International Standard 1163/2

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Plastics — Unplasticized compounds of homopolymers and copolymers of vinyl chloride — Part 2 : Determination of properties

Plastiques — Compositions non plastifiées d'homopolymères et de copolymères de chlodure de vinyle — Partie 2 : Determination des propriétés

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 1163/2 was developed by Technical Committee ISO/TC 61, *Plastics*, and was circulated to the member bodies in July 1978.

It has been approved by the member bodies of the following countries :

Australia	Greece	Poland
Austria	Hungary	Romania
Belgium	Iran	South Africa, Rep. of
Brazil	Ireland	Spain
Bulgaria	Israel	Sweden
Canada	Italy	Switzerland
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Finland	Mexico	USA
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The member body of the following country expressed disapproval of the document on technical grounds :

India

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Plastics — Unplasticized compounds of homopolymers and copolymers of vinyl chloride — Part 2 : Determination of properties

0 INTRODUCTION

The properties of a moulded article depend, among other things, on the composition of the moulding material, the shape and the state of anisotropy of the moulding, and on the methods of test used. Anisotropy is a function of the moulding conditions, including the temperature, pressure, injection rate, etc. In addition, any post-treatment of the moulded article, such as conditioning or annealing, will influence the values of the properties.

The values of the properties determined according to this International Standard are not applicable to specimens of other dimensions or to specimens prepared by a different procedure. Also, colorants and other additives may affect the property values.

In order to designate a material, it is only necessary to determine the properties described in Part 1 of ISO 1163. Other test methods given in this part of ISO 1163 shall be used to specify properties related to the intended application of the material.

1 SCOPE AND FIELD OF APPLICATION

This part of ISO 1163 specifies the equipment and general procedure for the preparation of standard test specimens from unplasticized compounds of homopolymers and copolymers of vinyl chloride (VC), methods of testing the characteristic properties according to ISO 1163/1, and the test conditions for determining other relevant properties.

2 REFERENCES

ISO 75, *Plastics and ebonite — Determination of temperature of deflection under load.*

ISO 175, *Plastics — Determination of the effects of liquid chemicals including water.* 1)

ISO 178, *Plastics — Determination of flexural properties of rigid plastics.*

ISO/R 179, *Plastics — Determination of the Charpy impact resistance of rigid plastics (Charpy impact flexural test).*

ISO/R 180, *Plastics — Determination of the Izod impact resistance of rigid plastics (Izod impact flexural tests).*

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

ISO 306, *Plastics — Determination of the Vicat softening temperature of thermoplastics.*

ISO 527, *Plastics — Determination of tensile properties.* 2)

ISO 868, *Plastics — Determination of indentation hardness of plastics by means of a durometer (Shore hardness).*

ISO 1163/1, *Plastics — Unplasticized compounds of homopolymers and copolymers of vinyl chloride — Part 1 : Designation.* 3)

ISO/R 1183, *Plastics — Methods for determining the density and relative density (specific gravity) of plastics, excluding cellular plastics.*

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

IEC Publication 93, *Recommended methods of test for volume and surface resistivities of electrical insulating materials.*

3 PREPARATION OF SPECIMENS

3.1 Principle

Preparation of a rough sheet from the material to be tested, using a heated two-roll mill. Subsequent compression moulding of the preliminary sheet so produced into sheets of uniform thickness. Preparation of test specimens from these moulded sheets by machining or die-cutting.

3.2 Preparation of preliminary sheets

3.2.1 *Apparatus*

Two-roll mixing mill, capable of operating satisfactorily at temperatures up to and including 200 °C.

The rolls shall be cylindrical; the dimensions may be, for example : diameter of 150 mm; length of 300 mm.

1) At present at the stage of draft. (Revision of ISO/R 175 and ISO/R 462.)

2) At present at the stage of draft. (Revision of ISO/R 527.)

3) At present at the stage of draft.

3.2.2 *Milling conditions*

3.2.2.1 The surface temperature of the mill rolls shall be the Vicat softening temperature of the material (ISO 306, method B) plus 90 °C. In certain cases, for example, with vinyl chloride/vinyl acetate copolymers having a significant VAC comonomer content, it may be necessary to select a lower temperature to prevent adherence of the material to the mill roll surface.

3.2.2.2 Detailed schedules for the milling of individual compositions are not included in this International Standard, 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 mill 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 nip settings shall be determined by the desired thickness of the milled sheet. The sum of the thicknesses of all sheets used shall be slightly higher than the thickness of the moulded sheet or test specimen.

3.2.3 *Procedure*

Add the material to the mill rolls. Any material falling through the nip shall be carefully and quickly collected from the tray and returned 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.

