INTERNATIONAL STANDARD

ISO 1163-2

Second edition
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Plastics — Unplasticized poly(vinyl chloride) (PVC-U) moulding and extrusion materials —

Part 2:
Preparation of test specimens and determination of properties

Plastiques — Poly(chlorure de vinyle) non plastifié (PVC-U) pour moulage et extrusion —

Partie 2: Préparation des éprouvettes et détermination des propriétés

Reference number
ISO 1163-2:1995(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 1163-2 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 9, *Thermoplastic materials*.

This second edition cancels and replaces the first edition (ISO 1163-2:1980), in which the table of test methods has been revised in accordance with ISO 10350.

ISO 1163 consists of the following parts, under the general title *Plastics — Unplasticized poly(vinyl chloride) (PVC-U) moulding and extrusion materials*:

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

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

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Plastics — Unplasticized poly(vinyl chloride) (PVC-U) moulding and extrusion materials —

Part 2:
Preparation of test specimens and determination of properties

1 Scope

This part of ISO 1163 specifies procedures and conditions for the preparation of test specimens of PVC-U materials in a specified state, and methods for measuring their properties. Any property listed in this part and referred to in combination with part 1 shall be determined by the method referred to in this part.

No figures are quoted for these properties. Those required for the designation of PVC-U thermoplastics are given in part 1 of this International Standard. All properties shall be determined by the appropriate methods referred to in this part of ISO 1163 and values obtained shall be presented as laid down in ISO 10350.

The values determined in accordance with this part of ISO 1163 will not necessarily be identical to those obtained using specimens of different dimensions and/or prepared by different procedures. The values obtained for the properties of a moulding depend on the moulding compound, the shape, the test method and the state of anisotropy. The last-mentioned depends on the gating of the mould and the moulding conditions, for example temperature, pressure and injection rate. Any subsequent treatment must also be considered, for example conditioning or annealing.

The thermal history and the internal stresses of the specimens may strongly influence the thermal and mechanical properties and the resistance to environmental stress cracking, but exert less effect on the electrical properties, which depend mainly on the chemical composition of the moulding compound.

In order to obtain reproducible test results, the following two conditions shall be met:

— use test specimens with the specified dimensions and conditioning;

— use test procedures as specified in this part of ISO 1163.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 1163. 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 1163 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 62:1980, *Plastics — Determination of water absorption.*

ISO 75-1:1993, *Plastics — Determination of temperature of deflection under load — Part 1: General test method.*

ISO 75-2:1993, *Plastics — Determination of temperature of deflection under load — Part 2: Plastics and ebonite.*

ISO 178:1993, *Plastics — Determination of flexural properties.*

ISO 179:1993, *Plastics — Determination of Charpy impact strength.*

ISO 291:1977, *Plastics — Standard atmospheres for conditioning and testing.*

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

ISO 306:1994, *Plastics — Thermoplastic materials — Determination of Vicat softening temperature (VST).*

ISO 527-1:1993, *Plastics — Determination of tensile properties — Part 1: General principles.*

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

ISO 527-4:—[1], *Plastics — Determination of tensile properties — Part 4: Test conditions for isotropic and orthotropic fibre-reinforced plastic composites.*

ISO 899-1:1993, *Plastics — Determination of creep behaviour — Part 1: Tensile creep.*

ISO 1163-1:—[2], *Plastics — Unplasticized poly(vinyl chloride) (PVC-U) moulding and extrusion materials — Part 1: Designation system and basis for specifications.*

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

ISO 1210:1992, *Plastics — Determination of the burning behaviour of horizontal and vertical specimens in contact with a small-flame ignition source.*

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

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

ISO 4589-2:—[1], *Plastics — Determination of burning behaviour by oxygen index — Part 2: Ambient-temperature test.*

ISO 4589-3:—[1], *Plastics — Determination of burning behaviour by oxygen index — Part 3: Elevated-temperature test.*

ISO 8256:1990, *Plastics — Determination of tensile-impact strength.*

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.*

IEC 112:1979, *Method for determining the comparative and the proof tracking indices of solid insulating materials under moist conditions.*

IEC 243-1:1988, *Methods of test for electric strength of solid insulating materials — Part 1: Tests at power frequencies.*

IEC 250:1969, *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 296:1982, *Specification for unused mineral insulating oils for transformers and switchgear.*

3 Preparation of test specimens

Test specimens shall be prepared by compression moulding.

The method applied shall be indicated in the list of properties for every test specimen, using "Q" as the code-letter for compression moulding.

