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Rubber, vulcanized or thermoplastic — Determination of flex cracking and crack growth (De Mattia)

Caoutchouc vulcanisé ou thermoplastique — Détermination de la résistance au développement d'une craquelure (De Mattia)

Reference number
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Contents

Page

Foreword

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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 on 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 the following URL: 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 132:2011), of which it constitutes a minor revision to update normative references in Clause 2 and improve the title and the key for Figure 1.

Introduction

Repeated bending or flexing of a rubber causes cracks to develop in that part of the surface where tension stress is set up during flexing or, if this part of the surface contains a crack, causes this crack to extend in a direction perpendicular to the stress. Certain soft vulcanizates, for instance those prepared from styrene-butadiene rubber, show marked resistance to crack initiation, but it is possible for these vulcanizates to have a low resistance to growth (propagation) of cracks. It is important, therefore, to measure both the resistance to crack initiation by flexing and the resistance to crack propagation.

The method is suitable for rubbers that have reasonably stable stress-strain properties, at least after a period of cycling, and do not show undue stress softening or set, or highly viscous behaviour. The results obtained for some thermoplastic rubbers should be treated with caution if the elongation at yield is below, or close to, the maximum strain imposed during the test.

Rubber, vulcanized or thermoplastic — Determination of flex cracking and crack growth (De Mattia)

WARNING 1 — 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 ensure compliance with any national regulatory conditions.

WARNING 2 — Certain procedures specified in this document might 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 document specifies a method of test intended for use in comparing the resistance of vulcanized or thermoplastic rubbers to the formation and growth of cracks, when subjected to repeated flexing on the De Mattia type machine. For determination of crack growth, an artificial cut is made in the test piece to initiate cut growth.

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 18899:2013, *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 terminological databases for use in standardization at the following addresses:

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

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

4 Apparatus

4.1 De Mattia type machine, the essential features of which are as follows.

The machine has stationary parts, provided with grips for holding one end of each of the test pieces in a fixed position, and similar but reciprocating parts for holding the other end of each of the test pieces. The travel is $57^{+0,5}_{0}$ mm and is such that the maximum distance between each set of opposing grips is 75^{+1}_{0} mm (see Figure 1).

The reciprocating parts are so arranged that their motion is straight and in the direction of, and in the same plane as, the common centreline of each opposing pair of grips. The planes of the gripping surfaces of each opposing pair of grips remain parallel throughout the motion.

