INTERNATIONAL STANDARD

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Rubber, vulcanized or thermoplastic — Accelerated ageing and heat resistance tests

Caoutchouc vulcanisé ou thermoplastique — Essais de résistance au vieillissement accéléré et à la chaleur

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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

This fifth edition cancels and replaces the fourth edition (ISO 188:2007), of which it constitutes a minor revision to include an annex (Annex D) specifying a calibration schedule for the apparatus used.

Introduction

Accelerated ageing and heat resistance tests are designed to estimate the relative resistance of rubber to deterioration with the passage of time. For this purpose, the rubber is subjected to controlled deteriorating influences for definite periods, after which appropriate properties are measured and compared with the corresponding properties of the unaged rubber.

In accelerated ageing, the rubber is subjected to a test environment intended to produce the effect of natural ageing in a shorter time.

In the case of heat resistance tests, the rubber is subjected to prolonged periods at the same temperature as that which it will experience in service.

Two types of method are given in this International Standard, namely an air-oven method using a low air speed and an air-oven method using forced air ventilation for a high air speed.

The selection of the time, temperature and atmosphere to which the test pieces are exposed and the type of oven to use will depend on the purpose of the test and the type of polymer.

In air-oven methods, deterioration is accelerated by raising the temperature. The degree of acceleration thus produced varies from one rubber to another and from one property to another.

Degradation can also be accelerated by air speed. Consequently, ageing with different ovens can give different results.

Consequences of these effects are:

a) Accelerated ageing does not truly reproduce under all circumstances the changes produced by natural ageing.

b) Accelerated ageing sometimes fails to indicate accurately the relative natural or service life of different rubbers; thus, ageing at temperatures greatly above ambient or service temperatures may tend to equalize the apparent lives of rubbers, which deteriorate at different rates in storage or service. Ageing at one or more intermediate temperatures is useful in assessing the reliability of accelerated ageing at high temperatures.

c) Accelerated ageing tests involving different properties may not give agreement in assessing the relative lives of different rubbers and may even arrange them in different orders of merit. Therefore, deterioration should be measured by the changes in property or properties which are of practical importance, provided that they can be measured reasonably accurately.

Air-oven ageing should not be used to simulate natural ageing which occurs in the presence of either light or ozone when the rubbers are stretched.

To estimate lifetime or maximum temperature of use, tests can be performed at several temperatures and the results can be evaluated by using an Arrhenius plot or the Williams Landel Ferry (WLF) equation as described in ISO 11346[2].

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WARNING — Persons using this International Standard should be familiar with normal laboratory practice. This standard 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 national regulatory conditions.

1 Scope

This International Standard specifies accelerated ageing or heat resistance tests on vulcanized or thermoplastic rubbers. Two methods are given:

Method A: air-oven method using a cell-type oven or cabinet oven with low air speed and a ventilation of 3 to 10 changes per hour;

Method B: air-oven method using a cabinet oven with forced air circulation by means of a fan and a ventilation of 3 to 10 changes per hour.

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 37, *Rubber, vulcanized or thermoplastic — Determination of tensile stress-strain properties*

ISO 48, *Rubber, vulcanized or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD)*

ISO 18899:2004, *Rubber — Guide to the calibration of test equipment*

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

3 Principle

3.1 General

Test pieces are subjected to controlled deterioration by air at an elevated temperature and at atmospheric pressure, after which specified properties are measured and compared with those of unaged test pieces.

The physical properties concerned in the service application should be used to determine the degree of deterioration but, in the absence of any indication of these properties, it is recommended that tensile strength, stress at intermediate elongation, elongation at break (in accordance with ISO 37) and hardness (in accordance with ISO 48) be measured.