BSI Standards Publication

Plastics – Sulfone polymer moulding and extrusion materials

Part 2: Preparation of test specimens and determination of properties

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National foreword

This British Standard is the UK implementation of EN ISO 24025-2:2020. It is identical to ISO 24025-2:2020. It supersedes BS EN ISO 2513-2:2017, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PRI/82, Thermoplastic materials.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Published by BSI Standards Limited 2020

ISBN 978 0 539 03418 9

ICS 83.080.20

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 June 2020.

Amendments/corrigenda issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 24025-2

May 2020

ICS 83.080.20

Supersedes EN ISO 25137-2:2017

English Version

Plastics - Sulfone polymer moulding and extrusion materials - Part 2: Preparation of test specimens and determination of properties (ISO 24025-2:2020)

Plastiques - Matériaux à base de polymères sulfone pour moulage et extrusion - Partie 2: Préparation des éprouvettes et détermination des propriétés (ISO 24025-2:2020)

Kunststoffe - Sulfonpolymer-Werkstoffe für das Spritzgießen und die Extrusion - Teil 2: Herstellung von Probekörpern und Bestimmung von Eigenschaften (ISO 24025-2:2020)

This European Standard was approved by CEN on 16 May 2020.

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EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (EN ISO 24025-2:2020) has been prepared by Technical Committee ISO/TC 61 "Plastics" in collaboration with Technical Committee CEN/TC 249 “Plastics” the secretariat of which is held by NBN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2020, and conflicting national standards shall be withdrawn at the latest by November 2020.

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Endorsement notice

The text of ISO 24025-2:2020 has been approved by CEN as EN ISO 24025-2:2020 without any modification.

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Foreword

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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).

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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 24025-2 cancels and replaces ISO 25137-2:2009, which has been technically revised.

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

— the normative references have been updated to the latest version;

— Clause 3 has been added;

— Table 2 has been updated according to the revised ISO 10350-1;

— three properties have been added: moulding shrinkage, luminous transmittance, yellowness index.

A list of all parts in the ISO 24025 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.

INTERNATIONAL STANDARD ISO 24025-2:2020

Plastics – Sulfone polymer moulding and extrusion materials —

Part 2: Preparation of test specimens and determination of properties

1 Scope

1.1 This document specifies the methods of preparation of test specimens and the test methods to be used in determining the properties of sulfone polymer 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.

1.2 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 sulfone polymer moulding and extrusion materials are listed.

1.3 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 24025-1.

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 62, *Plastics — Determination of water absorption*

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

ISO 178, *Plastics — Determination of flexural properties*

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 306, *Plastics — Thermoplastic materials — Determination of Vicat softening temperature (VST)*

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

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

ISO 1133-1, *Plastics — Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics — Part 1: Standard method*

ISO 1183-1, *Plastics — Methods for determining the density of non-cellular plastics — Part 1: Immersion method, liquid pycnometer method and titration method*

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

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 11357-2, *Plastics — Differential scanning calorimetry (DSC) — Part 2: Determination of glass transition temperature and glass transition step height*

ISO 15512, *Plastics — Determination of water content*

ISO 17223, *Plastics — Determination of yellowness index and change in yellowness index*

ISO 20753, *Plastics — Test specimens*

ISO 26723, *Plastics — Determination of total luminous transmittance and reflectance*

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

IEC 60243-1, *Electrical strength of insulating materials — Test methods — Part 1: Tests at power frequencies*

IEC 60296, *Fluids for electrotechnical applications — Unused mineral insulating 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*

IEC 62631-2-1, *Dielectric and resistive properties of solid insulating materials — Part 2-1: Relative permittivity and dissipation factor — Technical frequencies (0.1 Hz to 10 MHz) — AC Methods*

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*

IEC 62631-3-2, *Dielectric and resistive properties of solid insulating materials — Part 3-2: Determination of resistive properties (DC methods) — Surface resistance and surface resistivity*

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 specimen 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, using the same processing conditions. The procedure to be used for each test method is indicated in Table 2.

4.2 Treatment of the material before moulding

Before moulding, the material shall be dried to a moisture level of no more than 0,05 % as determined using ISO 15512.

4.3 Injection moulding

Injection-moulded specimens shall be prepared in accordance with ISO 294-1, using the conditions specified in Table 1.

Table 1 — Conditions for injection moulding of test specimens

Material	Melt temperature °C	Mould temperature °C	Injection velocity mm/s
PSU	345 to 390	100 to 160	200 ± 100
PESU	345 to 390	130 to180	
PPSU	360 to 390	140 to 180	

5 Conditioning of test specimens

Test specimens for melt rheology and thermal analysis (i.e. determination of glass transition temperature, T_g) shall be dried and stored in a desiccator at (23 ± 2) °C before testing. The recommended drying conditions for these specimens are 2 h at 160 °C. The target moisture level is no more than 0,03 %. Test specimens for temperature of deflection under load shall be annealed as per Table 2 before conditioning for at least 24 h at (23 ± 2) °C and (50 ± 10) % relative humidity. Test specimens for other properties shall be conditioned for at least 24 h at (23 ± 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 one of the standard atmospheres in ISO 291 unless specifically stated otherwise in Table 2 and Table 3. A test atmosphere of (23 ± 2) °C and (50 ± 10) % relative humidity shall be used in cases of dispute.