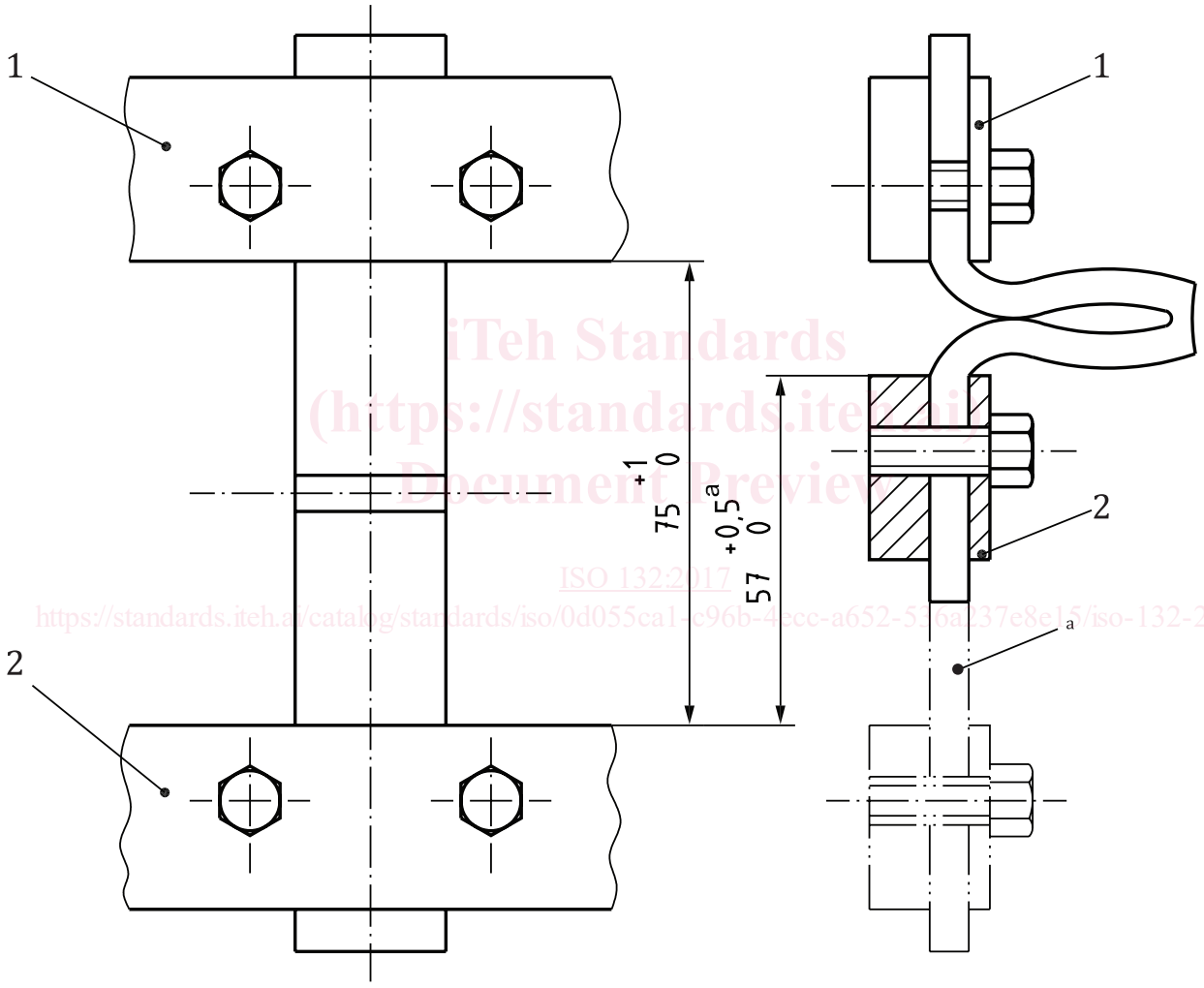
The eccentric which actuates the reciprocating parts is driven by a constant-speed motor to give 5,00 Hz ± 0,17 Hz, with sufficient power to flex at least six, and preferably 12, test pieces at one test. The grips hold the test pieces firmly, without undue compression, and enable individual adjustment to be made to the test pieces to ensure accurate insertion.

It is useful to arrange the test pieces in two equal groups, so that one group is being flexed while the other group is being straightened, thus reducing the vibration in the machine.

For testing at elevated or subnormal temperatures, the machine can be enclosed in a chamber with temperature control near the centre of the test piece to ±2 °C, if necessary, by using an air circulator.

4.2 Piercing tool and suitable jig, for piercing the test pieces (see 6.2).

Dimensions in millimetres



Key

1 upper grip
2 lower grip
a Travel.

Figure 1 — De Mattia type machine, front view showing extended test piece, side view showing bent test piece and the grip travel

5 Calibration

The requirements for calibration of the test apparatus are given in Annex A.

6 Test pieces

6.1 Shape, dimensions and preparation

Each test piece shall be a strip with a moulded groove. The strips can be moulded individually in a multiple-cavity mould, as shown in Figure 2, or can be cut from a wide slab having a moulded groove.

The groove in the test piece shall have a smooth surface and be free from irregularities from which cracks can start prematurely. The groove shall be moulded into the test piece or slab by a half-round ridge in the centre of the cavity.

