



**SLOVENSKI STANDARD**  
**SIST EN ISO 1873-2:2000**

**01-maj-2000**

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Plastics - Polypropylene (PP) moulding and extrusion materials - Part 2: Preparation of test specimens and determination of properties (ISO 1873-2:1997)

Kunststoffe - Polypropylen (PP)-Formmassen - Teil 2: Herstellung von Probekörpern und Bestimmung von Eigenschaften (ISO 1873\_2 1873-2:1997)

Plastiques - Polypropylène (PP) pour moulage et extrusion - Partie 2: Préparation de éprouvettes et détermination des propriétés (ISO 1873-2:1997)

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**Ta slovenski standard je istoveten z: EN ISO 1873-2:1997**

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**ICS:**

83.080.20      Plastomeri      Thermoplastic materials

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Descriptors: Plastics, thermoplastic resins, moulding materials, extruding materials, polypropylene, tests, determination, properties, test specimens, specimen preparation

English version

## Plastics — Polypropylene (PP) moulding and extrusion materials — Part 2: Preparation of test specimens and determination of properties

(ISO 1873-2 : 1997)

Plastiques — Polypropylène (PP) pour moulage et extrusion — Partie 2: Préparation des éprouvettes et détermination des propriétés  
(ISO 1873-2 : 1997)

Kunststoffe — Polypropylen (PP)-Formmassen — Teil 2: Herstellung von Probekörpern und Bestimmung von Eigenschaften  
(ISO 1873-2 : 1997)

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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**CEN**

European Committee for Standardization  
Comité Européen de Normalisation  
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

## Foreword

The text of the International Standard ISO 1873-2 : 1997 has been prepared by Technical Committee ISO/TC 61, Plastics, in collaboration with Technical Committee CEN/TC 249, Plastics, the secretariat of which is held by IBN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 1997 and conflicting national standards shall be withdrawn at the latest by October 1997.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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# Plastics — Polypropylene (PP) moulding and extrusion materials —

## Part 2: Preparation of test specimens and determination of properties

### 1 Scope

This part of ISO 1873 specifies the methods of preparation of test specimens and the test methods to be used in determining the properties of PP 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 PP 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 1873 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 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 1873. 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 1873 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: —1), *Plastics — Standard atmospheres for conditioning and testing.*

1) To be published. (Revision of ISO 291:1977)

- 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 specimens.*
- ISO 294-3:1996, *Plastics — Injection moulding of test specimens of thermoplastic materials — Part 3: Plates.*
- 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:—<sup>2)</sup>, *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 1873-1:1995, *Plastics — Polypropylene (PP) moulding and extrusion materials — Part 1: Designation system and basis for specifications.*
- 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 4589-2:1996, *Plastics — Determination of burning behaviour by oxygen index — Part 2: Ambient-temperature test.*
- ISO 6603-2:1989, *Plastics — Determination of multiaxial impact behaviour of rigid plastics — Part 2: Instrumented juncture test.*
- ISO 8256:1990, *Plastics — Determination of tensile-impact strength.*
- 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.*

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<sup>2)</sup> To be published. (Revision of ISO 1210:1992)

IEC 296:1982, *Specification for unused mineral insulating oils for transformers and switchgear.*

ASTM D 5420:1993, *Test method for impact resistance of flat, rigid plastic specimen by means of a striker impacted by a falling weight (Gardner impact).*

### 3 Preparation of test specimens

It is essential that specimens are always 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 (M = injection moulding, Q = compression moulding).

#### 3.1 Treatment of the material before moulding

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

#### 3.2 Injection moulding

Injection-moulded specimens shall be prepared in accordance with ISO 294-1 or ISO 294-3, 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	Hold pressure time s	Total cycle time s
MFR < 1,5 g/10 min	255	40	200 ± 20	40	60
1,5 ≤ MFR < 7 g/10 min	230	40	200 ± 20	40	60
MFR ≥ 7 g/10 min	200	40	200 ± 20	40	60

NOTE — Heat-sensitive polypropylenes may undergo molecular breakdown during moulding; therefore an increase in the melt flow rate to > 1,5 times the original value shall be avoided with such materials. If the MFR increases by more than 1,5 times the original value, the melt temperature shall be lowered, 10 °C at a time, until the increase in MFR is < 1,5 times the original value. This adjustment in melt temperature shall be reported. The uniformity of the mouldings shall be checked by weighing. Their masses shall not differ by more than 1 % from each other.

