SLOVENSKI STANDARD
SIST EN ISO 1133:2005

01-oktober-2005

Nadomešča:
SIST EN ISO 1133:2000

Polimerni materiali - Ugotavljanje masnega (MFR) in volumskega pretoka taline (MVR) plastomerov (ISO 1133:2005)

Plastics - Determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics (ISO 1133:2005)

Kunststoffe - Bestimmung der Schmelze-Massefließrate (MFR) und der Schmelze-Volumenfließrate (MVR) von Thermoplasten (ISO 1133:2005)

Plastiques - Détermination de l'indice de fluidité à chaud des thermoplastiques, en masse (MFR) et en volume (MVR) (ISO 1133:2005)

Ta slovenski standard je istoveten z: **EN ISO 1133:2005**

ICS:

83.080.20	Plastomeri	Thermoplastic materials

SIST EN ISO 1133:2005 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 1133

June 2005

ICS 83.080.20

Supersedes EN ISO 1133:1999

English version

Plastics - Determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics (ISO 1133:2005)

Plastiques - Détermination de l'indice de fluidité à chaud des thermoplastiques, en masse (MFR) et en volume (MVR) (ISO 1133:2005)

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This European Standard was approved by CEN on 19 May 2005.

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Ref. No. EN ISO 1133:2005: E

Foreword

This document (EN ISO 1133:2005) 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 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of an identical text or by endorsement, at the latest by December 2005, and conflicting national standards shall be withdrawn at the latest by December 2005.

This document supersedes EN ISO 1133:1999.

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

Endorsement notice

The text of ISO 1133:2005 has been approved by CEN as EN ISO 1133:2005 without any modifications.

INTERNATIONAL STANDARD

ISO 1133

Fourth edition
2005-06-01

Plastics — Determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics

Plastiques — Détermination de l'indice de fluidité à chaud des thermoplastiques, en masse (MFR) et en volume (MVR)

Reference number
ISO 1133:2005(E)

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Published in Switzerland

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 1133 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 5, *Physical-chemical properties*.

This fourth edition cancels and replaces the third edition (ISO 1133:1997), in which the clauses relating to temperature control have been revised. In addition, the clarity of the text has been improved.

Plastics — Determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics

1 Scope

This International Standard specifies two procedures for the determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastic materials under specified conditions of temperature and load. Procedure A is a mass-measurement method. Procedure B is a displacement-measurement method. Normally, the test conditions for measurement of melt flow rate are specified in the material standard with a reference to this International Standard. The test conditions normally used for thermoplastics are listed in Annexes A and B.

The MVR will be found particularly useful when comparing materials of different filler content and when comparing filled with unfilled thermoplastics. The MFR can be determined from MVR measurements provided the melt density at the test temperature and pressure is known.

These methods are in principle also applicable to thermoplastics for which the rheological behaviour is affected during the measurement by phenomena such as hydrolysis, condensation or crosslinking, but only if the effect is limited in extent and only if the repeatability and reproducibility are within an acceptable range. For materials which show significantly affected rheological behaviour during testing, these methods are not appropriate. In such cases, the use of the viscosity number in dilute solution, determined in accordance with the relevant part of ISO 1628, is recommended for characterization purposes.

NOTE The rates of shear in these methods are much smaller than those used under normal conditions of processing, and therefore data obtained by these methods for various thermoplastics may not always correlate with their behaviour during processing. Both methods are used primarily in quality control.

2 Normative references

The following referenced documents are indispensable for the application 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 1622-2, *Plastics — Polystyrene (PS) moulding and extrusion materials — Part 2: Preparation of test specimens and determination of properties*

ISO 1628 (all parts), *Plastics — Determination of the viscosity of polymers in dilute solution using capillary viscometers*

ISO 1872-2, *Plastics — Polyethylene (PE) moulding and extrusion materials — Part 2: Preparation of test specimens and determination of properties*

ISO 1873-2, *Plastics — Polypropylene (PP) moulding and extrusion materials — Part 2: Preparation of test specimens and determination of properties*

ISO 2580-2, *Plastics — Acrylonitrile-butadiene-styrene (ABS) moulding and extrusion materials — Part 2: Preparation of test specimens and determination of properties*

ISO 2897-2, *Plastics — Impact-resistant polystyrene (PS-I) moulding and extrusion materials — Part 2: Preparation of test specimens and determination of properties*

ISO 4287, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Terms, definitions and surface texture parameters*

ISO 4613-2, *Plastics — Ethylene/vinyl acetate (E/VAC) moulding and extrusion materials — Part 2: Preparation of test specimens and determination of properties*

ISO 4894-2, *Plastics — Styrene/acrylonitrile (SAN) moulding and extrusion materials — Part 2: Preparation of test specimens and determination of properties*

