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**Plastics — Polybutene (PB) moulding and
extrusion materials —**

Part 2:

Preparation of test specimens and
determination of properties

Plastiques — Polybutène (PB) 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.

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 8986-2 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 9, *Thermoplastic materials*.

ISO 8986 consists of the following parts, under the general title *Plastics — Polybutene (PB) moulding and extrusion materials*:

- *Part 1: Designation system and basis for specifications*
- *Part 2: Preparation of test specimens and determination of properties*

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Plastics — Polybutene (PB) moulding and extrusion materials —

Part 2:

Preparation of test specimens and determination of properties

1 Scope

This part of ISO 8986 specifies the methods of preparation of test specimens and the test methods to be used in determining the properties of PB 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 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 PB moulding and extrusion materials are listed.

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 8986, as are the designatory properties specified in part 1.

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 standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 8986. 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 8986 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 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 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 527-4:—¹⁾, *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 1133:1991, *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 1210:1992, *Plastics — Determination of the burning behaviour of horizontal and vertical specimens in contact with a small-flame ignition source.*

ISO 1628-3:1991, *Plastics — Determination of viscosity number and limiting viscosity number — Part 3: Polyethylenes and polypropylenes.*

ISO 2818:1994, *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 4589-2:—¹⁾, *Plastics — Determination of burning behaviour by oxygen index — Part 2: Ambient-temperature test.*

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

ISO 8986-1:1993, *Plastics — Polybutene (PB) moulding and extrusion materials — Part 1: Designation system and basis for specifications.*

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

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.*

ASTM D 638-91, *Test method for tensile properties of plastics.*

ASTM D 3350-93, *Specification for polyethylene plastics pipe and fitting materials.*

3 Preparation of test specimens

The test specimens shall be prepared by compression moulding.

It is essential that the specimens are always prepared by the same procedure using the same processing conditions.

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

Moisture content of filled or reinforced materials shall be expressed as a percentage of the total mass of the compound.

3.1 Treatment of the material before moulding

Before processing, no pretreatment of the material sample is normally necessary.

1) To be published.

3.2 Compression moulding

Compression-moulded sheets shall be prepared in accordance with ISO 293, using the conditions specified in table 1.

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.

A type 1 (frame) mould has to be used, but it is necessary to start cooling whilst simultaneously applying the full pressure. This avoids the melt being pressed out of the frame and avoids sink marks.

4 Conditioning of test specimens

Test specimens shall be conditioned in accordance with ISO 291 for at least 10 days at $23\text{ °C} \pm 2\text{ °C}$ and $(50 \pm 5)\%$ relative humidity.

NOTE 1 The use of accelerated conditioning is allowed if it can be demonstrated that the test results are reproducible

and equivalent to those obtained on specimens aged for 10 days.

5 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 $23\text{ °C} \pm 2\text{ °C}$ and $(50 \pm 5)\%$ relative humidity unless specifically stated otherwise in tables 2 and 3.

Table 2 is compiled from ISO 10350, and the properties listed are those which are appropriate to polybutene (PB) 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 table 2, which are in wide use or of particular significance in the practical characterization of polybutene (PB) moulding and extrusion materials.

Table 1 — 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 pressure MPa	Preheating time min
All grades	200	30	30 ± 5	5	5 ± 1	Contact	5 to 15

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

Property	Unit	Standard	Specimen type (dimensions in mm)	Specimen preparation ¹⁾	Test conditions and supplementary instructions
Rheological properties					
Melt mass-flow rate	g/10 min	ISO 1133	Moulding compound	—	See conditions given in part 1 of this International Standard
Melt volume-flow rate	cm ³ /10 min				
Mechanical properties					
Tensile modulus	MPa	ISO 527-1, ISO 527-2, ISO 527-4	See ISO 3167	Q	Test speed 1 mm/min
Yield stress	MPa				Test speed 50 mm/min
Yield strain	%				Test speed 50 mm/min
Nominal strain at break	%				Test speed 50 mm/min
Stress at 50 % strain	MPa				Test speed 50 mm/min
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	See ISO 3167	Q	At 1 h } Strain ≤ 0,5 % At 1 000 h }
Flexural modulus	MPa	ISO 178	80 × 10 × 4	Q	Test speed 2 mm/min
Charpy impact strength	kJ/m ²	ISO 179	80 × 10 × 4	Q	Method 1eU (edgewise impact)
Charpy notched impact strength	kJ/m ²		80 × 10 × 4 V-notch, r = 0,25	Q	Method 1eA (edgewise impact)
Tensile notched impact strength	kJ/m ²	ISO 8256	80 × 10 × 4 double V-notch, r = 1	Q	Only to be quoted if fracture cannot be obtained with notched Charpy test
Thermal properties					
Melting temperature	°C	ISO 3146	Moulding compound	—	Method C (DSC or DTA). Use 10 °C/min
Glass transition temperature	°C	IEC 1006	Moulding compound	—	Method A (DSC or DTA). Use 20 °C/min
Temperature of deflection under load	°C	ISO 75-1, ISO 75-2	110 × 10 × 4 edgewise or 80 × 10 × 4 flatwise	Q	0,45 MPa and 1,8 MPa
Coefficient of linear thermal expansion	°C ⁻¹	TMA (see ISO 10350)	Prepared from ISO 3167	Q	Parallel } Quote the secant value Normal } over the temperature range 23 °C to 55 °C
Flammability	mm/min	ISO 1210	125 × 13 × 3	Q	Method A — linear burning rate of horizontal specimens
Ignitability	%	ISO 4589-2	80 × 10 × 4	Q	Procedure A — top surface ignition
Electrical properties					
Relative permittivity	—	IEC 250	≥ 80 × ≥ 80 × 1	Q	Frequency 100 Hz and 1 MHz (compensate for electrode edge effect)
Dissipation factor	—				
Volume resistivity	Ω·m	IEC 93	≥ 80 × ≥ 80 × 1	Q	Voltage 100 V
Surface resistivity	Ω				
Electric strength	kV/mm	IEC 243-1	{ ≥ 80 × ≥ 80 × 1 ≥ 80 × ≥ 80 × 3 }	Q	Use 25 mm/75 mm coaxial-cylinder electrode configuration. Immerse in IEC 296 transformer oil. Use short time (rapid rise) test
Comparative tracking index	—	IEC 112	≥ 15 × ≥ 15 × 4	Q	Use solution A
1) See next page.					