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Plastics — Plasticized poly(vinyl chloride) (PVC-P) moulding and extrusion materials —

Part 2: Preparation of test specimens and determination of properties

Plastiques — Matériaux à base de poly(chlorure de vinyle) plastifié (PVC-P) 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.

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).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 9, *Thermoplastic materials*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 249, *Plastics*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This first edition of ISO 24023-2 cancels and replaces ISO 2898-2:2008, which has been technically revised.

The main changes compared to the previous edition are as follows:

— ISO 3167 has been replaced by ISO 20753;

— IEC 60093 has been replaced by the new editions of IEC 62631-3-1and IEC 62631-3-2.

A list of all parts in the ISO 24023 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 — Plasticized poly(vinyl chloride) (PVC-P) 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 PVC-P moulding and extrusion materials. It gives the requirements for handling test materials and for conditioning both the test material before moulding and the specimens before testing.

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 lists properties and test methods which are suitable and necessary to characterize PVC-P 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 24023 (all parts).

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 176, *Plastics — Determination of loss of plasticizers — Activated carbon method*

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

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

ISO 458-2, *Plastics — Determination of stiffness in torsion of flexible materials — Part 2: Application to plasticized compounds of homopolymers and copolymers of vinyl chloride*

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 868, *Plastics and ebonite — Determination of indentation hardness by means of a durometer (Shore hardness)*

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 3451-5, *Plastics — Determination of ash — Part 5: Poly(vinyl chloride)*

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

ISO 24023-1, *Plastics — Plasticized polyvinyl chloride) (PVC-P) moulding and extrusion materials — Part 1: Designation system and basis for specifications*

ISO 20753, *Plastics — Test specimens*

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*

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

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 are not necessarily identical to those obtained using specimens of different dimensions or prepared using different procedures.

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

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

4.2 Treatment of the material before moulding

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

4.3 Compression moulding

Before compression moulding, the material shall be plasticized using a two-roll mill under the conditions specified in Table 1.

Unless it constitutes a variable under study, the required number of milled sheets shall be placed cross layered in the preheated mould and prepare compression-moulded sheets in accordance with ISO 293, using the conditions specified in Table 2.

Table 1 — Conditions for milling of material before compression moulding

Shore hardness of material	Roll surface temperature °C	Milling time[a] min	Roll surface speed m/min	Speed ratio	Roll nip width mm	Roll diameter mm	Roll length mm
Up to A 80	130 to 160	Approximately 5	Approximately 10	1:1,2	Approximately 1	e.g. 150	e.g. 300
D 35 to D 50	145 to 170	Approximately 5	Approximately 10	1:1,2	Approximately 1	e.g. 150	e.g. 300

[a] Measured from the moment when a sheet is formed.

Table 1 *(continued)*

Shore hardness of material	Roll surface temperature °C	Milling time[a] min	Roll surface speed m/min	Speed ratio	Roll nip width mm	Roll diameter mm	Roll length mm
Above D 50	160 to 175	Approxi mately 5	Approxi mately 10	1:1,2	Approxi mately 1	e.g. 150	e.g. 300
[a] Measured from the moment when a sheet is formed.							

Table 2 — Conditions for compression moulding of test specimens

Shore hardness of 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
Up to A 80	130 to 160	Not defined	Approxi mately 40[a]	2 to 10	2 to 5	Approxi mately 0,3	Max. 5
D 35 to D 50	145 to 175	Not defined	Approxi mately 40[a]	2 to 10	2 to 5	Approxi mately 0,3	Max. 5
Above D 50	170 to 180	Not defined	Approxi mately 40[a]	2 to 10	2 to 5	Approxi mately 0,3	Max. 5
[a] Very soft materials may require a lower temperature.							

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.

Test specimen preparation shall be according to Annex A.

5 Conditioning of test specimens

The test specimens for all determinations shall be conditioned in accordance with ISO 291 for at least 48 h at 23 °C ± 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 °C ± 2 °C and 50 % ± 10 % relative humidity unless specifically stated otherwise in Tables 3 and 4.

