INTERNATIONAL STANDARD 1747

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Rubber, vulcanized — Determination of adhesion to rigid plates in shear — Quadruple shear method

Caoutchouc vulcanisé — Détermination de l'adhérence, en cisaillement, à des plaques rigides — Méthode du quadruple cisaillement

First edition — 1976-04-01

UDC 678.4/.7.063 : 678.01 : 539.61 **Ref. No. ISO 1747-1976 (E)**

Descriptors : rubber, vulcanized rubber, tests, adhesion tests, shear tests.

Price based on 4 pages

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.

Prior to 1972, the results of the work of the Technical Committees were published as ISO Recommendations; these documents are now in the process of being transformed into International Standards. As part of this process, Technical Committee ISO/TC 45 has reviewed ISO Recommendation R 1747 and found it technically suitable for transformation. International Standard ISO 1747 therefore replaces ISO Recommendation R 1747-1971 to which it is technically identical.

ISO Recommendation R 1747 was approved by the Member Bodies of the following countries :

Australia	Iran	Sri Lanka
Austria	Israel	Spain
Belgium	Italy	Sweden
Brazil	Korea, Dem. P. Rep. of	Switzerland
Czechoslovakia	Korea, Rep. of	Thailand
Egypt, Arab Rep. of	Netherlands	Turkey
France	New Zealand	United Kingdom
Greece	Peru	U.S.S.R.
Hungary	Poland	
India	South Africa, Rep. of	

No Member Body expressed disapproval of the Recommendation.

No Member Body disapproved the transformation of ISO/R 1747 into an International Standard.

Printed in Switzerland

Rubber, vulcanized — Determination of adhesion to rigid plates in shear — Quadruple shear method

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies a method for the determination of the strength of bonds of rubber to metal or other rigid plates where the rubber is assembled between four parallel rigid plates.

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

2 PRINCIPLE

Measurement of the force required to cause the rupture of a unit of standard dimensions comprising four parallelepipeds of rubber symmetrically disposed and bonded to four parallel rigid plates, the force being parallel to the bonding surfaces.

3 APPARATUS

3.1 *Testing machines,* conforming to the requirements of national standards for verification of testing machines. It shall be capable of accurately registering the applied forces during the test while maintaining the specified constant rate of separation of the jaws of 50 ± 5 mm/min.

NOTE — Inertia (pendulum) type dynamometers are apt to give results which differ because of frictional and inertial effects. An inertialess (for example electronic or optical transducer) type dynamometer gives results which are free from these effects and is therefore to be preferred.

3.2 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.

4 TEST PIECE

4.1 Shape and dimensions

The standard test piece consists of four identical parallelepipedal rubber elements 4 ± 0,1 mm thick, 20 ± 0,1 mm wide and 25 ± 0,1 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 secure its further assembly to the corresponding holding fixture. The thickness of the rigid plates shall be $5\ ^{0}_{-0,1}$ mm. A typical test piece is shown in figure 1.

4.2 Preparation

The standard test piece shall be prepared as follows :

4.2.1 Rectangular rigid plates of the standard dimensions shall be prepared and treated in accordance with a normal adhesion system.

4.2.2 Unvulcanized rubber blanks shall be cut using a die of such a size that a limited amount of flash is obtained on moulding.

4.2.3 The rigid plates and rubber blanks shall then be disposed for vulcanization in the mould. Moulding may be performed in two different ways :

a) by compression moulding, where individual rubber blanks are preassembled in the mould between the rigid plates;

b) by transfer moulding, where a single rubber blank is transferred into a plurality of cavities through appropriate nozzles.

A suitable type of transfer mould accommodating six test parts (24 cavities) is shown in figure 2.

4.2.4 During the preparation of the test pieces, great care shall be taken to keep the exposed surfaces of the rubber and metal free from dust, moisture and foreign matter. The treated surfaces shall not be touched by hand during assembly.

4.2.5 The vulcanization shall be carried out by heating the mould for a definite time at controlled temperature under pressure.

