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Rubber, vulcanized or thermoplastic — Determination of stress relaxation in compression —

Part 2: Testing with temperature cycling

*Caoutchouc vulcanisé ou thermoplastique — Détermination de la
relaxation de contrainte en compression —*

Partie 2: Essais avec cycles de température



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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 3384-2 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 2, *Testing and analysis*.

ISO 3384 consists of the following parts, under the general title *Rubber, vulcanized or thermoplastic — Determination of stress relaxation in compression*:

- *Part 1: Testing at constant temperature*
- *Part 2: Testing with temperature cycling*

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Introduction

When a constant strain is applied to rubber, the force necessary to maintain that strain is not constant but decreases with time; this behaviour is called "stress relaxation". Conversely, when rubber is subjected to a constant stress, an increase in the deformation takes place with time; this behaviour is called "creep".

The processes responsible for stress relaxation can be physical or chemical in nature, and under all normal conditions both types of process will occur simultaneously. However, at normal or low temperatures and/or short times, stress relaxation is dominated by physical processes, while at high temperatures and/or long times chemical processes are dominant.

If the life-time of a material is to be investigated, it can be determined using the method described in ISO 11346 (see the Bibliography).

In addition to the need to specify the temperatures and time intervals in a stress relaxation test, it is necessary to specify the initial stress and the previous mechanical history of the test piece since these can also influence the measured stress relaxation, particularly in rubbers containing fillers.

The two cycling test methods specified are designed to carry out the following:

- age the test piece by stress relaxation and determine the sealing force at low temperatures (method A);
- introduce thermal stress by stress relaxation and determine the sealing force at low temperatures (method B).

For products used in outdoor applications where the temperature can cycle between a low temperature (e.g. $-40\text{ }^{\circ}\text{C}$) and a high temperature (e.g. $150\text{ }^{\circ}\text{C}$), it is important to also consider the shrinking of the rubber at low temperatures when assessing performance in the anticipated application and life-time.

For polymers that crystallize at low temperature, the crystallization will add to the shrinking of the rubber. For example, for hoses and seals in automotive applications, the product might work satisfactorily at the normal working temperature, but might leak at a low temperature.