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# International Standard



# 4637

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## Rubber-coated fabrics — Determination of rubber-to-fabric adhesion — Direct tension method

*Supports textiles revêtus de caoutchouc — Détermination de l'adhérence du caoutchouc au textile — Méthode par traction directe*

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**Descriptors** : coated fabrics, fabrics coated with rubber, rubber, tests, adhesion tests.

## 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 4637 was developed by Technical Committee ISO/TC 45, *Rubber and rubber products*, and was circulated to the member bodies in April 1978.

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

Austria	India	Spain
Belgium	Italy	Sri Lanka
Brazil	Korea, Rep. of	Sweden
Canada	Mexico	Switzerland
Czechoslovakia	Netherlands	Thailand
Egypt, Arab Rep. of	Poland	Turkey
France	Romania	United Kingdom
Hungary	South Africa, Rep. of	USSR

No member body expressed disapproval of the document.

# Rubber-coated fabrics — Determination of rubber-to-fabric adhesion — Direct tension method

## 1 Scope and field of application

This International Standard specifies a method for the determination of rubber-to-fabric adhesion under direct tension. It is only suitable when the material to be tested is substantially uniform in thickness and flat or sufficiently flexible to be maintained flat under light pressure. It is particularly suitable for materials having a very thin rubber layer which are difficult to test by stripping or peeling methods. However it should be noted that the results obtained by this method will not necessarily correlate with those obtained by a stripping test such as that described in ISO/R 36, *Determination of the adhesion strength of vulcanized rubbers to textile fabrics*.

## 2 References

ISO/R 468, *Surface roughness*.

ISO 2231, *Fabric coated with rubber or plastics — Standard atmospheres for conditioning and testing*.

## 3 Principle

Bonding of metal cylinders, by means of a suitable adhesive, onto opposing faces of a test piece. Measurement of the tensile force necessary to cause separation of the rubber from the fabric, this tensile force being applied along the axis of the metal cylinders.

## 4 Apparatus and material

**4.1 Tensile testing machine**, having self-aligning jaws and a jaw separation rate of  $50 \pm 5$  mm/min. The response time of the force-measuring elements of the machine shall be such as to record the maximum force within an accuracy of  $\pm 2\%$  having regard to the time to failure, which is 1 to 2 s.

**4.2 Two metal cylinders**, preferably aluminium,  $25 \pm 0,5$  mm in diameter and approximately 50 mm long, each having at one end a means of attachment to the jaws of the tensile testing machine. The other end of each cylinder shall be accurately machined flat and perpendicular to the major axis. The flatness of this end over the whole surface is of major importance and the surface roughness of the cylinders, after preparation as described in clause 7, shall have an arithmetical mean deviation,  $R_a$ , not greater than  $0,80 \mu\text{m}$ , when determined according to the M system of ISO/R 468.

**4.3 "Wet or dry" abrasive paper**, 600 grit.

**4.4 Forceps**, for handling the test piece.

**4.5 Jig**, to enable the cylinders to be aligned during the preparation of the test assembly. A suitable device which may be made from any reasonably rigid material is shown in the figure.

**4.6 Weight**, having a mass of 1 kg, of suitable form and dimensions for applying an axial load to the cylinders.

**4.7 Ethyl cyanoacrylate adhesive**, having a viscosity of 75 to 100 mPa·s measured at 25 °C, and a minimum bond strength to the metal to be used of 14 MPa, measured in direct tension. The adhesive used for testing shall only wet the surface of the test piece and shall have no penetrating influence upon it.

NOTE — An adhesive having a somewhat lower bond strength than that specified may be suitable depending on the rubber-to-fabric adhesion of the material being tested. However, the viscosity should be within the given limits.

## 5 Test piece

The test piece shall consist of a square of the material under test, of lateral dimensions approximately 32 mm.

## 6 Conditioning of test pieces

The test pieces shall be conditioned for not less than 24 h in one of the standard laboratory atmospheres specified in ISO 2231. The same conditions shall be used throughout any one test or any series of tests intended to be comparable.

## 7 Procedure

**WARNING — Suitable precautions should be taken to avoid inhalation of trichloroethylene vapour which is hazardous to health.**

Degrease the metal cylinders by washing in trichloroethylene after which the test surfaces shall not be touched by hand. Abrade the test surfaces of each cylinder by light lapping on the abrasive paper supported on a flat surface such as plate glass or a surface plate, and then wipe the abraded surfaces with a clean lint-free rag soaked in trichloroethylene. Dry the cylinder by gently dabbing on a pad of filter paper.

Degrease the test piece by wiping with a clean lint-free rag soaked in a 1 % (V/V) solution of ammonium hydroxide ( $\rho$  0,880 g/cm<sup>3</sup>) in acetone. Allow the test piece to dry in a dust-free atmosphere at room temperature. During this and subsequent operations, the test piece shall be handled only with the forceps.

Apply one or two drops of the adhesive to the prepared face of one of the cylinders and then gently superimpose the other cylinder onto the first so that the prepared faces are opposed. Spread the adhesive uniformly over the surface by gentle and rapid circular motion of the cylinders relative to each other. Immediately separate the cylinders to avoid bonding and place one of them in the jig with the prepared surface uppermost. Apply two drops of adhesive to this surface, superimpose the test piece and spread the adhesive uniformly by gentle rubbing action of the test piece on the cylinder. Apply two drops of adhesive to the upper surface of the test piece, superimpose the second cylinder and spread the adhesive by gentle rubbing action of the cylinder. Align the two cylinders in the jig with the test piece symmetrically placed. The time-lapse between the first application of adhesive and the final alignment shall not exceed 90 s. Place the weight on top of the upper cylinder. Carefully remove the assembly from the jig after a time of not less than 5 min.

