INTERNATIONAL STANDARD 813

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Vulcanized rubber — Determination of adhesion to metal — One-plate method

Élastomères vulcanisés — Détermination de l'adhérence au métal — Méthode à une plaque

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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 813 and found it suitable for transformation. International Standard ISO 813 therefore replaces ISO Recommendation R 813-1968.

ISO Recommendation R 813 was approved by the Member Bodies of the following countries :

Argentina	Germany	Poland
Australia	Hungary	Spain
Austria	India	Sweden
Brazil	Israel	Switzerland
Canada	Italy	United Kingdom
Chile	Japan	U.S.A.
Colombia	Korea, Rep. of	U.S.S.R.
Czechoslovakia	Netherlands	Yugoslavia
France	New Zealand	

No Member Body expressed disapproval of the Recommendation.

No Member Body disapproved the transformation of ISO/R 813 into an International Standard.

Printed in Switzerland

Vulcanized rubber — Determination of adhesion to metal — One-plate method

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies a method for the determination of the adhesion strength of rubber-to-metal bonds where the rubber part is assembled to one metal plate.

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.

2 PRINCIPLE

Measurement of the force required to cause separation of a rubber part adhering to a metal surface, the angle of separation being 90° and the width and thickness of the rubber being fixed within specified limits.

3 APPARATUS

3.1 Tensile testing machine conforming to the requirements of national standards for verification of testing machines. It shall be capable of accurately registering the maximum force in newtons obtained during the test, and of 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 *Fixture* *for holding the test piece to the upper head of* the machine so that the direction of pull to cause separation is at all times during the test as nearly perpendicular as possible to the plane of the rubber-to-metal bond, that is, making an angle of 90° with the face of the top holding fixture. The fixture shown in figure 1 complies with this requirement.

3.3 Grip so designed that it does not allow the rubber to slip or cause it to rupture.

4 TEST PIECE

4.1 Dimensions

The standard test piece shall consist of a strip of rubber 6,0 ± 0,1 mm thick in the test area, 25,0 ± 0,1 mm wide and 125 mm long, adhering to a 25 mm square area of the face of a metal strip.

The dimensions of the metal strip shall be 1,5 ± 0,1 mm thick, 25,0 ± 0,1 mm wide and 60 ± 1 mm long.

The test piece shall be so prepared that the bonded area of 25 mm length and 25,0 ± 0,1 mm width is approximately in the middle of the metal strip as shown in figure 2.

