SLOVENSKI STANDARD
SIST EN ISO 6721-2:1999

01-maj-1999

Polimerni materiali ï Doloļevanje dinamiļnih mehanskih lastnosti ï 2. del: Metoda s torzijskim nihalom (ISO 6721-2:1994, vkljuļno s tehniļnim popravkom 1:1995)

Plastics - Determination of dynamic mechanical properties - Part 2: Torsion-pendulum method (ISO 6721-2:1994, including Technical Corrigendum 1:1995)

Kunststoffe - Bestimmung dynamisch-mechanischer Eigenschaften - Teil 2: Torsionspendel-Verfahren (ISO 6721-2:1994, einschließlich Technische Korrektur 1:1995)

Plastiques - Détermination des propriétés mécaniques dynamiques - Partie 2: Méthode au pendule de torsion (ISO 6721-2:1994, Rectificatif Technique 1:1995 inclus)

Ta slovenski standard je istoveten z: **EN ISO 6721-2:1996**

ICS:

83.080.01	Polimerni materiali na splošno	Plastics in general

SIST EN ISO 6721-2:1999 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 6721-2

February 1996

ICS 83.080

Descriptors: see ISO document

English version

Plastics - Determination of dynamic mechanical properties - Part 2: Torsion-pendulum method (ISO 6721-2:1994, including Technical Corrigendum 1:1995)

Plastiques - Détermination des propriétés mécaniques dynamiques - Partie 2: Méthode au pendule de torsion (ISO 6721-2:1994, Rectificatif Technique 1:1995 inclus)

Kunststoffe - Bestimmung dynamisch-mechanischer Eigenschaften - Teil 2: Torsionspendel-Verfahren (ISO 6721-2:1994, einschließlich Technische Korrektur 1:1995)

This European Standard was approved by CEN on 1996-01-26. 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.

The European Standards exist 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, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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

Ref. No. EN ISO 6721-2:1996 E

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 a 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 August 1996, and conflicting national standards shall be withdrawn at the latest by August 1996.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, 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 6721-2:1994 including Technical Corrigendum 1:1995 has been approved by CEN as a European Standard without any modification.

INTERNATIONAL STANDARD

ISO 6721-2

First edition
1994-11-01

Plastics — Determination of dynamic mechanical properties —

Part 2:
Torsion-pendulum method

Plastiques — Détermination des propriétés mécaniques dynamiques —

Partie 2: Méthode au pendule de torsion

Reference number
ISO 6721-2:1994(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 6721-2 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 2, *Mechanical properties*.

Together with ISO 6721-1, it cancels and replaces ISO 537:1989, which has been technically revised.

ISO 6721 consists of the following parts, under the general title *Plastics — Determination of dynamic mechanical properties*:

- *Part 1: General principles*
- *Part 2: Torsion-pendulum method*
- *Part 3: Flexural vibration — Resonance-curve method*
- *Part 4: Tensile vibration — Non-resonance method*
- *Part 5: Flexural vibration — Non-resonance method*
- *Part 6: Shear vibration — Non-resonance method*
- *Part 7: Torsional vibration — Non-resonance method*

Annex A forms an integral part of this part of ISO 6721. Annexes B, C and D are for information only.

International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

Plastics — Determination of dynamic mechanical properties —

Part 2:
Torsion-pendulum method

1 Scope

This part of ISO 6721 specifies two methods (A and B) for determining the linear dynamic mechanical properties of plastics, i.e. the storage and loss components of the torsional modulus, as a function of temperature, for small deformations within the frequency range from 0,1 Hz to 10 Hz.

