



SLOVENSKI STANDARD SIST EN ISO 2535:2000

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Plastics - Unsaturated polyester resins - Measurement of gel time at 25 °C (ISO 2535:1997)

Kunststoffe - Ungesättigte Polyesterharze - Bestimmung der Gel-Zeit bei 25°C (ISO 2535:1997)

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Plastiques - Résines de polyesters non saturés - Mesurage de la durée de gélification a 25°C (ISO 2535:1997)

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN ISO 2535

July 1998

ICS 83.080.10

Descriptors: see ISO document

English version

Plastics - Unsaturated polyester resins - Measurement of gel
time at 25 °C (ISO 2535:1997)

Plastiques - Résines de polyesters non saturés - Mesurage
de la durée de gélification à 25 °C (ISO 2535:1997)

Kunststoffe - Ungesättigte Polyesterharze - Bestimmung
der Gel-Zeit bei 25 °C (ISO 2535:1997)

This European Standard was approved by CEN on 12 June 1998.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

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EN ISO 2535:1998

Foreword

The text of the International Standard from Technical Committee ISO/TC 61 "Plastics" of the International Organization for Standardization (ISO) has been taken over as an European Standard by Technical Committee CEN/TC 249 "Plastics", the secretariat of which is held by IBN.

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 January 1999, and conflicting national standards shall be withdrawn at the latest by January 1999.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Endorsement notice

The text of the International Standard ISO 2535:1997 has been approved by CEN as a European Standard without any modification.

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INTERNATIONAL STANDARD

**ISO
2535**

Second edition
1997-03-01

Plastics — Unsaturated polyester resins — Measurement of gel time at 25 °C

*Plastiques — Résines de polyesters non saturés — Mesurage du temps de
gélification à 25 °C*

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Reference number
ISO 2535:1997(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 2535 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 12, *Thermosetting materials*.

This second edition cancels and replaces the first edition (ISO 2535:1974), of which it constitutes a minor (editorial) revision.

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Plastics – Unsaturated polyester resins – Measurement of gel time at 25 °C

1 Scope

This International Standard specifies a method of measuring, under defined conditions, the gel time at 25 °C of unsaturated polyester resins.

This method is applicable to all resins, but it is particularly useful for cold-setting resins.

2 Normative reference

The following standard contains provision which, through reference in this text, constitute provisions of ISO 2535. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on ISO 2535 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 472:1988, *Plastics — Vocabulary*.

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3 Definition

[SIST EN ISO 2535:2000](#)

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For the purposes of this International Standard, the following definition applies:

3.1 gel time: The time required for a liquid material to form a gel under specified conditions of temperature. [ISO 472]

4 Principle

A mixture of resin with specified amounts of standard accelerator and initiator is prepared at 25 °C.

This mixture is placed in a test tube of specified dimensions, which is immersed in a bath thermostatically controlled at 25 °C.

A device, which is designed to have the least possible effect on the viscometric properties of the mixture, is used to indicate the exact time that the viscosity of the mixture reaches 50 Pa·s (500 P) (the viscosity conventionally taken as corresponding to the start of the gel state). The elapsed time between the end of the addition of the initiator and accelerator and the moment when the viscosity reaches 50 Pa·s is conventionally called the "gel time at 25 °C".

NOTE 1 The type and proportion of accelerator and initiator and the temperature given in this International Standard are reference conditions.

In particular cases, however, other conditions may be agreed between the interested parties (see 7.2).

5 Reagents

5.1 Acetone, of purity $\geq 99\%$.

5.2 Toluene, of purity $\geq 99\%$.

5.3 Reference accelerator: cobalt octoate solution in toluene.

Weigh into a beaker $5\text{ g} \pm 0,01\text{ g}$ of a base solution of cobalt octoate containing 6 % of cobalt metal in an inert solvent. Transfer to a 50 ml volumetric flask fitted with a ground-glass stopper. Make up to 50 ml with toluene (5.2).

1 ml of this solution corresponds to 0,100 g of the base solution of cobalt octoate containing 6 % of cobalt metal.

5.4 Reference initiator: 50 % (m/m) solution of methyl ethyl ketone peroxide in dimethyl phthalate assaying 9 % of active oxygen.

Store this solution in a refrigerator and use it within 1 month of preparation or receipt.

NOTE 2 Commercial methyl ethyl ketone peroxide is a mixture of isomers in variable proportions, and two commercial products assaying the same percentage of active oxygen may give different test results (see clause 10).

WARNING — In no circumstances should the methyl ethyl ketone peroxide and cobalt octoate solutions be mixed together, as an explosive mixture is formed. Mix each separately into the polyester resin.

6 Apparatus

6.1 Borosilicate-glass test tube, having an internal diameter of 18 mm, a length of 180 mm and a wall thickness of $1,2\text{ mm} \pm 0,2\text{ mm}$, fitted with a stopper, to hold the test mixture.

6.2 Viscosity-measuring device, to measure the viscosity of the mixture in the tube.

The device shall be such that it has the least possible effect on the rheological properties of the mixture.

NOTE 3 A description of a suitable device (see figure 1) is given below as an example:

A glass rod, 6 mm in diameter and of sufficient length, is immersed in the mixture to a depth of 50 mm. The rod is rotated about its axis at a slow speed (1 r/min to 2 r/min) by means of a torsion wire driven by a geared electric motor.

