INTERNATIONAL STANDARD

ISO 2898-2

Third edition
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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
ISO 2898-2:1997(E)

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.

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.

International Standard ISO 2898-2 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 9, *Thermoplastic materials.*

This third edition cancels and replaces the second edition (ISO 2898-2:1989) and includes the following changes:

— the text has been brought into accordance with the standard SC 9 frame text;

— the test conditions for tensile stress and volume resistivity have been revised in accordance with ISO 10350.

ISO 2898 consists of the following parts, under the general title *Plastics — Plasticized poly(vinyl chloride) (PVC-P) moulding and extrusion materials*:

— *Part 1: Designation system and basis for specifications*

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

Annex A forms an integral part of this part of ISO 2898.

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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

1 Scope

This part of ISO 2898 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. 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 PVC-P 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 2898, 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 2898. 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 2898 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 176:1976, *Plastics — Determination of loss of plasticizers — Activated carbon method.*

ISO 291:—[1)], *Plastics — Standard atmospheres for conditioning and testing.*

ISO 293:1986, *Plastics — Compression moulding test specimens of thermoplastic materials.*

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

ISO 458-2:1985, *Plastics — Determination of stiffness in torsion of flexible materials — Part 2: Application to plasticized compounds of homopolymers and copolymers of vinyl chloride.*

ISO 527-2:1993, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics.*

ISO 868:1985, *Plastics and ebonite — Determination of indentation hardness by means of a durometer (Shore hardness).*

ISO 1183:1987, *Plastics — Methods for determining the density and relative density of non-cellular plastics.*

ISO 2818:1994, *Plastics — Preparation of test specimens by machining.*

ISO 2898-1:1996, *Plastics — Plasticized poly(vinyl chloride) (PVC-P) moulding and extrusion materials — Part 1: Designation system and basis for specifications.*

ISO 3167:1993, *Plastics — Multipurpose test specimens.*

ISO 3451-5:1989, *Plastics — Determination of ash — Part 5: Poly(vinyl chloride).*

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.*

3 Preparation of test specimens

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.

3.1 Treatment of the material before moulding

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

3.2 Compression moulding

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

Table 1 — Conditions for milling of material before compression moulding

Shore hardness of material	Roll surface temperature °C	Milling time [1] 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	approx. 5	approx. 10	1:1,2	approx. 1	e.g. 150	e.g. 300
D 35 to D 50	145 to 170	approx. 5	approx. 10	1:1,2	approx. 1	e.g. 150	e.g. 300
above D 50	160 to 175	approx. 5	approx. 10	1:1,2	approx. 1	e.g. 150	e.g. 300

1) Measured from the moment when a sheet is formed.

Sheet material from the mill shall be stacked, preferably with sheet orientation alternating from layer to layer, in the preheated mould. Compression-moulded sheets shall then be prepared in accordance with ISO 293, using the conditions specified in table 2.

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	135 to 165	not defined	approx. 40 1)	2 to 10	2 to 5	approx. 0,3	max. 5
D 35 to D 50	145 to 175	not defined	approx. 40 1)	2 to 10	2 to 5	approx. 0,3	max. 5
above D 50	170 to 180	not defined	approx. 40 1)	2 to 10	2 to 5	approx. 0,3	max. 5

1) 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.

For additional details on test specimen preparation, see annex A.

4 Conditioning of test specimens

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 ± 5) % relative humidity.

5 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 °C ± 2 °C and (50 ± 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 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)

Property	Unit	Standard	Specimen type (dimensions in mm)	Test conditions and supplementary instructions
Mechanical properties				
Tensile stress at 50 % strain	MPa	ISO 527-2	ISO 3167 specimen A	Test speed 50 mm/min Distance between gauge marks 70 mm
Electrical properties				
Volume resistivity	Ω·m	IEC 93	⩾ 80 × ⩾ 80 × 1	Voltage 100 V
Other properties				
Density [1)]	kg/m³	ISO 1183	10 × 10 × 4	Method A or B Report the result to two decimal places
1) Designatory property				

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

Property	Unit	Standard	Specimen type	Test conditions and supplementary instructions
Mechanical properties				
Tensile stress at 100 % elongation	MPa	ISO 527-2	Specimen 1BA Thickness 2 mm	Test speed 500 mm/min
Shore A or D hardness [1)]	—	ISO 868	Disc of diameter 50 mm or square specimen 50 mm × 50 mm 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 D if Shore A hardness > 85
Thermal properties				
Torsional stiffness as a function of temperature [1)]	°C	ISO 458-2	60 mm × 6 mm × 2 mm NOTE — For very flexible compounds, use a 60 mm × 6 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 2898-1, TST = 300.
Other properties				
Sulfated ash	% (*m*/*m*)	ISO 3451-5	Pellets	Method B
Loss of plasticizers	% (*m*/*m*)	ISO 176	Disc of diameter 50 mm and thickness 1 mm	Method B
1) 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 part of ISO 2898, 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 from 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.

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

A.3 Preparation of moulded sheet

A.3.1 Apparatus

A.3.1.1 Hydraulic moulding press, capable of developing a moulding pressure of at least 10 MPa.

The press platens shall be equipped with means of heating and cooling such that the surface can be heated to a temperature of 180 °C and such that the maximum deviation from this temperature at the centre of the platen does not exceed 3 °C at any point within the moulding area.

A.3.1.2 Male/female mould or **window frame between two metal plates**.

Parting foils (for example, aluminium or photographic-type highly polished ferrotype plates) can be placed between the materials and the metal surfaces.

A.3.2 Moulding conditions

The mass of material necessary to fill the mould is determined in advance, either by calculation from the known material density, or by making a trial moulding. The sum of the thickness of all the milled sheets used shall be slightly greater than the thickness of the moulded sheet or test specimen.

A.3.3 Procedure

Place the required number of milled sheets, preferably cross-layered, in the preheated mould.

Close the preheated platens of the press and maintain a pressure of approximately 0,3 MPa for a maximum of 5 min to facilitate preheating of the material. Then increase the mould pressure to between 2 MPa and 10 MPa and maintain this pressure for 2 min to 5 min. During this time, there shall be sufficient flow of the material between the mould and the metal surfaces to result in formation of a small amount of moulding flash. Cool the mould to approximately 40 °C or, in the case of very soft materials, to a lower temperature, while maintaining constant applied pressure. Open the mould and remove the sheet.

A.4 Preparation of the test specimens from the moulded sheet

Prepare the required test specimens from the moulded sheet by machining or by stamping, using a sharp die of the required shape and with cutting edges which are free from defects such as notches and burrs.

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