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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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Foreword

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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.

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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*

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 °C) and a high temperature (e.g. 150 °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.