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**Plastics — Polyamide (PA) moulding  
and extrusion materials —**

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

*Plastiques — Matériaux polyamides (PA) pour moulage et extrusion —  
Partie 2: Préparation des éprouvettes et détermination des propriétés*

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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 2.

The main task of technical committees is to prepare International Standards. 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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 1874-2 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 9, *Thermoplastic materials*.

This third edition cancels and replaces the second edition (ISO 1874-2:1995), which has been technically revised, as follows:

- Tables 1 and 2 have been revised;
- the normative references have been updated.

ISO 1874 consists of the following parts, under the general title *Plastics — Polyamide (PA) moulding and extrusion materials*:

- *Part 1: Designation*
- *Part 2: Preparation of test specimens and determination of properties*

# Plastics — Polyamide (PA) moulding and extrusion materials —

## Part 2:

## Preparation of test specimens and determination of properties

### 1 Scope

This part of ISO 1874 specifies the methods of preparation of test specimens and the test methods to be used in determining the properties of polyamide 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.

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 that are suitable and necessary to characterize polyamide moulding and extrusion materials are listed.

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 part of ISO 1874, as are the designatory properties (viscosity number and tensile modulus of elasticity) found in ISO 1874-1.

### 2 Normative references

The following referenced documents are indispensable for the application 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 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 294-3, *Plastics — Injection moulding of test specimens of thermoplastic materials — Part 3: Small plates*

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

ISO 307, *Plastics — Polyamides — Determination of viscosity number*

ISO 472, *Plastics — Vocabulary*

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 1110, *Plastics — Polyamides — Accelerated conditioning of test specimens*

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

ISO 1183, *Plastics — Methods for determining the density and relative density of non-cellular plastics*

ISO 1874-1, *Plastics — Polyamide (PA) moulding and extrusion materials — Part 1: Designation*

ISO 3167, *Plastics — Multipurpose test specimens*

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

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

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

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

ISO 15512, *Plastics — Determination of water content*

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

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

IEC 60243-1, *Electric 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 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 Preparation of test specimens**

#### **3.1 Treatment of the material before moulding**

Before processing, the material sample shall have reached room temperature.

Before processing, the moisture content of the material sample shall not exceed 0,2 % (mass fraction) in the case of PAs having a viscosity number  $\leq 200$  ml/g, and shall not exceed 0,1 % (mass fraction) in the case of PAs having a viscosity number  $> 200$  ml/g. For PA46, PA6T/66, PA6T/XT, PA6T/6I/66, PA6T/6I, PA6I/6T and PA NDT/INDT, the moisture content shall be less than 0,1 % (mass fraction).

The moisture content of filled or re-inforced materials shall be expressed as a percentage of the total mass of the compound. The moisture content shall be determined in accordance with ISO 15512 and the viscosity number in accordance with ISO 307.

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 a suitable gas (dried air, nitrogen or argon, for example). Better results may be obtained using a dehumidifier hopper drier.

### 3.2 Injection moulding

Injection-moulded specimens shall be prepared in accordance with ISO 294-1, using the conditions specified in Table 1. The specimens shall be prepared by injection moulding from dry granules. It is essential that 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.

**Table 1 — Conditions for injection moulding of test specimens**

Material <sup>a, b</sup>	Viscosity number <sup>c</sup> mg/l	Filler content %	Plasticizer content %	Melt temperature °C	Mould temperature °C
PA6	≤ 160	0	0	250	80
	> 160 but ≤ 200	0	0	260	80
	> 200	0	0	270	80
	≤ 120	> 0 but ≤ 70	0	270	80
	> 120 but ≤ 200	> 0 but ≤ 70	0	290	80
PA6/66	≤ 160	0	0	230	5
	> 160	0	0	250	5
PA66	≥ 100	0	0	290	80
	≤ 160	> 0 but ≤ 50	0	290	80
	≤ 160	> 50 but ≤ 70	0	300	100
PA66/6	≤ 200	≤ 70	0	290	80
PA46	≤ 260	≤ 70	0	315	120
PA69	≤ 200	0	0	270	80
PA610	≤ 200	0	0	270	80
PA612	≤ 250	0	0	250	80
	≤ 250	> 0 but ≤ 70	0	290	80
PA 11	≤ 150	0	≥ 0	210	80
	> 150 but ≤ 200	0	≥ 0	230	80
	> 200 but ≤ 240	0	≥ 0	250	80
	≤ 130	> 0 but ≤ 30	0	220	80
	≤ 130	> 30 but ≤ 50	0	230	80
	> 130 but ≤ 240	> 0 but ≤ 20	0	250	80
	> 130 but ≤ 240	> 20 but ≤ 50	0	260	80
PA12	≤ 130	≤ 10	≤ 5	200	80
	> 130 but ≤ 200	≤ 10	≤ 5	220	80
	> 200	≤ 10	≤ 5	240	80
	≤ 130	0	> 5	200	60
	> 130 but ≤ 200	0	> 5	210	60
	> 200	0	> 5	220	60
	≤ 130	> 10 but ≤ 30	0	230	80
	≤ 130	> 30 but ≤ 70	0	250	80
	> 130 but ≤ 240	> 10 but ≤ 30	0	240	80
	> 130 but ≤ 240	> 30 but ≤ 70	0	260	80