ISO 6402-2, *Plastics — Acrylonitrile-styrene-acrylate (ASA), acrylonitrile-(ethylene-propylene-diene)-styrene (AEPDS) and acrylonitrile-(chlorinated polyethylene)-styrene (ACS) moulding and extrusion materials — Part 2: Preparation of test specimens and determination of properties*

ISO 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method*

ISO 7391-2, *Plastics — Polycarbonate (PC) moulding and extrusion materials — Part 2: Preparation of test specimens and determination of properties*

ISO 8257-2, *Plastics — Poly(methyl methacrylate) (PMMA) moulding and extrusion materials — Part 2: Preparation of test specimens and determination of properties*

ISO 8986-2, *Plastics — Polybutene (PB) moulding and extrusion materials — Part 2: Preparation of test specimens and determination of properties*

ISO 9988-2, *Plastics — Polyoxymethylene (POM) moulding and extrusion materials — Part 2: Preparation of test specimens and determination of properties*

ISO 10366-2, *Plastics — Methyl methacrylate-acrylonitrile-butadiene-styrene (MABS) moulding and extrusion materials — Part 2: Preparation of test specimens and determination of properties*

ISO 15494, *Plastic piping systems for industrial applications — Polybutene (PB), polyethylene (PE) and polypropylene (PP) — Specifications for components and the system — Metric series*

ISO 15876-3, *Plastics piping systems for hot and cold water installations — Polybutylene (PB) — Part 3: Fittings*

3 Terms and definitions

For the purpose of this document, the following terms and definitions apply.

3.1
melt mass-flow rate
MFR
rate of extrusion of a molten resin through a die of specified length and diameter under prescribed conditions of temperature, load and piston position in the barrel of an extrusion plastometer, the rate being determined as the mass extruded over a specified time

NOTE The correct SI units are decigrams per minute (dg/min). However, grams per 10 minutes (g/10 min) have customarily been used in the past and are also acceptable.

3.2
melt volume-flow rate
MVR
rate of extrusion of a molten resin through a die of specified length and diameter under prescribed conditions of temperature, load and piston position in the barrel of an extrusion plastometer, the rate being determined as the volume extruded over a specified time

NOTE The correct SI units are cubic decimetres per minute (dm^3/min). More commonly used units, which are also acceptable, are cubic centimetres per 10 minutes (cm^3/10 min).

3.3
load
combined mass of piston and added weight, as specified by the conditions of the test

NOTE It is expressed in kilograms (kg).

4 Principle

The melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) are determined by extruding molten material from the barrel of a plastometer under preset conditions of temperature and load. For melt mass-flow rate, timed segments of the extrudate are weighed and the extrudate rate is calculated in g/10 min and recorded. For melt volume-flow rate, the distance that the piston moves in a specified time or the time required for the piston to move a specified distance is measured to generate data in cm^3/10 min. Melt volume-flow rate may be converted to melt mass-flow rate, or *vice-versa*, if the density of the material is known under the conditions of the test.

5 Apparatus

5.1 Extrusion plastometer

The basic apparatus comprises an extrusion plastometer operating at a fixed temperature. The general design is as shown in Figure 1. The thermoplastic material, which is contained in a vertical cylinder, is extruded through a die by a piston loaded with a known weight. The apparatus consists of the following essential parts.

5.1.1 Cylinder, fixed in a vertical position (see 5.1.5). The cylinder shall be manufactured from a material resistant to wear and corrosion up to the maximum temperature of the heating system, and the finish, properties and dimensions of its surface shall not be affected by the material being tested. For particular materials, measurements may be required at temperatures up to 450 °C. The cylinder shall have a length between 115 mm and 180 mm and an internal diameter of 9,550 mm ± 0,025 mm. The base of the cylinder shall be thermally insulated in such a way that the area of exposed metal is less than 4 cm^2, and it is recommended that an insulating material such as Al_2O_3, ceramic fibre or another suitable material be used in order to avoid sticking of the extrudate.

The bore shall be hardened to a Vickers hardness of no less than 500 (HV 5 to HV 100) (see ISO 6507-1) and shall be manufactured by a technique that produces a surface roughness of less than Ra (arithmetical mean deviation) = 0,25 µm (see ISO 4287). If necessary, a piston guide shall be provided to keep friction caused by misalignment of the piston down to a minimum.

NOTE Excessive wear of the cylinder, piston head, and piston is an indication of misalignment of the piston. Regular checking for wear and change to the surface appearance of the cylinder, piston and piston head is required to ensure these items are within specification.

5.1.2 Piston, having a working length at least as long as the cylinder. The piston shall be manufactured from a material resistant to wear and corrosion up to the maximum temperature of the heating system and its properties and dimensions shall not be affected by the material being tested. The piston shall have a head 6,35 mm ± 0,10 mm in length. The diameter of the head shall be less than the internal diameter of the cylinder by 0,075 mm ± 0,010 mm. The upper edge shall have its sharp edge removed. Above the head, the piston