4.2.6 At the conclusion of vulcanization, great care shall be taken in removing the test pieces from the mould to avoid subjecting the adhered surfaces to undue stress.

4.3 Number

The test shall be carried out on five test pieces.

5 TIME-LAPSE BETWEEN VULCANIZATION AND TESTING

Unless otherwise specified for technical reasons, the following requirements for time-lapse shall be observed :

5.1 For all test purposes, the minimum time between vulcanization and testing shall be 16 h.

5.2 The maximum time between vulcanization and testing shall be 4 weeks, and for evaluations intended to be comparable the tests should, as far as possible, be carried out after the same time-interval.

6 CONDITIONING OF TEST PIECES

6.1 When a test is made at a standard laboratory temperature, the test piece shall be maintained at the conditions of test for at least 16 h immediately before testing.

6.2 When tests are made at higher or lower temperatures, the test pieces shall be maintained at the conditions of test for a period of time sufficient to reach temperature equilibrium with the testing environment, or for the period of time required by the specification covering the material or product being tested, and immediately tested.

7 TEMPERATURE OF TEST

The test should normally be carried out at a standard laboratory temperature (20 ± 2 °C or 23 ± 2 °C or 27 ± 2 °C). When other temperatures are used, these should be selected from the following list of preferred temperatures :

– 75, – 55, – 40, – 25, – 10, 0, 40, 50, 70, 85,

100, 125, 150, 175, 200, 225 and 250 °C.

The same temperature shall be used throughout any one test or series of tests intended to be comparable.

8 PROCEDURE

After conditioning as specified in clause 6, immediately mount the test piece in the testing machine, taking care to ensure freedom of self-alignment with the direction of force application. Apply steadily increasing traction forces at a rate of separation of the jaws of 50 ± 5 mm/min until the test piece breaks. Record the maximum force.

9 EXPRESSION OF RESULTS

9.1 Adhesion value

The adhesion value, expressed in megapascals*, shall be calculated by dividing the maximum force by the total bonded area of one of the double sandwiches on the corresponding rigid plate.

9.2 Symbols for adhesion failure

R indicates that the failure is in the rubber.

RC indicates that the failure is at the interface between the rubber and the cover cement.

CP indicates that the failure is at the interface between the cover cement and the prime cement.

M indicates that the failure is at the interface between the rigid plates and the prime cement.

10 TEST REPORT

The test report shall include the following particulars :

a) results for all fives test pieces, calculated in accordance with 9.1, for the adhesion value;

b) designation of type of failure, in accordance with 9.2;

c) identification of the rubber compound;

d) nature of the rigid plates;

e) description of the method of securing adhesion;

f) moulding process (compression, transfer, casting, etc.);

g) duration and temperature of vulcanization;

h) temperature of test;

i) date of vulcanization;

j) date of test.