NOTE – Deviations from 3.2.2 and 3.2.3, if necessary, should be included in the test report.

3.3 Preparation of moulded sheet

3.3.1 *Apparatus*

3.3.1.1 **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 200 °C. The platen temperature over the moulding area shall be uniform. The maximum deviation at any point from the temperature at the centre of the platen shall not exceed 3 °C within the moulding area.

3.3.1.2 **Male/female mould,** or **window frame between two metal plates.**

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

3.3.2 *Moulding conditions*

The necessary mass of material to fill a mould shall be predetermined, either by calculation from the known material density, or by making a trial moulding.

The moulding temperature shall be the Vicat softening temperature of the material (ISO 306, method B) plus approximately 100 °C.

3.3.3 *Procedure*

Place the required mass of pieces cut from the milled sheet in the preheated mould (3.3.1.2).

Close the preheated platens of the press (3.3.1.1) and maintain a pressure of approximately 0,5 MPa for 5 min to facilitate preheating the material. Then increase the mould pressure to between 5 and 10 MPa and maintain this pressure for 2 to 5 min. During this time, there shall be sufficient flow of the material between the metal surfaces to result in the formation of a small amount of moulding flash. Cool the mould to approximately 40 °C, while maintaining constant applied pressure. Open the mould and remove the sheet.

3.4 Preparation of test specimens

Prepare the required test specimens from the moulded sheet by machining (see ISO 2818) or by stamping, using a sharp die of the required shape, the cutting edges of which are free from defects such as notches and burrs.

4 CONDITIONING

The conditioning and all test determinations shall be made at 23 °C and 50 % relative humidity in accordance with the requirements of ISO 291, unless the relevant test method specifies otherwise.

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

* 1 MPa = 1 MN/m^2

5 TEST METHODS

Property	Method	Test specimen[2]	Unit	Remarks
Density[1]	ISO/R 1183, method A or B	Granules or fragments of moulded articles	g/cm^3	
Mechanical properties				
Impact resistance (Charpy)[1]	ISO/R 179	Notched specimen according to figure 2 of ISO/R 179 50 mm × 6 mm × 4 mm	kJ/m^2	Preferred temperatures : −40 °C, −20 °C, 0 °C and 23 °C For ISO 1163/1 : 23 °C
Impact resistance (Izod)	ISO/R 180	Notched specimen according to figure 2 of ISO/R 180 63,5 mm × 12,7 mm × 4 mm	J/m	
Modulus of elasticity in tension[1]	ISO 527	Type 1 specimen 150 mm × 20/10 mm × 4 mm (recommended thickness) Distance between gauge marks : 50 mm	MPa	Speed A (1 mm/min)[4]
Tensile stress at yield			MPa	Speed B (5 mm/min)
Tensile stress at maximum load or at break			MPa	Speed B (5 mm/min)
Elongation at yield			%	Speed B (5 mm/min)
Elongation at break			%	Speed B (5 mm/min)
Modulus of elasticity in flexure	ISO 178	80 mm × 10 mm × 4 mm	MPa	Test speed : 2 mm/min
Flexural stress at conventional deflection			MPa	Conventional deflection : 1,5 h (h = thickness)
Shore hardness	ISO 868	Disc of diameter 50 mm, or square specimen 50 mm × 50 mm Thickness : 4 or 6 mm		Force applied to the specimen : 50 N Preferred scale : D
Thermal properties				
Vicat softening temperature[1]	ISO 306, method B	10 mm × 10 mm Preferred thickness : 4 mm	°C	Rate of increase of temperature : 50 °C/h Recommended heat transfer fluid : silicone oil
Temperature of deflection under load	ISO 75, method A	⩾ 110 mm × 10 mm × 4 mm	°C	Heat transfer by silicone oil
Fire behaviour : Methods under study by ISO/TC 92 and ISO/TC 61/SC 4				
Electrical properties[3]				
Volume resistivity	IEC Publication 93	120 mm × 120 mm × 1 or 4 mm	Ω·cm	Test voltage : 500 V
Chemical properties				
Resistance to chemical substances	ISO 175	For change in mass : disc ϕ 50 mm × 3 mm For change in mechanical properties : specimens as defined in the relevant International Standards.	% (m/m) See the relevant International Standards	Immersion time : 7 days

1) Property used for designation (see ISO 1163/1).

2) For tolerances on test specimen dimensions, see the relevant ISO methods.

3) Other electrical properties may be determined in accordance with IEC standard methods.

4) Calculation of modulus of elasticity is valid only in the range of low elongations. Therefore, the load/elongation recording intervals should be chosen so as to permit drawing the tangent to the load/elongation curve with sufficient precision.