min ± 10 %)[1]
Elastic modulus	MPa	150 × 10 × 4 (Type 2)	ISO/R 527	Speed A (1 mm/min ± 10 %)
Flexural modulus	MPa	80 × 10 × 4	ISO 178	Speed A1 (2 mm/min ± 20 %)
Shear modulus and mechanical loss factor	MPa	60 × 10 × 1	ISO 537	–70 °C to melting point
Tensile creep modulus	MPa	150 × 10 × 4 (Type 2)	ISO 899	At 1 000 h
Impact resistance				
— Izod	kJ/m²	80 × 10 × 4 (Type 1)	ISO 180, method 1A	Type A notch
— Charpy (notched specimen)	kJ/m²	80 × 10 × 4 (Type 1)	ISO 179, method 1A	Type A notch Distance between supports: 62 mm
— Charpy (unnotched specimen)	kJ/m²	80 × 10 × 4 (Type 1)	ISO 179, method 1D	Distance between supports: 62 mm
Ball indentation hardness	—	Thickness ⩾ 4	ISO 2039-1	
Rockwell hardness	—	Thickness ⩾ 4	ISO 2039-2	R scale
Thermal properties				
Deflection temperature under load	°C	110 × 10 × 4	ISO 75	Method A (1,80 MPa) Method B (0,45 MPa)
Melting temperature	°C	—	ISO 3146	
Electrical properties				
Surface resistance	Ω	100 × 100 × 1,5 (min.)[2]	IEC 93	
Volume resistivity	Ω·cm	100 × 100 × 1,5 (min.)[2]	IEC 93	Test voltage: 1 000 V
Dielectric strength	kV/mm	100 × 100 × 1,0 (min.)[2]	IEC 243-1	P25/P75 mm electrodes; insulating liquid
Relative permittivity		100 × 100 × 1,5 (min.)[2]	IEC 250	1 MHz and 50 Hz
Dissipation factor (tan δ)	—	100 × 100 × 1,5 (min.)[2]	IEC 250	1 MHz and 50 Hz
Comparative tracking index	—	50 × 50 × 3 (min.)[3]	IEC 112	50 Hz to 60 Hz; solution A
Miscellaneous properties				
Melt flow rate (MFR)	g/10 min	—	ISO 1133	Set of conditions No. 4 (190 °C/2,16 kg)
Density	g/cm³	—	ISO 1183	

1) Filled and reinforced materials shall be pulled at speed B (5 mm/min ± 20 %).

2) 100 mm discs are acceptable alternatives.

3) 50 mm discs are acceptable alternatives.

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