INTERNATIONAL STANDARD

ISO 9988-2

Second edition
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Plastics — Polyoxymethylene (POM) moulding and extrusion materials —

Part 2: Preparation of test specimens and determination of properties

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

Partie 2: Préparation des éprouvettes et détermination des propriétés

Reference number
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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 3.

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 part of ISO 9988 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 9988-2 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 9, *Thermoplastic materials*.

This second edition cancels and replaces the first edition (ISO 9988-2:1991), which has been technically revised.

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

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

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

Plastics — Polyoxymethylene (POM) moulding and extrusion materials —

Part 2: Preparation of test specimens and determination of properties

1 Scope

This part of ISO 9988 specifies the methods of preparation of test specimens and the test methods to be used in determining the properties of polyoxymethylene 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.

Procedures and conditions are described 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 polyoxymethylene moulding and extrusion materials are listed.

The properties have been selected from the general test methods in ISO 10350:1993. 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 9988, as are the designatory properties specified in part 1: melt flow rate and tensile modulus.

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 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 9988. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 9988 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 62:1999, *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 178:1993, Plastics — Determination of flexural properties.

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

ISO 180:—[2], *Plastics — Determination of Izod impact strength*.

ISO 291:1997, *Plastics — Standard atmospheres for conditioning and testing*.

ISO 294-1:1996, *Plastics — Injection moulding of test specimens of thermoplastic materials — Part 1: General principles, and moulding of multipurpose and bar specimens*.

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

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

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

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

ISO 9988-1:1998, *Plastics — Polyoxymethylene (POM) moulding and extrusion materials — Part 1: Designation system and basis for specifications*.

ISO 10350:1993[3], *Plastics — Acquisition and presentation of comparable single-point data*.

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*.

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

2) To be published. (Revision of ISO 180:1993)

3) ISO 10350:1993 is the normative reference, even though it has been replaced by ISO 10350-1:1998.

3 Preparation of test specimens

Specimens shall be prepared by injection moulding. It is essential that they are always prepared by the same procedure, using the same processing conditions. The standard conditions are given below.

The material shall be kept in moisture-proof containers until it is required for use.

3.1 Treatment of the material before moulding

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

3.2 Injection moulding

Specimens shall be prepared in accordance with ISO 294-1, ISO 294-3 or ISO 294-4, using the conditions specified in Table 1.

Table 1 — Conditions for injection moulding of test specimens

Material	Melt temperature °C	Mould temperature °C	Average injection velocity mm/s
Homopolymer, MFR ⩽ 7	215	90	140 ± 100
Homopolymer, MFR > 7	215	90	300 ± 100
Homopolymer, impact-modified, MFR ⩽ 7	210	60	140 ± 100
Copolymer, MFR > 4	205	90	200 ± 100
Copolymer, impact-modified	205	80	200 ± 100
Copolymer, MFR ⩽ 4	205	90	140 ± 100

4 Conditioning of test specimens

Test specimens shall be conditioned in accordance with ISO 291 for at least 16 h at (23 ± 2) °C and (50 ± 5) % relative humidity.

5 Determination of properties

In the determination of properties and the presentation of data, the standards, supplementary instructions and notes given in ISO 10350:1993 shall be applied. All tests shall be carried out in the standard atmosphere of (23 ± 2) °C and (50 ± 5) % relative humidity unless specifically stated otherwise in Tables 2 and 3.

Table 2 is compiled from ISO 10350:1993 and the properties listed are those which are appropriate to polyoxymethylene moulding and extrusion materials. These properties are those considered useful for comparisons of data generated for different thermoplastics.

Table 3 contains those properties, not found specifically in ISO 10350:1993, which are in wide use or of particular significance in the practical characterization of polyoxymethylene moulding and extrusion materials. These properties may be based on specimens which are not listed in ISO 10350:1993.

Table 2 — General properties and test conditions (selected from ISO 10350:1993)

Property	Unit	Standard	Specimen type (dimensions in mm)	Test conditions and supplementary instructions	
Rheological properties					
Melt mass-flow rate	g/10 min	ISO 1133	Moulding compound	Temperature 190 °C, load 2,16 kg	
Melt volume-flow rate	cm^3/10 min				
Mechanical properties					
Tensile modulus	MPa	ISO 527-1 ISO 527-2	ISO 3167, type A	Test speed 1 mm/min	
Yield stress				Test speed 50 mm/min	
Yield strain	%				
Nominal strain at break					
Stress at break	MPa			Test speed 5 mm/min. Only to be quoted if strain at break is < 10 %.	
Strain at break	%				
Tensile creep modulus	MPa	ISO 899-1	ISO 3167, type A	At 1 h At 1 000 h	Strain $\leqslant 0{,}5$ %
Flexural modulus		ISO 178	80 × 10 × 4	Test speed 2 mm/min	
Charpy impact strength	kJ/m^2	ISO 179-1	80 × 10 × 4	Method 1e (edgewise impact)	
Charpy notched impact strength			80 × 10 × 4 V-notch $r = 0{,}25$		
Thermal properties					
Melting temperature	°C	ISO 3146	Moulding compound	Method C (DSC or DTA) Use 10 °C/min	
Temperature of deflection under load	°C	ISO 75-1 ISO 75-2	80 × 10 ×4 flatwise	Method A (1,8 MPa) and method B (0,45 MPa)	
Coefficient of linear thermal expansion	$°C^{-1}$	TMA (see ISO 10350:1993)	Prepared from ISO 3167	Parallel Normal	Quote the secant value over the temperature range 23 °C to 55 °C
Electrical properties					
Comparative tracking index	—	IEC 60112	$\geqslant 15 \times \geqslant 15 \times 4$	Use solution A	
Other properties					
Water absorption	%	ISO 62	50 × 50 × 3 or 50 × 3 disc	24 h immersion in water at 23 °C	
Density	kg/m^3	ISO 1183	10 × 10 × 4		

Table 3 — Additional properties and test conditions of particular utility to polyoxymethylene moulding and extrusion materials

Property	Unit	Standard	Specimen type (dimensions in mm)	Test conditions and supplementary instructions
Mechanical properties				
Izod impact strength, notched	kJ/m^2	ISO 180	80 × 10 ×4	Method 1A
Electrical properties				
Relative permitivity	—	IEC 60250	⩾60 × ⩾60 × 2	Frequency 100 Hz and 1 MHz (compensate for electrode edge effect).
Dissipation factor				
Volume resistivity	Ω·m	IEC 60093		Voltage 100 V
Surface resistivity	Ω			
Electric strength	kV/mm	IEC 60243-1		Use 25 mm/75 mm coaxial-cylinder electrode configuration. Immerse in IEC 60296 transformer oil. Use 20 s step-by-step test.
Other properties				
Moulding shrinkage	%	ISO 294-4	60 × 60 ×2	Report shrinkage perpendicular and parallel to flow, post-moulding shrinkage and total shrinkage.