
**Plastics — Polyketone (PK) moulding
and extrusion materials —**

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

Plastiques — Polycétone (PK) pour moulage et extrusion —

Partie 2: Préparation des éprouvettes et détermination des propriétés

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Published in Switzerland

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical committee ISO/TC 61, *Plastics*, Subcommittee SC 9, *Thermoplastic materials*.

This second edition cancels and replaces the first edition (ISO 21970-2:2018), of which it constitutes a minor revision to update the normative references (see [Clause 2](#)).

A list of all parts in the ISO 21970 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Plastics — Polyketone (PK) moulding and extrusion materials —

Part 2: Preparation of test specimens and determination of properties

1 Scope

This document specifies the methods of preparation of test specimens and the standard test methods to be used in determining the properties of thermoplastic polyketone moulding and extrusion materials. Requirements for handling test material and/or conditioning both the test material before moulding and the specimens before testing are given.

The properties have been selected from the general test methods in ISO 10350-1. Other test methods in wide use for or of particular significance to these moulding and extrusion materials are also included in this document, as are the designatory properties specified in ISO 21970-1.

It is intended that the methods of preparation and conditioning, the specimen dimensions and the test procedures specified in this document be used in order to obtain reproducible and comparable test results. 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 documents are referred to in the text in such a way that some or all of their content constitutes requirements 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, *Plastics — Determination of water absorption*

ISO 75-1, *Plastics — Determination of temperature of deflection under load — Part 1: General test method*

ISO 75-2, *Plastics — Determination of temperature of deflection under load — Part 2: Plastics and ebonite*

ISO 178, *Plastics — Determination of flexural properties*

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

ISO 179-2, *Plastics — Determination of Charpy impact properties — Part 2: Instrumented impact test*

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

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

ISO 527-1, *Plastics — Determination of tensile properties — Part 1: General principles*

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

ISO 1133-1, *Plastics — Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics — Part 1: Standard method*

ISO 1183-1, *Plastics — Methods for determining the density of non-cellular plastics — Part 1: Immersion method, liquid pycnometer method and titration method*

ISO 1183-2, *Plastics — Methods for determining the density of non-cellular plastics — Part 2: Density gradient column method*

ISO 1183-3, *Plastics — Methods for determining the density of non-cellular plastics — Part 3: Gas pycnometer method*

ISO 3451-4, *Plastics — Determination of ash — Part 4: Polyamides*

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

ISO 4892-1, *Plastics — Methods of exposure to laboratory light sources — Part 1: General guidance*

ISO 4892-2, *Plastics — Methods of exposure to laboratory light sources — Part 2: Xenon-arc lamps*

ISO 4892-3, *Plastics — Methods of exposure to laboratory light sources — Part 3: Fluorescent UV lamps*

ISO 4892-4, *Plastics — Methods of exposure to laboratory light sources — Part 4: Open-flame carbon-arc lamps*

ISO 6603-2, *Plastics — Determination of puncture impact behaviour of rigid plastics — Part 2: Instrumented impact testing*

ISO 10350-1, *Plastics — Acquisition and presentation of comparable single-point data — Part 1: Moulding materials*

ISO 11357-2, *Plastics — Differential scanning calorimetry (DSC) — Part 2: Determination of glass transition temperature and glass transition step height*

ISO 11357-3, *Plastics — Differential scanning calorimetry (DSC) — Part 3: Determination of temperature and enthalpy of melting and crystallization*

ISO 11359-2, *Plastics — Thermomechanical analysis (TMA) — Part 2: Determination of coefficient of linear thermal expansion and glass transition temperature*

ISO 15512, *Plastics — Determination of water content*

ISO 20753, *Plastics — Test specimens*

ISO 21970-1, *Plastics — Polyketone (PK) moulding and extrusion materials — Part 1: Designation system and basis for specifications*

IEC 62631-2-1, *Dielectric and resistive properties of solid insulating materials — Part 2-1: Relative permittivity and dissipation factor — Technical frequencies (0,1 Hz – 10 MHz) — AC methods*

IEC 62631-3-1, *Dielectric and resistive properties of solid insulating materials — Part 3-1: Determination of resistive properties (DC methods) — Volume resistance and volume resistivity — General method*

IEC 62631-3-2, *Dielectric and resistive properties of solid insulating materials — Part 3-2: Determination of resistive properties (DC methods) — Surface resistance and surface resistivity*

IEC 60112, *Methods for determining the comparative and the proof tracking indices of solid insulating materials under moist conditions*

IEC 60243-1, *Electrical strength of insulating materials — Test methods — Part 1: Test at power frequencies*

IEC 60296, *Specification for unused mineral insulating oils for transformers and switchgear*

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

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org>

4 Preparation of test specimens

4.1 General

It is essential that specimens are always prepared by the same procedure (injection moulding), using the same processing conditions.