Allow the assembly to stand for 16 to 24 h in the standard laboratory atmosphere before performing the measurement of the tensile force.

After this period, carefully mount the assembly, maintained at the standard laboratory temperature, in the tensile testing machine, ensuring proper alignment. Operate the machine at a jaw separation rate of  $50 \pm 5$  mm/min until the assembly breaks. Record the maximum force achieved, examine the separated test piece and note the mode of failure.

Discard as an unacceptable failure any test piece which fails within the adhesive or at the adhesive interface with the rubber or metal, and carry out a repeat test. Carry out measurements on additional test pieces until five acceptable failures have been obtained.

NOTE — The amount of adhesive used should be such that a small, but not excessive, fillet of adhesive forms on the test piece around each cylinder. If metals other than aluminium are used for the cylinder, different methods of preparation may be desirable.

## 8 Expression of results

Express the result, as "force at failure" (under the specified conditions), in kilonewtons, as the median of the test results on five test pieces.

The mode of failure shall be expressed as an approximate percentage of the total bonded area of the five test pieces, using the following designations :

C = cohesive failure within the rubber;

RF = adhesive failure between the rubber and fabric.

## 9 Test report

The test report shall include the following information :

- a) sample details : a full description of the sample and its origin;
- b) test method : a reference to this International Standard i.e. ISO 4637;
- c) test details : the standard laboratory temperature and humidity used;
- d) test results : the value of the adhesion expressed in accordance with clause 8, together with a description of the mode of failure in accordance with clause 8;
- e) date of test.

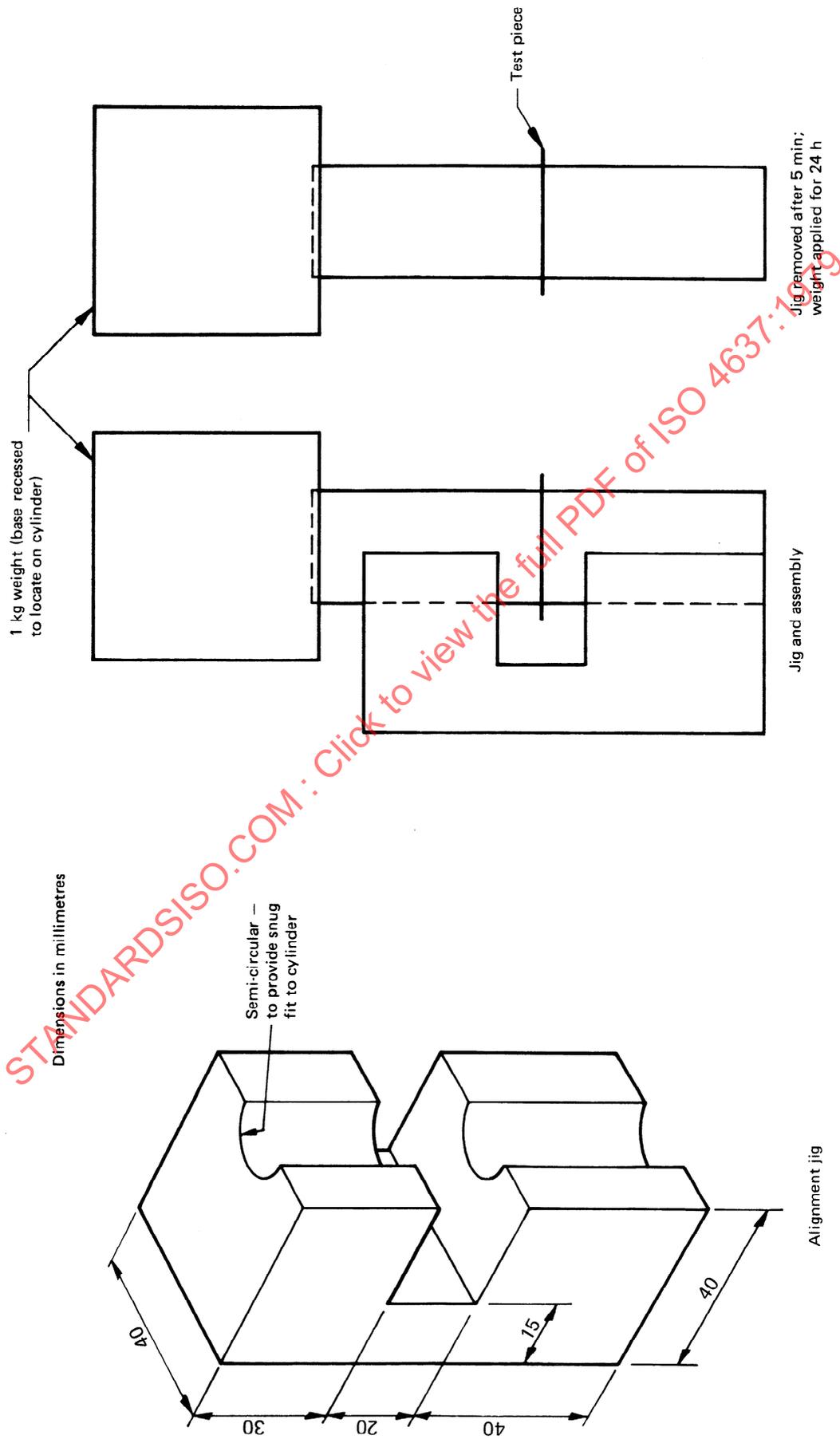


Figure — Preparation of test assembly

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