INTERNATIONAL STANDARD

ISO 23337

First edition
2007-08-01

Rubber, vulcanized or thermoplastic — Determination of abrasion resistance using the Improved Lambourn test machine

Caoutchouc vulcanisé ou thermoplastique — Détermination de la résistance à l'abrasion à l'aide d'une machine de Lambourn perfectionnée

Reference number
ISO 23337:2007(E)

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

Published in Switzerland

Contents

Page

Foreword ... iv
Introduction ... v
1 Scope ... 1
2 Normative references ... 1
3 Terms and definitions ... 2
4 Principle ... 2
5 Apparatus ... 4
6 Test pieces ... 5
7 Test conditions ... 5
8 Procedure ... 6
9 Expression of results ... 6
10 Precision ... 7
11 Test report ... 7
Annex A (informative) **Precision** ... 9
Bibliography ... 11

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 23337 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 2, *Testing and analysis*.

Introduction

Various types of laboratory test equipment for determining the wear resistance of rubber compounds have been developed, depending on the products to which rubber compounds have been applied in the past. One such piece of equipment, called the “Improved Lambourn” abrasion test machine, is briefly introduced with other types in ISO 23794 [2] and the test method for using it is described in detail in this International Standard.

The main features of the Improved Lambourn machine are as follows:

a) The slip rate is adjustable by virtue of the fact that the abrasive wheel and test piece are driven separately. A servo-mechanism is used for driving both the abrasive wheel and the test piece to ensure accurate speed control. In older types of equipment, both the abrasive wheel and the test piece were driven by the same drive system, with the speeds of rotation controlled by braking systems, which could result in an inaccurately controlled slip rate.

b) A controlled feed of carborundum grit to the nip between the rubber test piece and the abrasive wheel ensures that abraded particles are prevented from adhering to the surface of the test piece or abrasive wheel, which is important in obtaining reproducible test results.

A previous wear study for rubber compounds using the Improved Lambourn machine showed that, at higher slip rates, wear resistance decreased in the order: butadiene rubber (BR) base compound, natural rubber (NR) base, styrene-butadiene rubber (SBR) base. However, at low slip rates, the order was reversed. This is interesting since the tread compound in truck and bus tyres generally uses NR or a blend of NR and BR base compound, while SBR base compound is used in car tyres. More details can be found in Reference [3] in the Bibliography.

Rubber, vulcanized or thermoplastic — Determination of abrasion resistance using the Improved Lambourn test machine

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.

CAUTION — Certain procedures specified in this International Standard may involve the use or generation of substances, or the generation of waste, that could constitute a local environmental hazard. Reference should be made to appropriate documentation on safe handling and disposal after use.

1 Scope

This International Standard specifies a method for the determination of the resistance of rubber to abrasion using the Improved Lambourn test machine.

The abrasion loss resulting from the slip caused by the difference in circumferential speed between a disc-shaped rubber test piece and an abrasive wheel, which are driven to rotate independently with their circumferences pressed against each other by a specified load, is determined. The test result can be reported as a volume loss per abrasion test time or running distance, and/or as an abrasion resistance index compared to a reference compound.

As the Improved Lambourn test machine is capable of setting various abrasive conditions, such as slip rate, sliding speed and load, independently, this method is suitable for the evaluation, under a wide range of severity conditions, of compounds for a range of rubber products, especially tyres. An example of the testing of tyre tread rubber is given in Annex A.

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 525, *Bonded abrasive products — General requirements*

ISO 2781, *Rubber, vulcanized or thermoplastic — Determination of density*

ISO 8486-1, *Bonded abrasives — Determination and designation of grain size distribution — Part 1: Macrogrits F4 to F220*

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

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
abrasion
loss of material from a surface due to frictional forces

[ISO 23794:2003]

3.2
abrasion resistance
resistance to wear resulting from mechanical action upon a surface

NOTE Abrasion resistance is expressed by the abrasion resistance index.