* 1 MPa = 1 MN/m²

Dimensions in millimetres

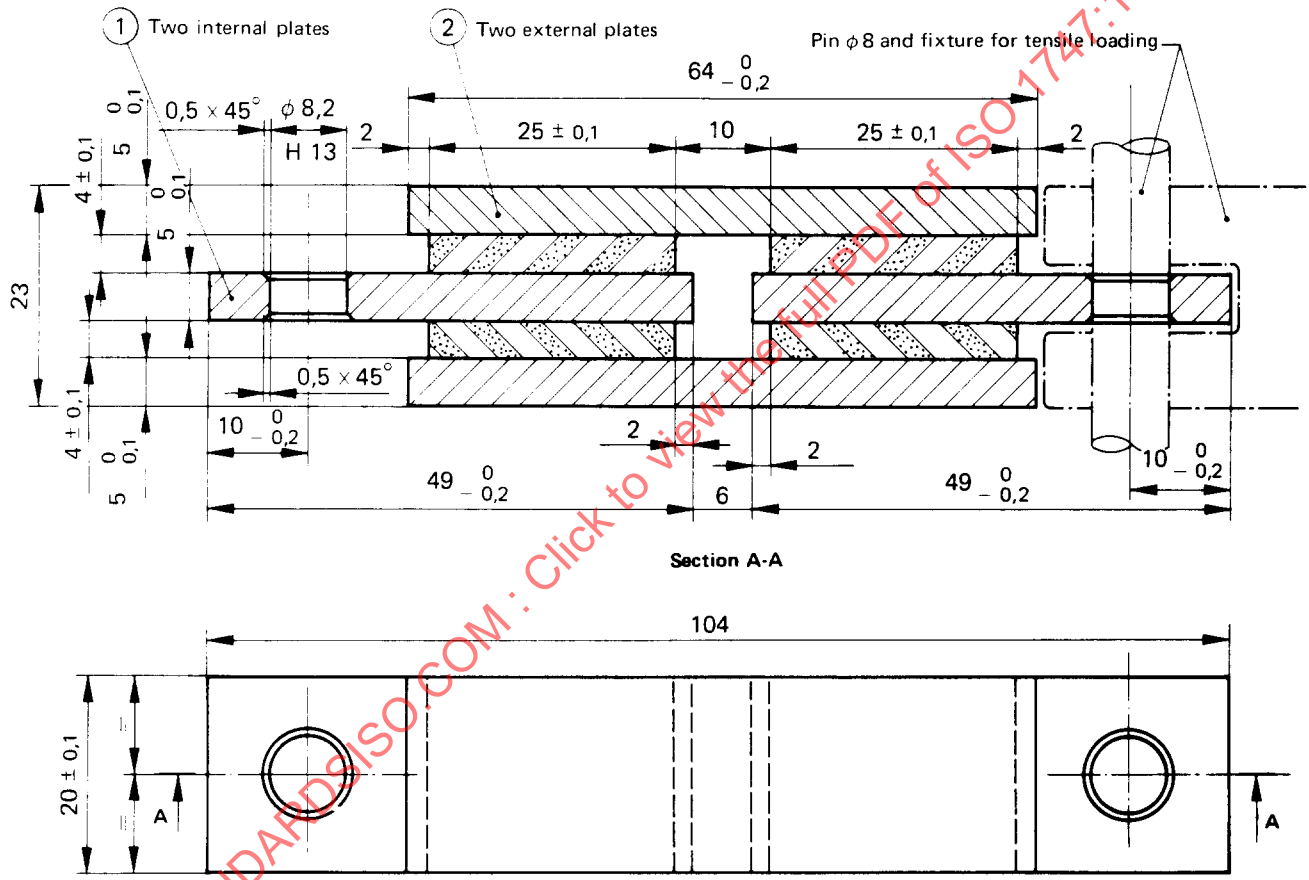
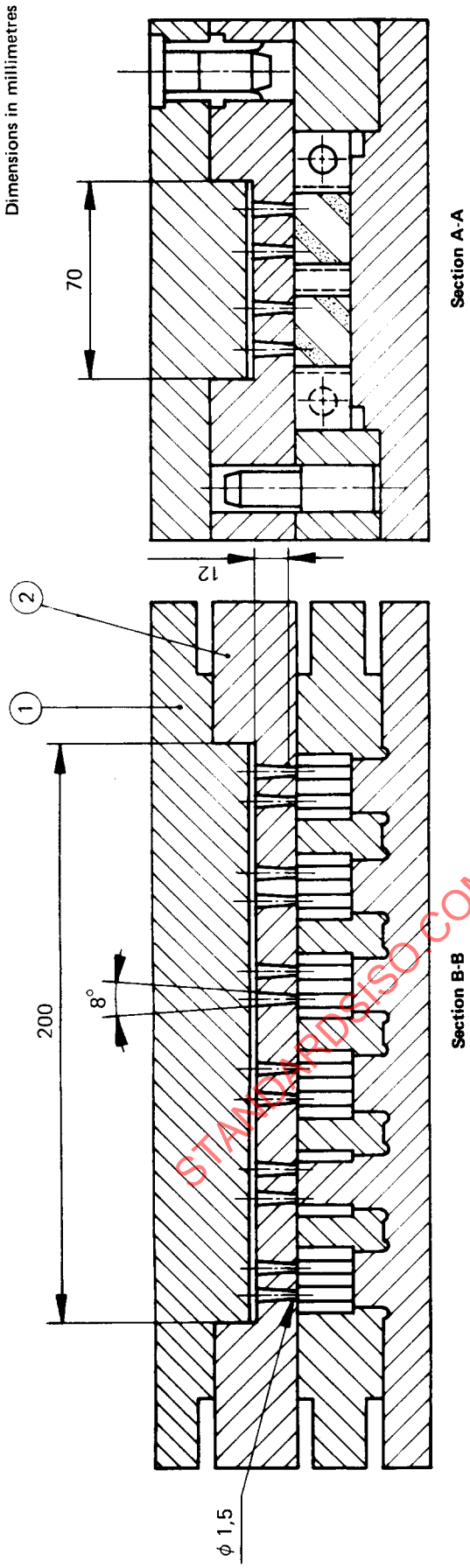