Table 1 (continued)

Material <sup>a, b</sup>	Viscosity number <sup>c</sup> mg/l	Filler content %	Plasticizer content %	Melt temperature °C	Mould temperature °C
PA MXD6	≤ 130	0	0	250	130
	> 130 but ≤ 160	0	0	260	130
	≤ 130	> 0 but ≤ 50	0	270	100
	≤ 130	> 50 but ≤ 70	0	280	130
	> 130 but ≤ 160	> 0 but ≤ 50	0	280	130
	> 130 but ≤ 160	> 50 but ≤ 70	0	290	130
PA6T/XT	≤ 160	≤ 70	0	325	150
PA6T/66	≤ 160	≤ 70	0	325	100
PA6T/6I	≤ 200	≤ 70	0	325	130
PA6I/6T	≤ 200	≤ 70	0	325	130
PA6T/6I/66	≤ 200	≤ 70	0	325	130
PA66/6I	≤ 160	≤ 70	0	290	90
PA9T	≤ 200	≤ 70	0	320	140
PA NDT/INDT	≤ 160	0	0	280	80
	≤ 120	> 0 but ≤ 50	0	300	80

<sup>a</sup> For the definition of PA and the symbols used to indicate the chemical structure of polyamide materials, see ISO 472 and ISO 1874-1, respectively.

<sup>b</sup> For the polyamides mentioned in this table, with the exception of PA46, PA6T/66, PA6T/XT, PA6T/6I, PA6I/6T PA6T/6I/66, PA66/6I and PA9T, the injection velocity shall be 200 mm/s ± 100 mm/s. For PA46, PA6T/66, PA6T/XT, PA6T/6I, PA6I/6T PA6T/6I/66, PA66/6I and PA9T, the injection velocity shall be 300 mm/s ± 100 mm/s.

<sup>c</sup> The preferred reference solvent according to ISO 307.

## 4 Conditioning of test specimens

### 4.1 Conditioning states of the test specimen

Separate sets of test specimens for the determination of properties shall be conditioned in two different ways: one set dry-as-moulded and the other in the moist state.

Properties shall be determined on specimens in the dry-as-moulded state, or on specimens in the moist state, or on specimens in both states. The state of the specimens shall be stated in the test report.

### 4.2 Dry-as-moulded (DAM) state

Test specimens are considered to be in the DAM state when they have been placed, immediately after moulding, in a moisture-proof container and stored at 23 °C ± 2 °C for at least 24 h. The moisture content of DAM specimens shall not exceed 0,2 % (mass fraction). The intentional addition of water to reach this moisture content is not allowed, nor is drying of specimens with moisture contents above this limit.

To maintain absorbed moisture at a low level, DAM specimens shall be tested in as short a time as possible (maximum 15 min) after removal from the moisture-proof container.

Annealing specimens prior to testing is not allowed.

### 4.3 Moist state

Test specimens are considered to be in the moist state when they have been conditioned at 23 °C and 50 % relative humidity until equilibrium has been reached (see ISO 291). The applied standard atmosphere class, or the applied tolerances, shall be stated in the test report.

NOTE The different classes of standard atmosphere correspond to different tolerance levels for the temperature and relative humidity (RH), as mentioned in ISO 291. The standard atmosphere classes for 23 °C/50 % RH are

- Class 1: (23 ± 1) °C / (50 ± 5) % RH;
- Class 2: (23 ± 2) °C / (50 ± 10) % RH.

The tolerances apply to the specimen-storage space in a test enclosure or conditioning enclosure. The relative humidity tolerance includes real tolerances on dew points and allowance for the usual errors and drift in control equipment and hygrometers.

Test specimens which have been conditioned by the procedure for accelerated conditioning of polyamides specified in ISO 1110 are also considered to be in the moist state. The moisture content shall be reported.

## 5 Determination of properties

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 in this part of ISO 1874. Values determined will not necessarily be identical to those obtained using specimens of different dimensions or prepared using different procedures.

All tests shall be carried out in the standard atmosphere of 23 °C ± 2 °C and (50 ± 5) % relative humidity unless specifically stated otherwise in Tables 2 and 3.

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