
**Plastics — Polycarbonate (PC)
moulding and extrusion materials —**

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

*Plastiques — Matériaux à base de polycarbonate (PC) pour moulage
et extrusion —*

Partie 2: Préparation des éprouvettes et détermination des propriétés

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Contents

	Page
Foreword	iv
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 Preparation of test specimens	3
4.1 General.....	3
4.2 Treatment of the material before moulding.....	3
4.3 Injection moulding.....	3
4.4 Compression moulding.....	3
5 Conditioning of test specimens	4
6 Determination of properties	4

Foreword

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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).

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

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.

This first edition of ISO 21305-2 cancels and replaces ISO 7391-2:2006, which has been technically revised.

A list of all parts in the ISO 21305 series can be found on the ISO website.

Plastics — Polycarbonate (PC) 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 test methods to be used in determining the properties of polycarbonate 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 in this document.

This document gives procedures and conditions for the preparation of test specimens and procedures for measuring properties of the materials from which these specimens are made. It also lists properties and test methods which are suitable and necessary to characterize polycarbonate moulding and extrusion materials.

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 21305-1.

In order to obtain reproducible and comparable test results, it is intended 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 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 75-2, *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 180, *Plastics — Determination of Izod impact strength*

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

ISO 293, *Plastics — Compression moulding of test specimens of thermoplastic materials*

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 306, *Plastics — Thermoplastic materials — Determination of Vicat softening temperature (VST)*

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

ISO 899-1, *Plastics — Determination of creep behaviour — Part 1: Tensile creep*

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 1133-2, *Plastics — Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics — Part 2: Method for materials sensitive to time-temperature history and/or moisture*

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

ISO 2818, *Plastics — Preparation of test specimens by machining*

ISO 20753, *Plastics — test specimens*

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

ISO 21305-1, *Plastics — Polycarbonate (PC) moulding and extrusion materials — Part 1: Designation system and basis for specifications*

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

IEC 60093, *Methods of test for volume resistivity and surface resistivity of solid electrical insulating materials*

IEC 60112, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

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

IEC 60250, *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, *Fluids for electrotechnical applications — 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 (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](#) or [4](#).

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.

4.2 Treatment of the material before moulding

Before processing, the material sample shall be dried for (5 ± 1) h at $(120 \pm 3)^\circ\text{C}$. The moisture content shall not exceed 0,02 %.

To ensure that the moisture content remains low, it is recommended that the sample material in the feed hopper of the injection-moulding machine be blanketed with dried air or nitrogen at a temperature of $(110 \pm 10)^\circ\text{C}$. Better results may be obtained using a dehumidifier hopper drier.

4.3 Injection moulding

Injection-moulded specimens shall be prepared in accordance with ISO 294-1, using the conditions specified in [Table 1](#). Melt volume rate (MVR) is defined in ISO 1133-1.

Table 1 — Conditions for injection moulding of test specimens

Material	Melt temperature °C	Mould temperature °C	Average injection velocity mm/s
Non-reinforced grades:			
MVR > 14,2 cm ³ /10 min	280	80	200 ± 100
9,5 cm ³ /10 min < MVR ≤ 14,2 cm ³ /10 min	290	80	200 ± 100
4,7 cm ³ /10 min < MVR ≤ 9,5 cm ³ /10 min	300	80	200 ± 100
MVR ≤ 4,7 cm ³ /10 min	310	90	200 ± 100
Glass-fibre-reinforced grades	300	110	200 ± 100

4.4 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	Full pressure MPa	Full-pressure time min
All grades	300	5	2

After moulding, cool the specimens for 4 min by putting a water-cooled board between the core and the removable bottom plate at a (moulding) pressure of 1 MPa.

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.

5 Conditioning of test specimens

Test specimens for the determination of electrical properties shall be conditioned in accordance with ISO 291 for at least 24 h at $(23 \pm 2)^\circ\text{C}$ and $(50 \pm 10)\%$ relative humidity.

Test specimens for the determination of mechanical and thermal properties shall be conditioned in accordance with ISO 291 for at least 4 h at $(23 \pm 2)^\circ\text{C}$ and $(50 \pm 10)\%$ 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 $(23 \pm 2)^\circ\text{C}$ and $(50 \pm 5)\%$ relative humidity unless specifically stated otherwise in [Tables 3](#) or [4](#).

[Table 3](#) is compiled from ISO 10350-1, and the properties listed are those which are appropriate to polycarbonate 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 polycarbonate moulding and extrusion materials.

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Table 3 — General properties and test conditions (selected from ISO 10350-1)

Property	Unit	Standard	Specimen type (dimensions in mm)	Specimen preparation ^a	Test conditions and supplementary instructions
Rheological properties					
Melt volume-flow rate (MVR)	cm ³ /10 min	ISO 1133-1 (preferred) ISO 1133-2 (alternative)	Moulding compound	—	For homopolymers: Temperature 300 °C, load 1,2 kg For copolymers (if applicable): Temperature 330 °C, load 2,16 kg
Mechanical properties					
Tensile modulus	MPa	ISO 527-2	Injection-moulded type A test specimen as defined in ISO 20753	M	Test speed 1 mm/min
Yield stress	MPa				Test speed 50 mm/min
Yield strain	%				
Nominal strain at break	%				
Stress at 50 % strain	MPa				
Stress at break	MPa				
Strain at break	%				Test speed 5 mm/min. Only to be quoted if strain at break is ≤10 %.
Tensile creep modulus	MPa	ISO 899-1	At 1 h and 1 000 h, strain in each case ≤0,5 %		
Flexural modulus	MPa	ISO 178	80 × 10 × 4		Test speed 2 mm/min
Flexural strength	MPa				
Charpy unnotched impact strength	kJ/m ²	ISO 179-1eU	80 × 10 × 4		