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Rubber, vulcanized — Determination of low-temperature characteristics — Temperature-retraction procedure (TR test)

Caoutchouc vulcanisé — Détermination des caractéristiques à basse température — Méthode température-retrait (essai TR)

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 2, *Testing and analysis*.

This sixth edition cancels and replaces the fifth edition (ISO 2921:2011), which has been technically revised.

The main changes compared to the previous edition are as follows:

— In 5.8, a clarification has been included as for how to set the slight tension on the test pieces.

— Precision results has been added as Annex B.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Rubber, vulcanized — Determination of low-temperature characteristics — Temperature-retraction procedure (TR test)

WARNING 1 — Persons using this document should be familiar with normal laboratory practice. 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 determine the applicability of any other restrictions.

WARNING 2 — Certain procedures specified in this document might involve the use or generation of substances, or the generation of waste, that could constitute a local environmental hazard. Reference should be made to appropriate documentation on safe handling and disposal after use.

1 Scope

This document specifies a method for the determination of the temperature-retraction characteristics of stretched vulcanized rubber.

This document does not cover thermoplastic rubbers, as many thermoplastic elastomers have a yield point in the range of 5 % to 20 % elongation.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 18899:2013, *Rubber — Guide to the calibration of test equipment*

ISO 23529, *Rubber — General procedures for preparing and conditioning test pieces for physical test methods*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at http://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 Principle

A test piece is stretched at standard laboratory temperature and then cooled to a sufficiently low temperature such that retraction does not occur upon removal of the stretching force. The stretching force is removed and the temperature increased at a uniform rate. The temperatures at which specified percentage retractions occur are determined.

5 Apparatus

5.1 Retraction apparatus, comprising the components specified in 5.2 to 5.8 (see also Figure 1).

5.2 Heat-transfer medium, liquid or gaseous, which remains fluid at the test temperature and which does not appreciably affect the material being tested, as prescribed in ISO 23529.

Gases may be employed as the heat-transfer medium provided the design of the apparatus is such that results obtained using them will duplicate those obtained with liquids.

The following fluids have been used satisfactorily:

a) for temperatures down to −60 °C, silicone fluids are usually suitable owing to their chemical inertness towards rubbers, their non-flammability and their non-toxicity;

NOTE A kinematic viscosity of about 5 mm^2/s at ambient temperature has been found suitable.

b) for temperatures down to −73 °C, ethanol;

c) for temperatures down to −120 °C, methylcyclohexane cooled by liquid nitrogen (found to be satisfactory with the use of suitable apparatus).

5.3 Temperature-measuring device, capable of measuring the temperature to within 0,5 °C over the whole range of temperatures over which the apparatus is to be used.

The temperature sensor shall be positioned near the test pieces.

5.4 Temperature control, capable of maintaining the temperature of the heat-transfer medium to within ±1 °C.

5.5 Container for the heat-transfer medium: A bath for a liquid medium or a test chamber for a gaseous medium, with means of heating the heat-transfer medium.

5.6 Means of agitating the heat-transfer medium: A stirrer for liquids or a fan or blower for gases, which ensures thorough circulation of the heat-transfer medium. It is important that the stirrer also moves the liquid vertically to ensure a uniform temperature in the liquid.

5.7 Stopwatch or other timing device, calibrated in seconds.

5.8 Rack with test piece holders, equipped with a loading device, holders for one or more test pieces and a locking device for the upper (movable) test piece holders (see Figure 1).

The rack shall be designed to maintain a slight tension (10 kPa to 20 kPa in air) on each test piece and to permit them to be stretched up to a maximum of 350 %; the design shall permit the upper test piece holder to be locked into position at the chosen elongation and subsequently released. Means shall be provided to enable the length of each test piece to be read, at any time during the test, with an accuracy of ±0,25 mm or better.

Alternatively, a series of removable scales graduated to allow the retraction to be read directly as a percentage of the elongation of the frozen rubber with an accuracy of ±0,5 % may be used as long as the tolerance is met.

The rack shall be designed to keep a slight tension of 10 kPa to 20 kPa in the liquid used.

Set the extra slight tension by having the upper test piece holder in a position in the middle of the elongation to be used and balance the holder. Then add weights to get the tension in the range of 10 kPa to 20 kPa. This is done at standard laboratory temperature.

NOTE The tension of the upper test piece holder is influenced of the liquid having a buoyancy effect depending of the volume of the test piece holder in the liquid.

The movable parts of the apparatus shall be constructed so that the lowest possible friction occurs.

