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## Rubber — Determination of adhesion to rigid materials using conical shaped parts

*Caoutchouc — Détermination de l'adhérence aux matériaux rigides au moyen de pièces coniques*

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## 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.

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 document 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](http://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 5600:2017), which has been technically revised.

The main changes are as follows:

- the normative references have been updated in [Clause 2](#), [Clause 5](#) and [Table A.1](#);
- the class of tensile-testing machine has been upgraded from class 2 to class 1 in [Clause 5](#);
- the expression of the type of adhesion failure has been changed in [9.2](#).

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

# Rubber — Determination of adhesion to rigid materials using conical shaped parts

**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 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 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 for the determination of the static vulcanized adhesion strength of rubber compounds to rigid materials. The test piece is composed of two conical ends of the rigid material, joined by a cylinder of rubber.

The adhesion is obtained by a bonding system which can include not only the rigid material and the rubber compound, but other elements such as thin alloy coatings or chemical treatments of rigid parts and either a single cement or both primer and cover cements. The bonding system for preparing the test pieces should be adequately specified by the user, but a provision is made in this document for the evaluation of different types of failure related to a complex bonding system.

The method is designed primarily for test pieces prepared in the laboratory under standard conditions in order to provide data for development and control of bonding systems and their components, such as cements or special rubber compounds, and of methods of manufacture. While intended to be applied where the rubber is bonded to rigid supporting pieces, it can be inapplicable such cases where the support, although of high-modulus material, has a low rigidity due to small transverse dimensions, as in the case of rubber bonded to metal wires, cords or thin sheets.

## 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

No terms and definitions are listed in this document.

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/>

## 4 Principle

The test consists in measuring the force required to cause the rupture of a test piece of standard dimensions, comprising a cylinder of rubber bonded to two rigid conical parts.

The particular geometry of the test piece produces in most cases an interfacial failure between the cylinder of rubber and the conical parts because of a stress concentration at the tip of the cones.

## 5 Apparatus

The usual laboratory apparatus and, in particular, the following shall be used.

**5.1 Tensile-testing machine**, ~~complying with~~ conforming to the requirements of ISO 5893:2019, class 1, and with a rate of traverse of the moving grip of  $(50 \pm 5)$  mm/min.

Inertia (pendulum) type dynamometers have a tendency to give results which differ because of inertial effects. A low-inertia type dynamometer (~~for example, e.g.~~ using an electronic or optical transducer) gives results which are free from this effect, and is therefore, ~~be~~ preferred.

**5.2 Fixtures**, for holding the test pieces in the test machine, which permit accurate centring of the applied load during the test.

## 6 Calibration

The test apparatus shall be calibrated in accordance with [Annex A](#).

## 7 Test piece

### 7.1 Form and dimensions

The standard test piece (see [Figure 1](#)) is formed by two rigid cylindrical parts terminated by opposite conical ends, and a cylinder of rubber bonded to the conical ends. The determination of the dimensions of the test piece shall be in accordance with ISO 23529.

The diameter of this cylinder and of the cylindrical portion of the rigid parts shall be  $(25 \pm 0,5)$  mm. The distance between the tips of the conical ends shall be  $(12 \pm 1)$  mm. The half-angle of the cone vertex shall be  $(45 \pm 1)^\circ$  and the tip shall be rounded to a radius not greater than 0,8 mm.

The cylindrical portion of each rigid part shall be not less than 5 mm in length and shall be terminated to match with the holding jaws ([5.2](#)) of the test machine ([5.1](#)).

### 7.2 Materials

The materials used shall conform to the specifications for the bonding system to be investigated. If no specification is given for the material of the rigid parts, they shall be made from low-carbon steel bars and their conical ends shall be grit-blasted.