4.2 Treatment of the material before moulding

Before processing, the moisture content of the material sample shall not exceed 0,2 % by mass. If the moisture level exceeds this limit, the sample shall be dried in accordance with the manufacturer's instructions until the moisture content is below the limit.

4.3 Injection moulding

Specimens shall be prepared in accordance with ISO 294-1 using the conditions specified in [Table 1](#).

Table 1 — Injection-moulding conditions

Material			Moulding conditions					
Designation code for composition	Designation code for melting temperature	Filler content	Melt temperature	Mould temperature	Average injection velocity	Hold pressure	Hold pressure time	Total cycle time
		%	°C	°C	mm/s	MPa	s	s
PK-EP	210	0 to 50	235	80	100 ± 50	70 ± 10	15 ± 5	≤35
	220		245					
	230		255					
	240		265					
	250		275					

5 Conditioning of test specimens

After moulding, test specimens shall be conditioned in accordance with ISO 291 for 48 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 10350-1 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 2](#) and [Table 3](#).

Table 2 is compiled from ISO 10350-1, and the properties listed are those which are appropriate to polyketone 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 polyketone moulding and extrusion materials.

Table 2 — General properties and test conditions (selected from ISO 10350-1)

Property	Unit	Standard	Specimen type (dimensions in mm)	Test conditions and supplementary instructions
Rheological properties				
Melt mass-flow rate	g/10 min	ISO 1133-1	Moulding compound	Use one of the test temperatures and loads given in ISO 21970-1
Melt volume-flow rate	cm ³ /10 min			
Mechanical properties				
Tensile modulus	MPa	ISO 527-1 ISO 527-2	See ISO 20753	Test speed 1 mm/min
Yield strength	MPa			Test speed 5 mm/min Failure without yielding If strain at break ≤10 % test speed 5 mm/min If strain at break >10 % test speed 50 mm/min
Yield strain	%			
Nominal strain at break	%			
Stress at 50 % strain	MPa			
Stress at break	MPa			
Strain at break	%			
Flexural modulus	MPa	ISO 178	80 × 10 × 4	Test speed 2 mm/min
Flexural strength	MPa			
Charpy unnotched impact strength	kJ/m ²	ISO 179-1	80 × 10 × 4	Method 1eU (edgewise impact)
Charpy notched impact strength	kJ/m ²	ISO 179-2	80 × 10 × 4 V-notch, r = 0,25	Method 1eA (edgewise impact)
Thermal properties				
Glass transition temperature	°C	ISO 11357-2	Moulding compound	Use 10 K/min
Melting temperature	°C	ISO 11357-3	Moulding compound	Use 10 K/min
Heat deflection temperature	°C	ISO 75-1 ISO 75-2	80 × 10 × 4	0,45 MPa and 1,8 MPa
Flammability	mm/min	IEC 60695-11-10	125 × 13 × 1,6 or other thickness	Method A — Linear burning rate of horizontal specimens
	s			Method B (vertical) a) afterflame time b) afterglow time

Table 2 (continued)

Property	Unit	Standard	Specimen type (dimensions in mm)	Test conditions and supplementary instructions
Electrical properties				
Relative permittivity	—	IEC 62631-2-1	$\geq 80 \times \geq 80 \times 1$	Frequency 100 Hz and 1 MHz (compensate for electrode edge effect)
Dissipation factor	—			
Volume resistivity	$\Omega \cdot m$	IEC 62631-3-1		Voltage 100 V
Surface resistivity	Ω	IEC 62631-3-2		
Electric strength	kV/mm	IEC 60243-1	$\geq 80 \times \geq 80 \times 4$	Use 25 mm/75 mm coaxial-cylinder electrode configuration. Immerse in IEC 60296 transformer oil. Use short time (rapid rise) test.
Comparative tracking index	—	IEC 60112	$\geq 15 \times \geq 15 \times 4$	Use solution A
Other properties				
Water absorption	%	ISO 62	Thickness ≥ 1 mm	Saturation value in water at 23 °C
				Saturation value at 23 °C and 50 % relative humidity
Density	kg/m ³	ISO 1183-1 ISO 1183-2 ISO 1183-3	Prepared from centre of ISO 20753 type A1	Use part of centre of multipurpose specimen