The temperature dependence of these properties, measured over a sufficiently broad range of temperatures (for example from − 50 °C to + 150 °C for the majority of commercially available plastics), gives information on the transition regions (for example the glass transition and the melting transition) of the polymer. It also provides information concerning the onset of plastic flow. The two methods described are not applicable to non-symmetrical laminates (see ISO 6721-3:1994, *Plastics — Determination of dynamic mechanical properties — Part 3: Flexural vibration — Resonance-curve method*). The methods are not suitable for testing rubbers, for which the user is referred to ISO 4663:1986, *Rubber — Determination of dynamic behaviour of vulcanizates at low frequencies — Torsion pendulum method.*

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this part of ISO 6721. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this part of ISO 6721 are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 6721-1:1994, *Plastics — Determination of dynamic mechanical properties — Part 1: General principles.*

3 Definitions

See ISO 6721-1:1994, clause 3.

4 Principle

A test specimen of uniform cross-section is gripped by two clamps, one of them fixed and the other connected to a disc, which acts as an inertial member, by a rod. The end of the specimen connected to the disc is excited, together with the disc, to execute freely decaying torsional oscillations. The oscillation mode is that designated IV in ISO 6721-1:1994, table 2, and the type of modulus is G_{to} as defined in ISO 6721-1:1994, table 3.

The inertial member is suspended either from the specimen (method A, see figure 1), or from a wire (method B, see figure 2). In the latter case, the wire is also part of the elastically oscillating system.