When the torsion wire is twisted to the angle corresponding to a viscosity of about 50 Pa·s (500 P), the time is taken. An automatic device may also be used to stop the motor as well as the stopwatch and signal the end of the test.

6.3 Bath, thermostatically controlled at $25\text{ °C} \pm 0,5\text{ °C}$ and protected from light.

6.4 Beaker, capacity 100 ml.

6.5 Two graduated pipettes, capacity 1 ml, graduated in 0,01 ml and **clearly marked to distinguish one from the other**.

6.6 Balance, accurate to within 0,1 g.

6.7 Spatula, stainless steel.

6.8 Stopwatch, accurate to 1 s.

7 Procedure

7.1 Determination

Clean the test tube (6.1) with acetone (5.1), dry and stopper it, and then immerse it to a depth of about 80 mm in the bath (6.3) thermostatically controlled at 25 °C .

Weigh $50\text{ g} \pm 0,1\text{ g}$ of resin into the beaker (6.4), place the latter in the bath at 25 °C and wait a sufficient time for the beaker and its contents to reach that temperature.

Dimensions in millimetres

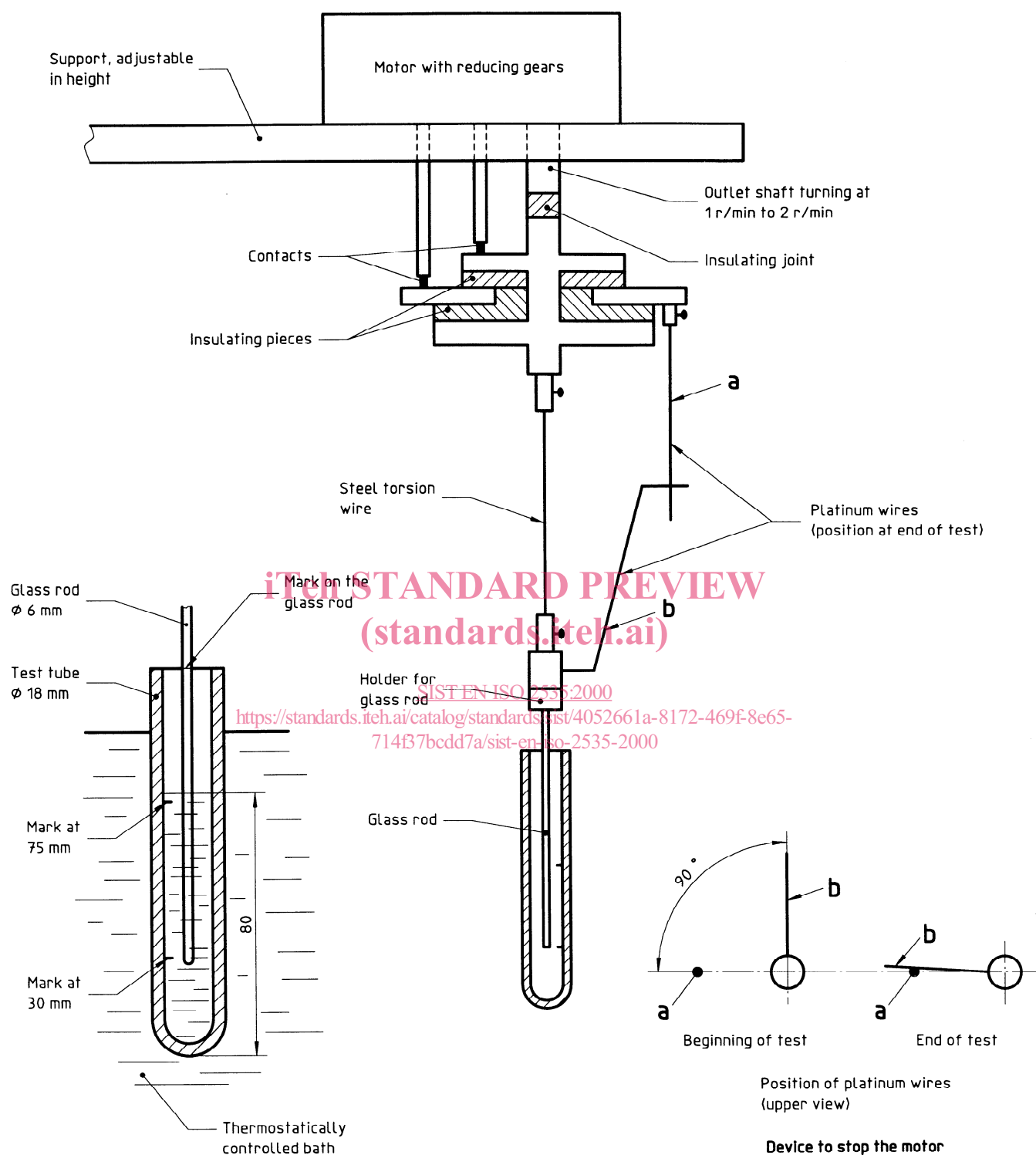


Figure 1 — Example of a suitable apparatus for the measurement of gel time using a rotating glass rod

Using one of the pipettes (6.5), add 0,50 ml of cobalt octoate solution (5.3) to the resin and mix with the spatula (6.7).

Using the other pipette, add 0,70 ml of methyl ethyl ketone peroxide solution (5.4) to the mixture, start the stopwatch (6.8) and mix with the spatula for 30 s.