Table 3 is compiled from ISO 10350-1, and the properties listed are those which are appropriate to PVC-P 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 PVC-P moulding and extrusion materials.

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

Property	Unit	International Standard	Specimen type mm	Test conditions and supplementary instructions
Mechanical properties				
Tensile stress at 50 % strain	MPa	ISO 527-1 ISO 527-2	ISO 20753 Type A2 specimen	Test speed 50 mm/min
Electrical properties				
Volume resistivity	Ω·m	IEC 62631-3–1	≥ 100 × ≥ 100 × (1 ± 0,5)	Voltage 100 V
Other properties				
Density[a]	kg/m^3	ISO 1183-1	At least 1 g	Method A or B Report the result to two decimal places
[a] Designatory property.				

Table 4 — Additional properties and test conditions of particular utility to PVC-P moulding and extrusion materials

Property	Unit	International Standard	Specimen type mm	Test conditions and supplementary instructions
Mechanical properties				
Tensile stress at 100 % elongation	MPa	ISO 527-1 ISO 527-2	Type 1BA specimen Thickness 2 mm	Test speed 500 mm/min
Shore A or D hardness[a]	—	ISO 868	Disc of diameter 50 mm or square 50 mm × 50 mm specimen Thickness 4 mm or 6 mm (type A: 6 mm only)	Force applied to specimen 50 N Take reading after 15 s ± 1 s Use Shore D if Shore A hardness ≥ 85
Thermal properties				
Torsional stiffness as a function of temperature[a]	°C	ISO 458-2	60 mm × 60 mm × 2 mm For very flexible compounds, use a 60 mm × 60 mm × 4 mm specimen at high temperatures of test.	The values of the torsional stiffness are plotted as a function of temperature. The two temperatures at which the stiffness in torsion has values of 300 MPa and 4,1 MPa are TST 300 and TST 4,1, respectively. For ISO 24023-1, TST = 300.
Other properties				
Sulfated ash	% (by mass)	ISO 3451-5	Pellets	Method B
Loss of plasticizers	% (by mass)	ISO 176	Disc of diameter 50 mm and thickness 1 mm	Method B
[a] Designatory property.				

Annex A
(normative)

Detailed description of the preparation of test specimens

A.1 Principle

A rough sheet of the material to be tested is prepared using a heated two-roll mill. This sheet is then compression moulded into sheets of uniform thickness. Test specimens are prepared from the moulded sheets by machining or die-cutting.

A.2 Preparation of preliminary sheets

A.2.1 Apparatus

A.2.1.1 Two-roll mixing mill, capable of operating satisfactorily at temperatures up to and including 180 °C. The rolls shall be cylindrical; the dimensions may be, for example: diameter 150 mm, length 300 mm.

A.2.2 Milling conditions

A.2.2.1 The surface temperature of the mill rolls, and the moulding temperature used subsequently (see A.3.3) shall be based on the Shore hardness value of the material.

The temperature of the rolls shall be selected to permit the material to band on the surface of the roll between 1 min and 2 min after the commencement of milling. There shall be a maximum difference of 4 °C between the rolls and ± 2 °C along the length of each roll.

A.2.2.2 Detailed schedules for the milling of individual compositions are not included in this document, but the following remarks apply to mixes of all types:

The surface speed of the rolls shall be approximately 10 m/min.

It is customary for there to be a differential speed between the two rolls. The preferred ratio is 1:1,2, the front (working) roll being the slower.

Proper mill mixing of the material requires a rolling bank. The amount of material should preferably be such that the ratio of the diameter of the rolling bank to the nip width is 10:1. The nip settings shall be determined by the desired thickness of the milled sheet. During mill mixing, the nip width shall be about 1 mm.

A.2.3 Procedure

Add the material to the mill rolls. Collect any material falling through the nip carefully and quickly form the tray and return to the moving mill rolls. After a sheet is formed, continue milling for approximately 5 min in such a way that optimum dispersion of all material components is obtained. This normally includes cutting the sheet, allowing it to form a roll, and re-feeding this roll into the nip. Remove the milled sheet from the rolls without stretching it.

Deviations from A.2.2 and A.2.3, if necessary, shall be included in a test report.