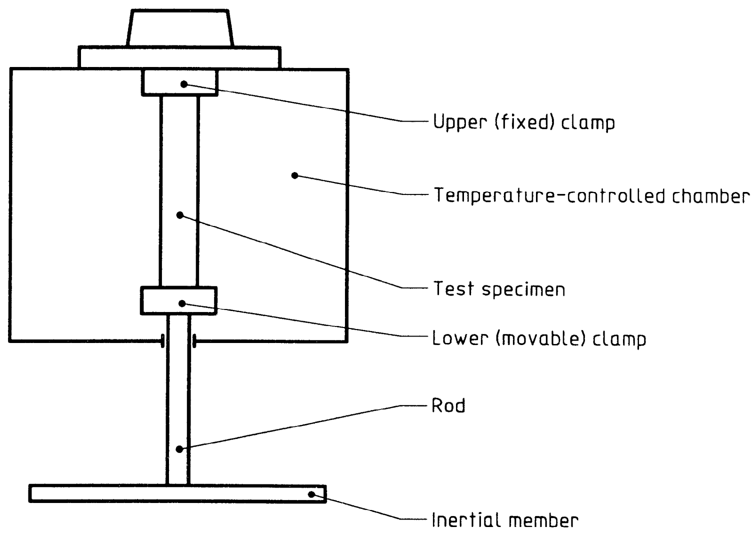

Figure 1 — Apparatus for method A

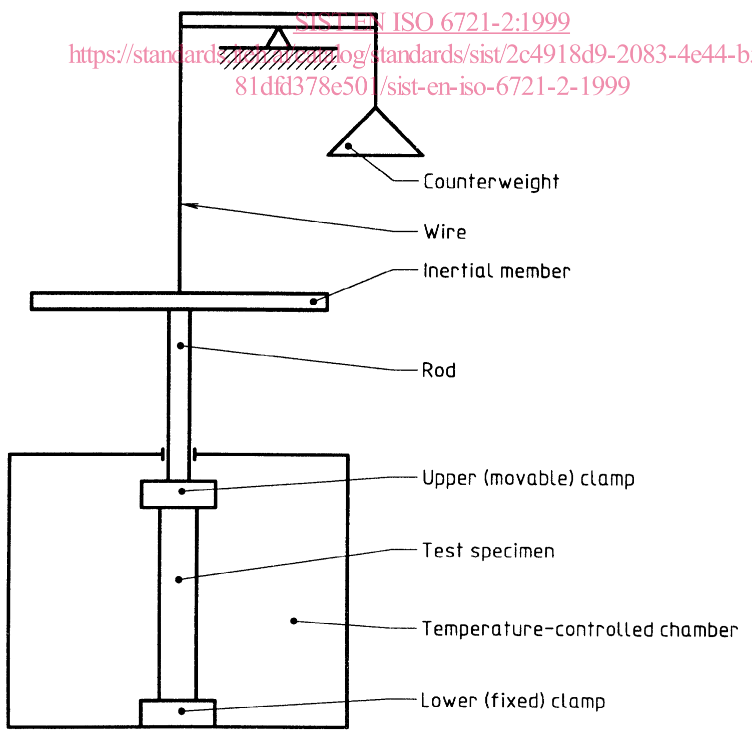

Figure 2 — Apparatus for method B

During a temperature run, the same inertial member can be used throughout the whole run, which results in a frequency decreasing naturally with increasing temperature, or the inertial member can be replaced at intervals by a member of different moment of inertia in order to keep the frequency approximately constant.

During the test, the frequency and the decaying amplitude are measured. From these quantities, the storage component G'_{to} and loss component G''_{to} of the torsional complex modulus G^*_{to} can be calculated.

5 Test apparatus

5.1 Pendulum

Two types of torsion pendulum are specified for use with this part of ISO 6721:

a) the inertial member is suspended from the test specimen and the lower end of the specimen is excited (method A, figure 1);

b) the inertial member is suspended from a wire attached to a counterweight and the upper end of the specimen is excited (method B, figure 2).

Both types of pendulum consists of an intertial member, two clamps for gripping the specimen (one of which is connected to the inertial member by a rod) and a temperature-controlled chamber enclosing the specimen and the clamps. For method B, a counterweight and connecting wire are also required.

5.2 Inertial member

The moment of inertia I of the inertial member, which may be made of aluminium, for instance, shall be selected as a function of the torsional stiffness of the specimen, so that the temperature-dependent natural frequency of the system lies between approximately 0,1 Hz and 10 Hz.

When testing standard specimens (see 6.1), a moment of inertia I of about 3×10^{-5} kg·m^2 is recommended if the same inertial member is to be used throughout a run.

NOTE 1 For certain materials, e.g. filled polymers, a value of I of about 5×10^{-5} kg·m^2 may be necessary.

If a constant frequency is desired over a broad temperature range, interchangeable inertial members with different values of I may be used, thereby permitting the moment of inertia to be varied in steps of less than 20 %, i.e. the frequency to be corrected in steps of less than 10 %. When testing standard specimens (see 6.1) at a frequency of about 1 Hz, a maximum moment of inertia of about 3×10^{-3} kg·m^2 is recommended.

5.2.1 Method A (see figure 1)

The total mass of the inertial member, the lower clamp, and the connecting rod shall be such that the weight W carried by the specimen is not too high [see annex A, equation (A.2)].

5.2.2 Method B (see figure 2)

The total mass of the inertial member, the upper clamp and the rod must be balanced by a suitable counterweight, so that the longitudinal force W acting on the specimen is minimized [see annex A, equation (A.2)]. The wire supporting these parts is part of the elastically oscillating system.

5.3 Clamps

The clamps shall be designed to prevent movement of the portion of the specimens gripped within them. They shall be self-aligning in order to ensure that the specimen axis remains aligned with the axis of rotation and the test specimen remains adequately secured over the whole temperature range without distortion occurring, thus allowing the free length of the specimen to be accurately determined.

The movable clamp shall be of low mass.

The moment of inertia of the whole system (consisting of the movable clamp, the inertial member and the connecting rod) shall be determined experimentally.

To prevent heat passing from the specimen out of the temperature-controlled chamber and in the opposite direction, the rod connecting the movable clamp and the inertial member shall be thermally non-conducting.

5.4 Oscillation-inducing device

The oscillation-inducing device shall be capable of applying to the pendulum a torsional impulse such that the pendulum oscillates initially through an angle of not more than 1,5° in each direction for normal materials, or not more than 3° in each direction for low-modulus materials (such as elastomers).

5.5 Oscillation-frequency and oscillation-amplitude recording equipment

Optical, electrical or other recording systems may be used provided they have no significant influence on