FIGURE 1 — **Test piece**



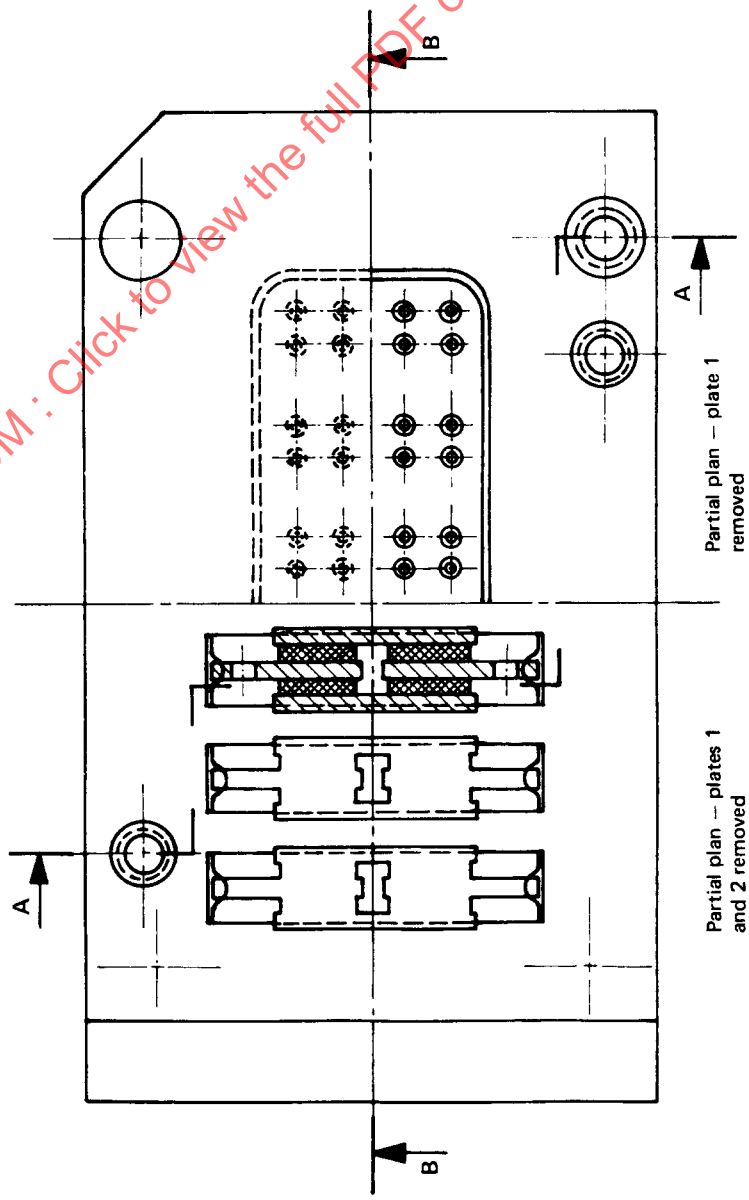


FIGURE 2 – Transfer mould