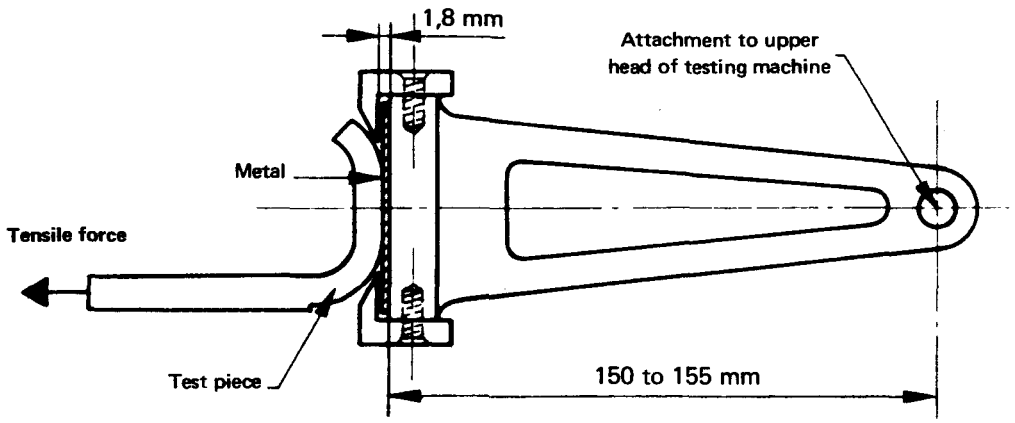

FIGURE 1 — **Test fixture for the adhesion test**

Dimensions in millimetres

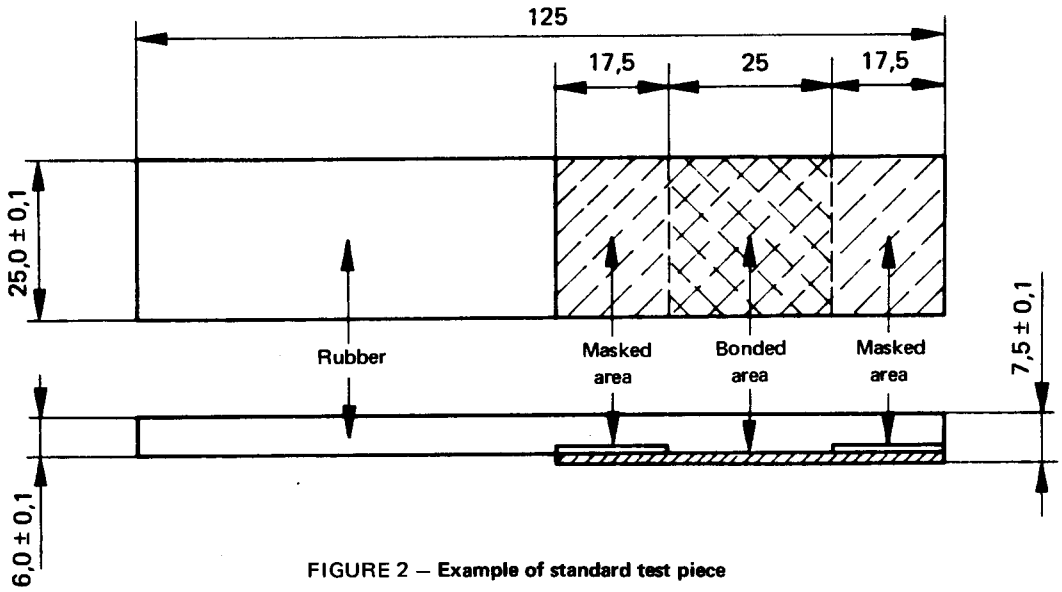

FIGURE 2 — **Example of standard test piece**

4.2 Preparation

4.2.1 Two types of mould may be used for vulcanization : moulds for several test pieces, or moulds for single test pieces.

4.2.1.1 When the test pieces are to be made using one mix and one type of adhesive system, a mould for several test pieces may be used. The inside mould dimension parallel to the longitudinal axis of the metal strip shall be 125 mm. The dimension along the transverse axis of the metal strip may be altered according to the number of test pieces to be cured at one time. The dimension perpendicular to the longitudinal and transverse axes of the metal strip shall be 7,50 ± 0,05 mm.

4.2.1.2 When only one test piece is to be made from a given mix, a mould as specified in 4.2.1.1 shall be used, except that the dimension along the transverse axis of the metal strip shall be restricted to the width of the test piece.

4.2.2 Unvulcanized rubber slabs 8,0 mm thick shall be cut to the dimensions of the required size for the mould, so as to provide maximum pressure of the rubber against the metal surface during vulcanization (length 125 mm, width according to the number of test pieces to be vulcanized).

4.2.3 During assembly and vulcanization, great care shall be taken to keep the surfaces to be bonded clean and free from dust, moisture and other foreign material.

4.2.3.1 Rectangular metal strips of the standard dimensions specified in 4.1 shall have the area to be bonded prepared in accordance with the method for securing adhesion that may be under investigation. Both ends shall be masked with pressure-sensitive tape so that the area specified in 4.1 is available for adhesion.

4.2.3.2 The rubber surface to be bonded shall be solvent washed, or treated in accordance with the method being investigated.

4.2.3.3 The metal strips and rubber slab shall then be assembled for vulcanization. When more than one test piece is prepared at a time, the metal strips shall be placed approximately 3 mm apart to allow for separation of the test pieces. The assembly shall then be placed in the mould with the metal strips at the bottom.

4.2.4 Vulcanization shall be carried out by heating the mould under pressure for a definite time at a controlled temperature in a suitable vulcanizing press. The time and temperature of vulcanization shall be in accordance with the system being investigated.

At the conclusion of the cure, care shall be taken in removing the test pieces from the mould to avoid subjecting the bonded surfaces to undue stress before the test pieces have cooled.

4.2.5 When more than one test piece is vulcanized at one time, the test pieces shall then be separated from each other in preparation for testing. This shall be done by cutting with scissors, hand-knife or other suitable equipment. The edges of the test pieces may then be buffed on a belt sander to bring the edge of the rubber flush to the edge of the metal strip. Care shall be taken not to overheat the metal parts or the rubber and not to reduce the width of the test piece beyond the tolerance allowed.

4.3 Number

Four test pieces shall be tested.

4.4 Conditioning

4.4.1 The test pieces shall be conditioned for at least 16 h at a standard laboratory temperature (23 ± 2 °C or 27 ± 2 °C)

immediately before test, the same temperature being used throughout any one test or series of tests intended to be comparable.

4.4.2 The time between vulcanization and testing shall not exceed 6 days.

5 PROCEDURE

5.1 Place the test piece symmetrically in the fixture shown in figure 1 with the separating edge towards the operator. Before the load is applied, strip the rubber from the metal plate for a distance of approximately 1,5 mm using a sharp knife. Place the test piece rubber in the grip. Then move the grip at the rate of 50 ± 5 mm/min until separation is complete. Record the maximum force required to cause separation over the distance of 25 mm.

5.2 An autographic recording of the adhesion value over the full length of the test piece may also be taken.

5.3 During the test, the operator shall cut the rubber back to the metal whenever the rubber stock tends to tear.

6 EXPRESSION OF RESULTS

6.1 Adhesion value

The adhesion value shall be expressed in newtons per millimetre of width.

6.2 Adhesion failure symbols

a) R indicates that the failure is in the rubber.

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

c) CP indicates that the failure is in the interface between the cover cement and the prime cement.

d) M indicates that the failure is at the interface between the metal and the prime cement.

7 TEST REPORT

The test report shall include the following :

a) all four test results expressed in accordance with clause 6;

b) a description of the type of failure, expressed in accordance with 6.2, with expression of percentage failure of each type present;

c) a description of the test piece, including the method of securing the adhesion;

d) date of vulcanization;

e) date of test;

f) time and temperature of vulcanization;

g) temperature of test.