It is essential that all specimens prepared by a particular method are prepared using the same processing conditions given in tables 1 and 2.

3.1 Treatment of the material before moulding

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

3.2 Compression moulding

Place the required number of milled sheets, preferably crosslayered, in the preheated mould and prepare compression-moulded sheets in accordance with ISO 293, using the conditions specified in table 2.

1) To be published.

2) To be published. (Revision of ISO 1163-1:1985)

Table 1 — Conditions for preplasticizing test specimens

Material	Mill-roll surface temperature °C	Milling time min	Roll surface speed m/min	Friction ratio	Roll nip width mm	Roll diameter mm	Roll length mm
All grades	VST/B + 90 (± 10)	5 ± 1	e.g. 10	1:1,2	e.g. 1	e.g. 150	e.g. 300

Table 2 — Conditions for compression moulding of test specimens

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
All grades	VST/B + 100 (± 10)	15 ± 3	⩽ 40	7,5 ± 2,5	3,5 ± 1,5	~ 0,5	~ 5

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.

4 Conditioning of test specimens

The test specimens shall be conditioned in accordance with ISO 291 for at least 16 h at 23 °C ± 2 °C and (50 ± 5) % relative humidity.

The minimum time between the preparation of a test specimen and the test shall be 16 h, except that for electrical properties it shall be 24 h.

5 Determination of properties

In the determination of properties and the presentation of results, the standards, methods and special conditions listed in table 3 shall apply. The supplementary instructions and notes given in ISO 10350 shall also be taken into consideration.

All tests shall be carried out at 23 °C ± 2 °C and (50 ± 5) % relative humidity, unless otherwise stated in table 3.

Table 3 — Properties and test conditions

Property	Unit	Standard	Specimen type (dimensions in mm)	Specimen preparation[1]	Test conditions and supplementary instructions
Mechanical properties					
Tensile modulus[2]	MPa	ISO 527-1, ISO 527-2, ISO 527-4	See ISO 3167	Q	Test speed 1 mm/min
Yield stress	MPa				Test speed 50 mm/min
Yield strain	%				Test speed 50 mm/min
Strain at break	%				Test speed 50 mm/min
Stress at 50 % strain	MPa				Test speed 50 mm/min
Tensile creep modulus	MPa	ISO 899-1	See ISO 3167	Q	At 1 h; At 1 000 h: Strain ⩽ 0,5 %
Flexural modulus	MPa	ISO 178	80 × 10 × 4	Q	Test speed 2 mm/min
Flexural strength	MPa				
Charpy notched impact strength[2]	kJ/m²	ISO 179	80 × 10 × 4 V-notch, $r = 0,25$	Q	Method 1eA (edgewise impact)
Tensile notched impact strength	kJ/m²	ISO 8256	80 × 10 × 4 double V-notch, $r = 1$	Q	Only to be quoted if fracture cannot be obtained with notched Charpy test.
Thermal properties					
Temperature of deflection under load	°C	ISO 75-1, ISO 75-2	110 × 10 × 4 or 80 × 10 × 4	Q	1,8 MPa
Vicat softening temperature[2]	°C	ISO 306	10 × 10 × 4	Q	Heating rate 50 °C/h, load 50 N
Flammability	mm/min	ISO 1210	125 × 13 × 3 (thicker than preferred specimen)	Q	Method A — linear burning rate of horizontal specimens
	s				Method B — afterflame and afterglow times of vertical specimens
Ignitability	%	ISO 4589-2, ISO 4589-3	80 × 10 × 4	Q	Procedure A — top surface ignition
Electrical properties					
Relative permittivity	—	IEC 250	⩾ 80 × ⩾ 80 × 1	Q	Frequency 1 kHz (compensate for electrode edge effect)
Dissipation factor	—				
Volume resistivity	Ω·m	IEC 93	⩾ 80 × ⩾ 80 × 1	Q	Voltage 500 V
Surface resistivity	Ω				
Electric strength	kV/mm	IEC 243-1	⩾ 80 × ⩾ 80 × 1	Q	Use 25 mm/75 mm coaxial-cylinder electrode configuration. Immerse in IEC 296 transformer oil. Use short time (rapid rise) test
Comparative tracking index	—	IEC 112	⩾ 15 × ⩾ 15 × 4	Q	Use solution A
Other properties					
Water absorption	%	ISO 62	50 × 50 × 4	Q	24 h immersion in water at 23 °C
Density	kg/m³	ISO 1183	10 × 10 × 4	Q	

1) Q = Compression moulding
2) Designatory property