Table 2 is compiled from ISO 10350-1, and the properties listed are those which are appropriate to sulfone polymer moulding and extrusion materials. Table 3 shows the appearance properties. These properties are those considered useful for comparisons of data generated for different thermoplastics.

Table 2 — General properties and test conditions (selected from ISO 10350-1)

Property	Unit	Test method	Specimen type (dimensions in mm)	Specimen preparation	Test conditions and supplementary instructions	
Rheological properties						
Melt mass-flow rate	g/10 min	ISO 1133-1	Moulding compound	—	PSU: 343 °C, load 2,16 kg PESU: 380 °C, load 2,16 kg PPSU: 365 °C, load 5,00 kg Alternative conditions: 360 °C, load 10,00 kg	
Melt volume-flow rate	$cm^3/10$ min					
Moulding shrinkage	%	ISO 294-4	60 × 60 × 2 ISO 294-3 type D2	—	Parallel to the melt flow direction Perpendicular to the direction of melt flow	
Mechanical properties						
Tensile modulus	MPa	ISO 527-2	ISO 20753/A1	Injection moulding	Test speed: 1 mm/min	
Yield stress					Test speed: 50 mm/min for unreinforced materials, and 5,0 mm/min for reinforced materials	
Yield strain	%					
Strain at break						
Tensile creep modulus	MPa	ISO 899-1			At 1 h At 1 000 h	Strain ≤ 0,5 %
Flexural modulus	MPa	ISO 178	80 × 10 × 4		Test speed 2 mm/min	
Flexural strength						
Charpy unnotched impact strength	kJ/m^2	ISO 179-1 or ISO 179-2	80 × 10 × 4		Edgewise impact Also record type of failure	
Charpy notched impact strength			80 × 10 × 4			
Tensile notched impact strength		ISO 8256	80 × 10 × 4 Machined double V-notch, r = 1		Only to be quoted if fracture cannot be obtained with notched Charpy impact test	
Thermal properties						
Glass transition temperature	°C	ISO 11357-2	Moulding compound	—	Use 20 K/min, Use equal-areas method in case of occurrence of enthalpy relaxations.	
Temperature of deflection under load	°C	ISO 75-2	80 × 10 × 4	Injection moulding followed by annealing (see next column)	Heating rate 120 °C/h Flexural stress 1,8 MPa Edgewise impact Anneal specimens for 4 h at 140 °C or for 1 h at one of the following temperatures: PSU: 170 °C; PESU and PPSU: 200 °C. Before testing, condition specimens at (23 ± 2) °C and (50 ± 10) % RH for at least 24 h.	
Vicat softening temperature	°C	ISO 306	≥ 10 × 10 × 4	Injection moulding	Heating rate 50 °C/h Load 50 N	
Burning behaviour	—	IEC 60695-11-10	125 × 13 × 3		Record one of classifications V-0, V-1, V-2, HB40, HB75	
Oxygen index	%	ISO 4589-2	80 × 10 × 4		Use procedure A (top surface ignition)	

Property	Unit	Test method	Specimen type (dimensions in mm)	Specimen preparation	Test conditions and supplementary instructions
Electrical properties					
Relative permittivity	—	IEC 62631-2-1	≥ 60 × ≥ 60 × 2	Injection moulding	Frequency 100 Hz and 1 MHz; compensate for electrode edge effects.
Dissipation factor	—				
Volume resistivity	Ω·m	IEC 62631-3-1	≥ 60 × ≥ 60 × 2		1-min value
Surface resistivity	Ω	IEC 62631-3-2			Voltage 500 V; Use contacting line electrodes 1 mm to 2 mm wide, 50 mm long and 5 mm apart.
Electric strength	kV/mm	IEC 60243-1	≥ 60 × ≥ 60 × 1 or ≥ 60 × ≥ 60 × 2		Use 25 mm/75 mm coaxial-cylinder electrodes. Immerse in transformer oil conforming to IEC 60296. Use a 20 s step-by-step test.
Comparative tracking index	—	IEC 60112	≥ 60 × ≥ 60 × 2		Use solution A
Other properties					
Water absorption	%	ISO 62	60 × 60 × 2	Injection moulding	Measure saturation value in water at 23 °C and equilibrium value at 23 °C and 50 % relative humidity.
Density	kg/m³ (g/cm³)	ISO 1183-1	10 × 10 × 4		Specimen to be taken from moulded product.

Table 3 — Appearance properties and test conditions

Property	Unit	Test method	Specimen type (dimensions in mm)	Specimen preparation	Test conditions and supplementary instructions
Luminous transmittance	%	ISO 26723	Specimen thickness: 2	Injection moulding	Standard illuminant: D65 or C. Before testing, condition specimens at (23 ± 2) °C and (50 ± 10) % RH for at least 40 h. No obstacles within 1,5 meters on the right side of the instrument.
Yellowness index	%	ISO 17223	Specimen thickness: 2		Standard illuminant D65 or C.

Bibliography

[1] ISO 24025-1, *Plastics — Sulfone polymer moulding and extrusion materials — Part 1: Designation system and basis for specifications*

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