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ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION

R 814

PREPARATION OF TEST PIECE AND METHOD OF TEST OF THE ADHESION OF VULCANIZED RUBBER TO METAL WHERE THE RUBBER IS ASSEMBLED TO TWO METAL PLATES

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BRIEF HISTORY

The ISO Recommendation R 814, *Preparation of test piece and method of test of the adhesion of vulcanized rubber to metal where the rubber is assembled to two metal plates,* was drawn up by Technical Committee ISO/TC 45, *Rubber*, the Secretariat of which is held by the British Standards Institution (BSI).

Work on this question by the Technical Committee led, in 1962, to the adoption of a Draft ISO Recommendation.

In November 1963, this Draft ISO Recommendation (No. 615) was circulated to all the ISO Member Bodies for enquiry. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

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 opposed the approval of the Draft.

The Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in September 1968, to accept it as an ISO RECOMMENDATION.

ISO Recommendation R 814 September 1968

PREPARATION OF TEST PIECE AND METHOD OF TEST OF THE ADHESION OF VULCANIZED RUBBER TO METAL WHERE THE RUBBER IS ASSEMBLED TO TWO METAL PLATES

1. SCOPE

This ISO Recommendation describes a method for testing the adhesion strength of rubber-to-metal bonds where the rubber part is assembled between two parallel metal plates.

This ISO Recommendation primarily applies 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 OF TEST

The test consists of measuring the force required to cause the rupture of a unit of standard dimensions, comprising rubber bonded to two parallel metal plates, the direction of the force being at 90° to the bonding surface.

3. APPARATUS

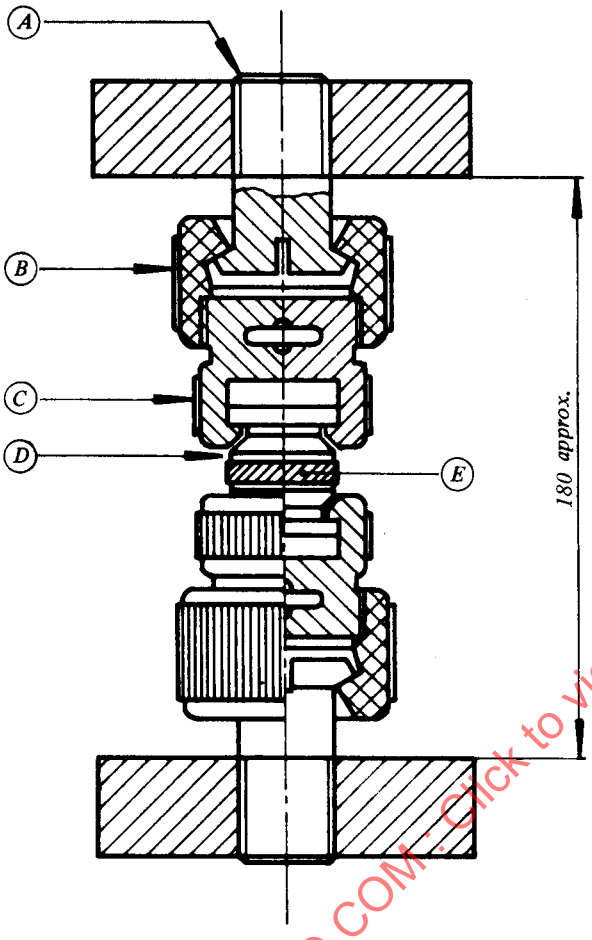
3.1 *Testing machine.* A tensile testing machine conforming to the requirements of national standards for verification of testing machines should be used. It should be capable of accurately registering the maximum force in newtons obtained during the test, and of maintaining the specified constant rate of separation of the jaws of 25 ± 5 mm per minute.

NOTE. – Inertia (pendulum) type dynamometers are apt to give results which differ because of frictional and inertial effects. An inertia-less (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.* The fixtures for holding the test pieces in the testing machine should permit accurate centering of the applied load during the test.

A suitable type of fixture is shown in Figure 1.

