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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

Reference number
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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.

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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For an explanation of 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 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 188:2011), which has been technically revised.

The main changes are as follows:

— add oven type with a forced air circulation and high air speed/air exchange rate;

— editorial changes for better understanding.

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.

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Introduction

Accelerated ageing and heat resistance tests are used to determine the change of defined properties of rubber and thermoplastic elastomers over a specified period. These properties are compared before and after the accelerated ageing and heat resistance tests.

In accelerated ageing, the rubber is exposed to an elevated temperature with the intention to simulate the effect of natural ageing in a shorter time. The degree of acceleration depends on the tested material as well as to the property being evaluated.

In the case of heat resistance tests, the rubber is exposed to prolonged periods at the operation temperature of the material.

Two types of ovens are specified in this document, cell ovens and cabinet ovens. Cabinet ovens can be of four types as described in Clause 5.

The duration, temperature, and atmosphere to which the test pieces are exposed and the type of oven to use depends on the purpose of the test and the type of polymer.

The change of properties not only depends on the temperature but can also depend on the air speed. Consequently, even tests at the same temperature but at different air speed (different ovens) may give different results.

Consequences of these effects are

a) accelerated ageing is only a simulation of the natural ageing and can therefore produce different results.

b) If different materials are compared, it is recommended to perform the accelerated ageing tests at more than one elevated temperature as different rubbers might show a different temperature behaviour (change of properties) at certain operation temperatures.

c) It is important to determine the properties of the rubber for the accelerated ageing test, which are used for the intended material application. Only these properties should be used for the evaluation of the test results. If these properties give a different ranking of the materials tested, it is recommended to agree on a lead property for evaluation. It is also recommended, that all evaluated properties are measured according to an international standard or an equivalent test procedure.

Air-oven ageing should not be used to simulate natural ageing under stress (bent or stretched test pieces) and the presence of light or ozone.

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.

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

WARNING — 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.

1 Scope

This document specifies accelerated ageing or heat resistance tests on vulcanized or thermoplastic rubbers/thermoplastic elastomers. Four methods are possible, they are detailed in Clause 5.

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, *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 terminology databases for use in standardization at the following addresses:

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

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

4 Principle

4.1 General

Test pieces are exposed to air at a given elevated temperature and at atmospheric pressure with controlled conditions of air circulation.

Physical properties are measured before and after exposure and the results compared.

The physical properties that are important for the intended application of the material should be used to determine the effects of exposure. 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 48-2) are measured.

4.2 Accelerated ageing test

Test pieces are subjected to a higher temperature than the rubber would experience in its intended application to simulate the effects of natural ageing in a shorter time.

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