[ISO 23794:2003]

3.3
abrasion resistance index
ratio of the loss in volume of a standard rubber to the loss in volume of a test rubber measured under the same specified conditions and expressed as a percentage

[ISO 23794:2003]

3.4
slip rate
ratio of the difference between the circumferential speed of the test piece and that of the abrasion wheel to the circumferential speed of the test piece, expressed as a percentage

3.5
running distance
total distance travelled by a point on the circumference of the test piece, determined from the initial outer diameter of the test piece, its speed of rotation and the abrasion time

3.6
reference compound
compound whose abrasion resistance is to be compared with that of the test rubber

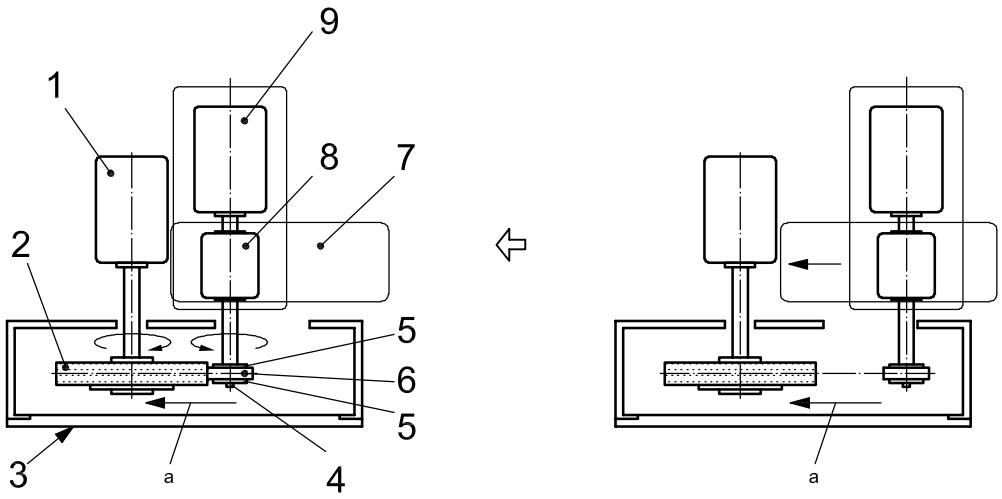
4 Principle

Wear occurs due to the slip caused by the difference in circumferential speed between a disc-shaped rubber test piece and an abrasive wheel rotating against each other for a specified length of time.

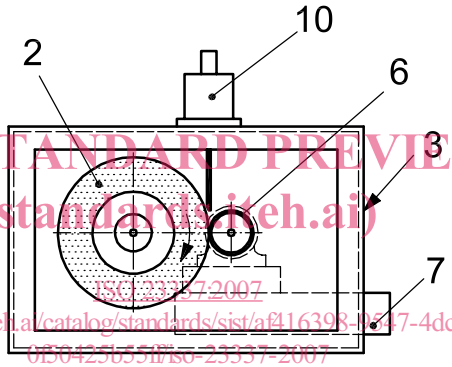
The test piece and the abrasive wheel, aligned with their circumferences pressed against each other by a specified load and with their axes of rotation parallel, are driven independently (see Figure 1).

Grit is fed into the nip between the test piece and the abrasive wheel to prevent smearing of the test piece and the abrasive wheel surface.

The loss in mass of the test piece is determined and the loss in volume per unit abrasion time or running distance is calculated from the density of the test material. The abrasion resistance index, if required, is determined by comparing this loss in volume with the loss in volume of a reference compound tested under the same conditions.



a) Top view



b) Front view

Key

1	drive motor for abrasive wheel	6	test piece
2	abrasive wheel	7	mechanism for exerting load on test piece
3	test chamber	8	torque meter
4	test piece mounting	9	drive motor for test piece
5	test piece guide	10	grit-dropping mechanism

[a] Test piece pressed against abrasive wheel.

The torque meter fitted to the test piece drive shaft detects any abnormal conditions from torque changes during the test. It shall be capable of measuring torques ranging from 0 N·m to 49 N·m to the nearest 0,01 N·m.

Figure 1 — Schematic illustration of apparatus