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Rubber, vulcanized or thermoplastic — Determination of shear modulus and adhesion to rigid plates — Quadruple-shear methods

Caoutchouc vulcanisé ou thermoplastique — Détermination du module de cisaillement et de la force d'adhérence à des plaques rigides — Méthodes du quadruple cisaillement

Reference number
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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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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 1827:2016), of which it constitutes a minor revision.

The changes are as follows:

— the normative references have been updated.

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Rubber, vulcanized or thermoplastic — Determination of shear modulus and adhesion to rigid plates — Quadruple-shear methods

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 determine the applicability of any other restrictions.

WARNING 2 — Certain procedures specified in this document can involve the use or generation of substances, or the generation of waste, that can constitute a local environmental hazard. Reference should be made to appropriate documentation on safe handling and disposal after use.

1 Scope

This document specifies methods for the determination of the modulus in shear and the strength of bonds of rubber to metal or other rigid plates, using rubber bonded between four parallel plates.

Method A describes the determination of the modulus in shear.

Method B describes the determination of the strength of the bonds.

The methods are applicable primarily to test pieces prepared in the laboratory under standard conditions, such can be used to provide data for the development and control of rubber compounds and methods of manufacture of bonded shear units.

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 5893:2019, *Rubber and plastics test equipment — Tensile, flexural and compression types (constant rate of traverse) — Specification*

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

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

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

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

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3.1
shear modulus
applied shear stress, calculated with respect to the bonded area of the rubber in a test piece, divided by the resultant shear strain in the direction of application of the stress

Note 1 to entry: The shear strain (γ) is half the measured deformation divided by the thickness of one rubber block or element. The shear stress (τ) is the applied force divided by twice the area of a bonded face of one rubber block or element.

Note 2 to entry: The form of the test piece specified ensures that there is zero applied stress in the direction normal to the bonded surfaces, so that the deformation can be regarded as simple shear.

Note 3 to entry: This definition of shear modulus is sometimes referred to as the secant modulus.

4 Principle

4.1 Method A — Determination of the shear modulus

The force required to obtain a range of predetermined shear strains of a unit of standard dimensions comprising four parallelepipeds of rubber symmetrically disposed and bonded to four parallel rigid plates is measured, the forces being parallel to the bonding surfaces and, as a rule, non-destructive, i.e. of maximum values appreciably lower than the bond strength.

4.2 Method B — Determination of the adhesion

The force required to cause the rupture of a unit as described for method A is measured.

5 Apparatus

5.1 Test machine, complying with the requirements of ISO 5893, capable of measuring force with an accuracy corresponding to class 1, as defined in ISO 5893:2019, and with a rate of traverse of the moving grip of 5 mm/min (method A) or 50 mm/min (method B).

The test machine shall include apparatus to measure the deformation of the rubber of the test piece to an accuracy of 0,02 mm.

5.2 Fixtures, for holding the test pieces in the grips, provided with a universal joint to permit accurate centring of the line of action of the applied force.

5.3 Environmental chamber, suitable for carrying out tests at the temperature chosen or specified (see Clause 10), conforming to the requirements of ISO 23529.

6 Calibration

The test apparatus shall be calibrated in accordance with the schedule given in Annex A.

7 Test piece

7.1 Shape and dimensions

The test piece shall consist of four identical parallelepipedic rubber elements 4 mm ± 1 mm thick, 20 mm ± 5 mm wide and 25 mm ± 5 mm long, bonded on each of their two largest opposite faces to the mating faces of four rigid plates of the same width and of appropriate lengths to obtain a symmetrical double-sandwich arrangement, means being provided at the free external end of each central plate to

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