SLOVENSKI STANDARD
SIST EN ISO 1628-1:2000

01-maj-2000

Polimerni materiali - Določanje viskoznosti polimerov v razredčenih raztopinah s kapilarnimi viskozimetri - 1. del: Splošna načela (ISO 1628-1:1998)

Plastics - Determination of the viscosity of polymers in dilute solution using capillary viscometers - Part 1: General principles (ISO 1628-1:1998)

Kunststoffe - Bestimmung der Viskosität von Polymeren in verdünnter Lösung durch ein Kapillarviskosimeter - Teil 1: Allgemeine Grundlagen (ISO 1628-1:1998)

Plastiques - Détermination de la viscosité des polymères en solution diluée a l'aide de viscosimetres a capillaires - Partie 1: Principes généraux (ISO 1628-1:1998)

Ta slovenski standard je istoveten z: **EN ISO 1628-1:1998**

ICS:

83.080.01	Polimerni materiali na splošno	Plastics in general

SIST EN ISO 1628-1:2000 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 1628-1

September 1998

ICS 83.080.10

Descriptors: see ISO document

English version

Plastics - Determination of the viscosity of polymers in dilute solution using capillary viscometers - Part 1: General principles (ISO 1628-1:1998)

Plastiques - Détermination de la viscosité des polymères en solution diluée à l'aide de viscosimètres à capillaires - Partie 1: Principes généraux (ISO 1628-1:1998)

Kunststoffe - Bestimmung der Viskosität von Polymeren in verdünnter Lösung durch ein Kapillarviskosimeter - Teil 1: Allgemeine Grundlagen (ISO 1628-1:1998)

This European Standard was approved by CEN on 4 September 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.

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 1628-1:1998 E

Foreword

The text of the International Standard ISO 1628-1:1998 has been prepared by Technical Committee ISO/TC 61 "Plastics" in collaboration with Technical Committee CEN/TC 249 "Pastics", 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 March 1999, and conflicting national standards shall be withdrawn at the latest by March 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 1628-1:1998 was approved by CEN as a European Standard without any modification.

INTERNATIONAL STANDARD

ISO 1628-1

Second edition
1998-09-15

Plastics — Determination of the viscosity of polymers in dilute solution using capillary viscometers —

Part 1:
General principles

Plastiques — Détermination de la viscosité des polymères en solution diluée à l'aide de viscosimètres à capillaires —

Partie 1: Principes généraux

Reference number
ISO 1628-1:1998(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 1628-1 was prepared by Technical Committee ISO/TC 61, *Plastics,* Subcommittee SC 5, *Physical-chemical properties*.

This second edition cancels and replaces the first edition (ISO 1628-1: 1984), which has been revised to include

a) the determination of the K-value;

b) a procedure for the determination of the efflux times for several solution concentrations by the addition of solvent to a given solution held in the viscometer;

c) revised viscometer specifications.

ISO 1628 consists of the following parts, under the general title *Plastics — Determination of the viscosity of polymers in dilute solution using capillary viscometers*:

— *Part 1: General principles*

— *Part 2: Poly(vinyl chloride) resins*

— *Part 3: Polyethylenes and polypropylenes*

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Printed in Switzerland

— *Part 4: Polycarbonate (PC) moulding and extrusion materials*

— *Part 5: Thermoplastic polyester (TP) homopolymers and copolymers*

— *Part 6: Methyl methacrylate polymers*

Annexes A and B form an integral part of this part of ISO 1628. Annex C is for information only.

Plastics — Determination of the viscosity of polymers in dilute solution using capillary viscometers —

Part 1:
General principles

1 Scope

This part of ISO 1628 defines the general conditions for the determination of the reduced viscosity, intrinsic viscosity and K-value of organic polymers in dilute solution. It defines the standard parameters that are applied to viscosity measurement, and can be used to develop standards for measuring the viscosities in solution of individual types of polymer. It can also be used to measure and report the viscosities of polymers in solution for which no separate standards exist.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 1628. 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 1628 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 31-0:1992, *Quantities and units — Part 0: General principles.*

ISO 31-3:1992, *Quantities and units — Part 3: Mechanics.*

ISO 3105:1994, *Glass capillary kinematic viscometers — Specifications and operating instructions.*

ISO 3205:1976, *Preferred test temperatures.*

3 Definitions

3.1 Dimensions and units

The dimensions of properties defined in this part of ISO 1628 are expressed in terms of L for length, M for mass and T for time in accordance with ISO 31-0, while the units appropriate to the properties are given in ISO 31-0 and ISO 31-3.