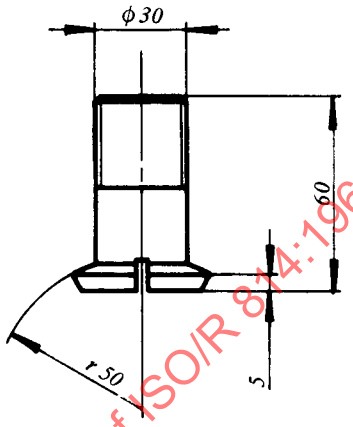
Dimensions in millimetres



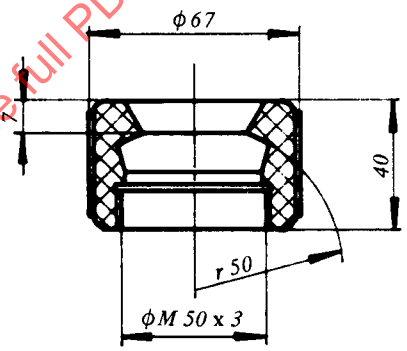
Assembly of parts

(D) = *metal part of test piece*

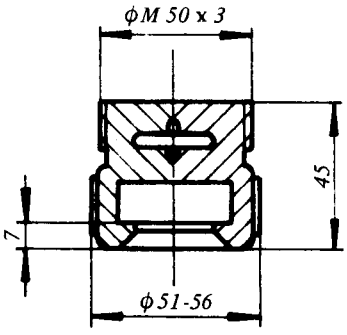
(E) = *rubber*



Part A – Tail fillet to suit test machine



Part B – Bridle fillet threaded to take part C



Part C – Split across centre to accept test piece and threaded to fit into part B.

FIG. 1 – **Test fixtures for holding rubber-to-metal bond test pieces**

4. STANDARD TEST PIECE

4.1 Dimensions of standard test piece

The standard test piece should consist of a rubber cylinder 3 ± 0.1 mm thick and of diameter between 35 and 40 ± 0.1 mm, having its circular ends bonded to the faces of two metal plates of equal diameter.

The thickness of the metal plates should not be less than 9 mm. A typical test piece is shown in Figure 2.

Dimensions in millimetres

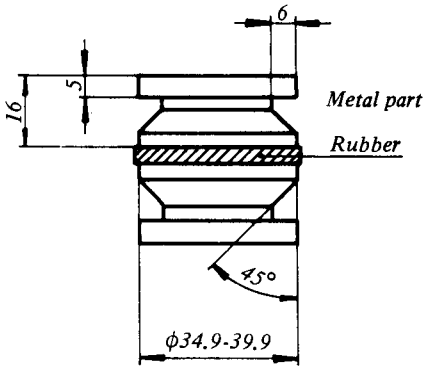


FIG. 2 – **Example of standard test piece**

4.2 Preparation of standard test piece

4.2.1 Circular metal parts of the standard dimensions should be prepared from rolled carbon steel bar. Other metals may be used provided that the parts are in conformity with the essential dimensions. The smooth metal parts should be prepared and treated in accordance with the adhesion system under investigation.

4.2.2 Unvulcanized rubber discs should be cut using a circular die of such size that a limited amount of flash is obtained on moulding. The surface of the rubber to be bonded to the metal should be treated in accordance with the method being investigated.

4.2.3 The rubber discs and metal end pieces should then be assembled for vulcanization in the mould. The mould should be constructed so that the rubber projects beyond the edges of the metal end pieces by approximately 0.04 mm in order to prevent tearing of the rubber by the edge of the metal during test.

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

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

4.2.6 At the conclusion of the cure, great care should 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.

4.3 Number of test pieces

Four test pieces should be tested.

4.4 Conditioning of test pieces

4.4.1 The test pieces should be conditioned for at least 16 hours at a standard laboratory temperature immediately before test. The standard laboratory temperature is 20 ± 2 °C, 23 ± 2 °C or 27 ± 2 °C, 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 should not exceed 6 days.

5. PROCEDURE

5.1 The test piece should be mounted in the test machine. Extreme care is necessary in centring and adjusting the test piece so that the tension is uniformly distributed in the cross section during the test.

5.2 Tension should be applied by separating the jaws at a constant rate of 25 ± 5 mm per minute until the test piece breaks. The maximum force should be recorded.

6. EXPRESSION OF RESULTS

6.1 Adhesion value

The adhesion value should be expressed in bars and should be calculated by dividing the maximum force, expressed in decinewtons, by the cross-sectional area of the test piece expressed in square millimetres.

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 should include the following :

(*a*) all four test results, expressed in accordance with section 6;

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

(*c*) a description of the method of securing the adhesion, and whether the test piece was prepared in the laboratory or taken from a production part;

(*d*) date of vulcanization;

(*e*) date of test;

(*f*) time and temperature of vulcanization;

(*g*) temperature of test;

(*h*) metal used, if other than the specified steel.