INTERNATIONAL STANDARD

ISO 1133-2

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

Part 2: Method for materials sensitive to time-temperature history and/or moisture

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

Partie 2: Méthode pour les matériaux sensibles à l'historique temps-température et/ou à l'humidité

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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 1133-2 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 5, *Physical-chemical properties*.

ISO 1133 consists of the following parts, under the general title *Plastics — Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics*:

— *Part 1: Standard method*

— *Part 2: Method for materials sensitive to time-temperature history and/or moisture*

Introduction

This part of ISO 1133 provides a method that is appropriate to those materials that exhibit a high rheological sensitivity to the time-temperature history experienced by the sample during the test and/or moisture. For such materials, ISO 1133-1, which has less-tightly specified testing conditions than this part of ISO 1133, is considered to be unsuitable for obtaining data of an acceptable level of precision (i.e. at least equivalent to that obtained by ISO 1133-1 for stable materials). This part of ISO 1133 is considered to be particularly relevant for moisture sensitive materials.

The primary difference between this part of ISO 1133 and ISO 1133-1 is that this part of ISO 1133 specifies tighter tolerances on the temperature, time line, sample amount and pre-treatment, resulting in more reproducible and accurate measurements.

The accuracy of MVR determination of thermoplastic materials whose rheological behaviour is affected by phenomena such as hydrolysis and condensation is often significantly influenced by:

— moisture content and sample conditioning;

— sample handling;

— a small difference in temperature, i.e. the temperature variation in the cylinder with position and/or time;

— the total time that the material is exposed to the test temperature;

— the sample volume;

— sample form (shape and size — pellets, powder, flake, etc.);

— cleaning of the apparatus.

In order to obtain accurate repeatable and reproducible results, not only does the equipment need to meet the requirements specified in this part of ISO 1133, but also the material handling and test procedure need to be followed precisely and consistently, particularly with respect to those details mentioned above to which the results are sensitive. Minor deviations from the equipment requirements, procedure and/or sample handling can result in considerable loss of repeatability, reproducibility and accuracy of the measurement.

In general, the test conditions for determination of MVR and MFR values are specified in the material standard and shall be referred to prior to conducting tests. Test conditions for the determination of MVR and MFR of materials whose rheological behaviour is affected by hydrolysis, condensation or cross-linking during the measurement are in many cases not yet mentioned in the materials standards. Standards for these materials are likely to be revised or developed in the future. Where no relevant material standard exists or where no test conditions are specified, then the drying and test conditions should be agreed between the interested parties.

NOTE At the time of publication, there is no evidence to suggest that the use of this part of ISO 1133 for stable materials results in better precision in comparison with the use of ISO 1133-1.

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

Part 2:
Method for materials sensitive to time-temperature history and/or moisture

WARNING — Persons using this document should be familiar with normal laboratory practice, if applicable. This document does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any regulatory requirements.

IMPORTANT — The equipment shall meet the requirements specified in this document and the measurements shall be carried out under specified conditions of temperature and load with special attention being paid to sample pre-treatment, strictly following the procedure prescribed in this document and in any applicable material standard.

1 Scope

This part of ISO 1133 specifies a procedure for the determination of the melt volume-flow rate (MVR) and melt mass-flow rate (MFR) of thermoplastic materials that exhibit a high rheological sensitivity to the time-temperature history experienced by the sample during the test and/or to moisture.

NOTE 1 Some grades of materials affected by hydrolysis are of, for example, poly(ethylene terephthalate) (PET), poly(butylene terephthalate) (PBT), poly(ethylene naphthalate) (PEN), other polyester types and polyamides; and by cross-linking are of, for example, thermoplastic elastomers (TPE) and thermoplastic vulcanizates (TPV). It is possible that this method will also be suitable for use with other materials.

It is possible that this method will not be appropriate for materials whose rheological behaviour is extremely affected during testing (see Note 2).

NOTE 2 For materials where the coefficient of variation of the MFR or MVR results is found to be higher than the precision mentioned in ISO 1133-1, the viscosity number in dilute solution (ISO 307, ISO 1628) can be more appropriate for characterization purposes.

NOTE 3 Minor deviations from the equipment requirements, procedure and/or sample handling can result in considerable loss of reproducibility, repeatability and accuracy of the measurement. MVR results determined on different materials, indicating the repeatability of the test method of this part of ISO 1133 when measured under ideal measurement conditions, are reported in Annex B.

MFR values can be determined by calculation from MVR measurements provided the melt density at the test temperature and pressure is known, or by measurement using a cutting device provided that the accuracy of the measurement is at least the same as that of the MVR measurement.

NOTE 4 The density of the melt is required at the test temperature and pressure. In practice, the pressure is low and values obtained at the test temperature and ambient pressure suffice.

The primary difference between this part of ISO 1133 and ISO 1133-1 is that this part of ISO 1133 specifies tighter tolerances on the temperature in the cylinder and on the time duration over which the material is subjected to that temperature. Thus the time-temperature history of the material is more tightly controlled and consequently, for materials that are likely to be affected by exposure to elevated temperatures, the variability of test results is reduced compared with whether the specifications of ISO 1133-1 were used.