International Standard 4666/1

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Rubber, vulcanized — Determination of temperature rise and resistance to fatigue in flexometer testing — Part 1 : Basic principles

Caoutchouc vulcanisé — Détermination de l'élévation de température et de la résistance à la fatigue dans les essais aux flexomètres — Partie 1 : Principes fondamentaux

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 4666/1 was developed by Technical Committee ISO/TC 45, *Rubber and rubber products*, and was circulated to the member bodies in September 1979.

It has been approved by the member bodies of the following countries :

Australia	Hungary	South Africa, Rep. of
Austria	India	Spain
Belgium	Italy	Sweden
China	Korea, Rep. of	Switzerland
Czechoslovakia	Libyan Arab Jamahiriya	Turkey
Denmark	Malaysia	United Kingdom
Egypt, Arab Rep. of	Netherlands	USA
France	Poland	USSR
Germany, F. R.	Romania	

The member bodies of the following countries expressed disapproval of the document on technical grounds :

Brazil
Canada

Printed in Switzerland

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0 Introduction

Under cyclic deformation, all rubbers absorb a part of the deformation energy and convert this into heat as a result of their visco-elastic behaviour. The heat generated leads to a temperature rise which can be very considerable in the interior of relatively thick components because of the low thermal conductivity of rubbers. In cases where the cyclic deformation or the temperature rise reaches high values, it is possible for damage to the rubber to occur through fatigue-initiated breakdown. This begins in the interior of the rubber, spreads outwards and can finally lead to the complete breakdown of the component.

The tests described in this International Standard yield either temperature rise data or the fatigue life of the rubber under given test conditions. Measurement of fatigue life over a range of conditions can be used to determine the limiting fatigue deformability or limiting fatigue stress of the rubber. The instruments used, commonly called flexometers, may subject test pieces to cycles of either constant stress amplitude or constant strain amplitude.

A distinction should be made between flexometer tests and fatigue tests conducted on thin test pieces undergoing tensile deformation. In the latter tests, the temperature rise is generally negligible owing to the rapid dissipation of heat generated, and failure results from the initiation and growth of cracks which ultimately sever the test piece. ISO 132 and ISO 133 describe tests for the determination of flex cracking and cut growth, respectively, using the De Mattia-type machine. The determination of resistance to tension fatigue will be described in ISO 6943.

1 Scope and field of application

This part of ISO 4666 lays down general principles for, and defines the terms used in, flexometer testing. It gives directions for carrying out measurements which make possible predictions regarding the durability of rubbers in finished articles (tyres, bearings, supports, V-belts, cable-pulley insert rings and similar products subject to dynamic flexing in service). However, owing to the wide variations in service conditions, no simple correlation between the accelerated tests described in this International Standard and service performance can be assumed.

2 References

ISO 132, *Vulcanized rubbers — Determination of resistance to flex cracking (De Mattia type machine).*

ISO 133, *Rubber vulcanized — Determination of crack growth (De Mattia).*

ISO 471, *Rubber — Standard temperatures, humidities and times for the conditioning and testing of test pieces.*

ISO 1826, *Rubber, vulcanized — Time-interval between vulcanization and testing — Specification.*

ISO 2856, *Elastomers — General requirements for dynamic testing.*

ISO 3383, *Rubber — General directions for achieving elevated or sub-normal temperatures for tests.*

ISO 4666/2, *Rubber, vulcanized — Determination of temperature rise and resistance to fatigue in flexometer testing — Part 2 : Rotary flexometer.*

ISO 4666/3, *Rubber, vulcanized — Determination of temperature rise and resistance to fatigue in flexometer testing — Part 3 : Compression flexometer.*[1)]

3 Definitions

For the purpose of this International Standard, the following definitions apply. For associated terms, refer to ISO 2856 which gives the general requirements for dynamic testing.

3.1 loading : Subjection of the test piece to a predetermined stress or strain, either static or cyclic.

3.2 pre-stress, σ_p : The constant static stress to which the test piece is subjected during the test.

NOTE — This may be used to simulate product requirements or simply to hold the test piece in the apparatus.

1) At present at the stage of draft.