3.2 Definitions applicable to any liquid

3.2.1 viscosity: The viscosity of a fluid sheared between two parallel plates, one of which moves relative to the other in uniform rectilinear motion in its own plane, is defined by the Newton equation

$$\tau = \eta \dot{\gamma} \qquad ...(1)$$

where

τ is the shear stress;

η is the viscosity;

$\dot{\gamma}$ is the velocity gradient or rate of shear, given by $\frac{dv}{dz}$ where v is the velocity of one plane relative to the other and z the coordinate perpendicular to the two planes.

The dimensions of viscosity are: $ML^{-1}T^{-1}$.

The units of viscosity are: Pa·s.

For practical use, the sub-multiple 10^{-3} Pa·s is more convenient.

NOTE — Viscosity is usually taken to mean “Newtonian viscosity”, in which case the ratio of shearing stress to velocity gradient is constant. In non-Newtonian behaviour, which is the usual case with high-polymer solutions, the ratio varies with the shear rate. Such ratios are often called “apparent viscosities” at the corresponding shear rate.

3.2.2 viscosity/density ratio; kinematic viscosity, ν: This ratio is defined by the equation

$$\nu = \frac{\eta}{\rho} \qquad ...(2)$$

where ρ is the density of the fluid at the temperature at which the viscosity is measured.

The dimensions of kinematic viscosity are: L^2T^{-1}.

The units of kinematic viscosity are $m^2 \cdot s^{-1}$.

For practical use, the sub-multiple 10^{-6} $m^2 \cdot s^{-1}$, i.e. $mm^2 \cdot s^{-1}$, is more convenient.

3.3 Definitions applicable to polymer solutions

3.3.1 relative viscosity, η_r (also known as viscosity ratio)**:** The ratio of the viscosity of the polymer solution (of stated concentration) η and the viscosity of the pure solvent η_0, at the same temperature:

$$\eta_r = \frac{\eta}{\eta_0} \qquad ...(3)$$

The ratio has no dimensions.

3.3.2 relative viscosity increment (also known as viscosity ratio increment and specific viscosity)**:** The viscosity ratio minus one:

$$\left(\frac{\eta}{\eta_0}\right)-1=\frac{\eta-\eta_0}{\eta_0} \qquad ...(4)$$

The increment has no dimensions.

3.3.3 reduced viscosity, I (also known as viscosity number)**:** The ratio of the viscosity ratio increment to the polymer concentration c in the solution:

$$I=\frac{\eta-\eta_0}{\eta_0\, c} \qquad ...(5)$$

The dimensions of reduced viscosity are: L^3M^{-1}.

The units of reduced viscosity are m^3/kg.

For practical use, the sub-multiple 10^{-3} m^3/kg, i.e. cm^3/g, is more convenient and the commonly quoted numerical values for reduced viscosity (viscosity number) use these practical units.

The reduced viscosity is usually determined at low concentration (less than 5 kg/m^3, i.e. 0,005 g/cm^3), except in the case of polymers of low molar mass, for which higher concentrations may be necessary.

3.3.4 inherent viscosity (also known as logarithmic viscosity number)**:** The ratio of the natural logarithm of the viscosity ratio to the polymer concentration in the solution:

$$\frac{\ln\left(\frac{\eta}{\eta_0}\right)}{c} \qquad ...(6)$$

The dimensions and units are the same as those given in 3.3.3.

The inherent viscosity is usually determined at low concentration (less than 5 kg/m^3, i.e. 0,005 g/cm^3), except in the case of polymers of low molar mass, for which higher concentrations may be necessary.

3.3.5 intrinsic viscosity, $[\eta]$ (also known as limiting viscosity number)**:** The limiting value of the reduced viscosity or of the inherent viscosity at infinite dilution:

$$[\eta]=\lim_{c\to 0}\left(\frac{\eta-\eta_0}{\eta_0\, c}\right) \qquad ...(7)$$

$$[\eta]=\lim_{c\to 0}\frac{\ln\left(\frac{\eta}{\eta_0}\right)}{c}$$

The dimensions and units are the same as those given in 3.3.3.