#### 3.3 Compression moulding

Compression-moulded sheets shall be prepared in accordance with ISO 293, using the conditions specified in table 2.

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 pressure MPa	Preheating time min
All grades	210	15	≤ 40	5/10 <sup>1)</sup>	5 ± 1	Contact	5 to 15

1) Use 5 MPa for frame mould and 10 MPa for positive mould.

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 may 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.

For thicker sheet ( $\approx 4$  mm), a type 2 (positive) mould has been found to work satisfactorily. The preheating time depends on the type of mould and the type of energy input (steam, electricity). For frame moulds, 5 min is usually sufficient but for positive moulds, due to the bigger mass, a preheating time of up to 15 min can be necessary, especially if electric heating is used.

### **i Conditioning of test specimens**

Test specimens shall be conditioned in accordance with ISO 291 for at least 40 h at  $23\text{ °C} \pm 2\text{ °C}$  and  $(50 \pm 5)\%$  relative humidity.

### **j 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 3 and 4.

Table 3 is compiled from ISO 10350, and the properties listed are those which are appropriate to polypropylene (PP) 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 polypropylene (PP) moulding and extrusion materials.



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

Property	Unit	Standard	Specimen type (dimensions in mm)	Specimen preparation <sup>1)</sup>	Test conditions and supplementary instructions
<b>Rheological properties</b>					
Melt mass-flow rate Melt volume-flow rate	g/10 min cm <sup>3</sup> /10 min	} ISO 1133	Moulding compound	—	Temperature 230 °C, load 2,16 kg
<b>Mechanical properties</b>					
Tensile modulus Yield stress Yield strain Nominal strain at break Stress at 50 % strain Stress at break Strain at break Tensile creep modulus	MPa MPa % % MPa Mpa % MPa	} ISO 527-1, ISO 527-2	See ISO 3167	M	Test speed 1 mm/min Test speed 50 mm/min Test speed 50 mm/min Test speed 50 mm/min Test speed 50 mm/min Test speed 5 mm/min. Only to be quoted if strain at break is < 10 %
Tensile creep modulus	MPa	ISO 899-1	See ISO 3167	M	At 1 h } Strain ≤ 0,5 % At 1 000 h }
Flexural modulus	MPa	ISO 178	80 × 10 × 4	M	Test speed 2 mm/min
Charpy impact strength	kJ/m <sup>2</sup>	} ISO 179	{ 80 × 10 × 4 80 × 10 × 4 V-notch, r = 0,25	M	Method 1eU (edgewise impact)
Charpy notched impact strength	kJ/m <sup>2</sup>			M	Method 1eA (edgewise impact)
Tensile notched impact strength	kJ/m <sup>2</sup>	ISO 8256	80 × 10 × 4 double V-notch, r = 1	M	Only to be quoted if fracture cannot be obtained with notched Charpy test
<b>Thermal properties</b>					
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	110 × 10 × 4 edgewise or 80 × 10 × 4 flatwise	M	0,45 MPa and 1,8 MPa
Coefficient of linear thermal expansion	°C <sup>-1</sup>	TMA (see ISO 10350)	Prepared from ISO 3167	M	Parallel } Quote the secant value over the Normal } temperature range 23 °C to 55 °C
Flammability	mm/min	ISO 1210	125 × 13 × 3	M	Method A — linear burning rate of horizontal specimens
Ignitability	%	ISO 4589-2	80 × 10 × 4	M	Procedure A — top surface ignition
<b>Electrical properties</b>					
Relative permittivity Dissipation factor	— —	} IEC 250	≥ 80 × ≥ 80 × 1	Q	Frequency 100 Hz and 1 MHz (compensate for electrode edge effect)
Volume resistivity Surface resistivity	Ω·m Ω	} IEC 93	≥ 80 × ≥ 80 × 1	Q	Voltage 100 V
Electric strength	kV/mm	IEC 243-1	{ ≥ 80 × ≥ 80 × 1 ≥ 80 × ≥ 80 × 3	Q M	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	M	Use solution A
<b>Other properties</b>					
Water absorption	%	ISO 62	50 × 50 × 3 or Ø 50 × 3 disc	M/Q	24 h immersion in water at 23 °C
Density	kg/m <sup>3</sup>	ISO 1183	—	M	Test specimen to be taken from injection- moulded specimen prepared as in 3.2.
1) M = Injection moulding Q = Compression moulding					