The half-round ridge shall have a radius of 2,38 mm ± 0,03 mm. The moulded groove shall be perpendicular to the direction of mill grain.

Results can be compared only between test pieces having thicknesses, measured close to the groove, which are within the tolerances, because the results of the test are dependent upon the thickness of the test piece.

If finished products are to be tested, test pieces without a groove can be used. They shall be prepared in accordance with ISO 23529. Cracks shall not be assessed on surfaces that have been cut or buffed. The use of test pieces cut and/or buffed from finished products shall be stated in the test report.

Dimensions in millimetres

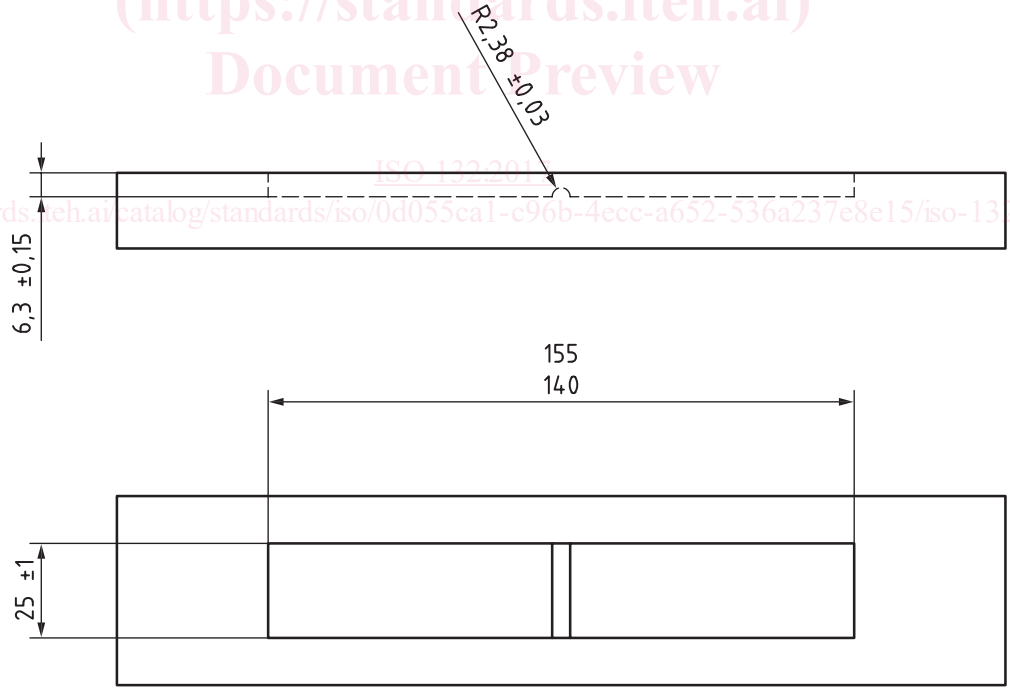


Figure 2 — Form for moulding test piece

6.2 Preparation of test pieces for crack growth measurement

Each test piece shall be prepared by piercing the bottom of the groove at a point equidistant from the sides, using a suitable jig. The piercing tool shall conform to the dimensions given in Figure 3. The piercing tool shall be maintained perpendicular to both the transverse and longitudinal axes, and

the cut accomplished by a single insertion and withdrawal of the tool. The cut shall be parallel to the longitudinal axis of the groove. Lubrication with water containing a suitable wetting agent can be used.

A suitable jig shall be provided to hold the piercing tool; the exact details are not specified but the principles of operation shall be as follows.

The test piece shall be held flat in a solid support. The piercing tool shall be normal to the support and placed centrally with respect to the groove in the test piece, with the cutting edge of the piercing tool parallel to the axis of the groove. Means shall be provided for passing the piercing tool through the entire thickness of the rubber, and the support shall have a hole of a size just sufficient to permit the piercing tool to project through the base of the test piece to not less than 2,5 mm and not more than 3 mm.