BRITISH STANDARD

METHODS OF TESTING VULCANIZED RUBBER

PART D 5. DETERMINATION OF TENSILE STRENGTH OF EBONITE

B.S. 903 : Part D 5 : 1957

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BRITISH STANDARDS INSTITUTION

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THIS BRITISH STANDARD, having been approved by the Rubber Industry Standards Committee and endorsed by the Chairman of the Chemical Divisional Council, was published under the authority of the General Council on 30th August, 1957.

The Institution desires to call attention to the fact that this British Standard does not purport to include all the necessary provisions of a contract.

In order to keep abreast of progress in the industries concerned, British Standards are subject to periodical review. Suggestions for improvements will be recorded and in due course brought to the notice of the committees charged with the revision of the standards to which they refer.

A complete list of British Standards, numbering over 2500, indexed and cross-indexed for reference, together with an abstract of each standard, will be found in the Institution's Yearbook, price 15s.

This standard makes reference to the following British Standards:

B.S. 350 Conversion factors and tables.
B.S. 1610 Verification of testing machines. Part 1. Methods of load verification; and verification of tensile and compression machines.

British Standards are revised, when necessary, by the issue either of amendment slips or of revised editions. It is important that users of British Standards should ascertain that they are in possession of the latest amendments or editions.

The following B.S.I. references relate to the work on this standard:—
Committee reference RUC/10 and RUC/10/6
Draft for comment CX(RUC)350

CO-OPERATING ORGANIZATIONS

The Rubber Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and industrial organizations:—

Board of Trade
*British Rubber Producers' Research Association
*Federation of British Rubber and Allied Manufacturers' Associations
*Institution of the Rubber Industry
*Ministry of Supply
Natural Rubber Development Board
*Research Association of British Rubber Manufacturers
*Rubber Growers' Association

The Government departments and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:—

Admiralty
Air Ministry
Association of British Chemical Manufacturers
Association of British Ebonite Manufacturers
British Cellular Rubber Manufacturers' Association
British Chemical Plant Manufacturers' Association
British Electrical and Allied Industries Research Association
British Railways, The British Transport Commission
British Rubber and Resin Adhesive Manufacturers' Association
Department of the Government Chemist
General Post Office
Institute of Brewing
Institution of Chemical Engineers
Institution of Gas Engineers
Institution of Mechanical Engineers
Institution of Mechanical Engineers (Automobile Division)
Institution of Municipal Engineers
Institution of Water Engineers
Ministry of Housing and Local Government
National College of Rubber Technology
National Physical Laboratory (D.S.I.R.)
Royal Institute of Chemistry
Rubber Trade Association of London
Society of Motor Manufacturers and Traders Ltd.

BRITISH STANDARD

METHODS OF TESTING VULCANIZED RUBBER

Part D 5

Method for the Determination of Tensile Strength of Ebonite

FOREWORD

This British Standard has been prepared under the authority of the Rubber Industry Standards Committee.

In deciding to issue a revision of the 1950 edition, it has been considered desirable to publish B.S. 903 in separate parts and the present part is a new method.

The group of parts to which this part belongs covers methods of testing ebonite and is marked with the prefix letter ' D '. Further parts in this group have been issued as follows:—

Part D 1. Determination of plastic yield temperature of ebonite.
Part D 2. Determination of plastic yield of ebonite at a specified temperature.
Part D 3. Determination of crushing strength of ebonite.
Part D 4. Determination of cross-breaking strength of ebonite.

NOTE. Where metric equivalents have been given the figures in British units are to be regarded as the standard. The metric conversions are approximate. More accurate conversions should be based on the tables in B.S. 350, ' Conversion factors and tables '.

SECTION 1 DEFINITIONS

For the purposes of this British Standard the following definitions shall apply:

Tensile stress. A stress applied so as to stretch the test piece longitudinally. It is the average load per unit area of the original cross-section.

Tensile strength. The maximum tensile stress reached during the stretching of the test piece to breaking point, the conditions being such that the stress is substantially uniform over the cross-section.

SECTION 2 SUMMARY AND EXPLANATORY NOTE

In this test, standard test pieces are stretched until they break, in a tensile testing machine capable of producing a constant rate of traverse of the loading grip.

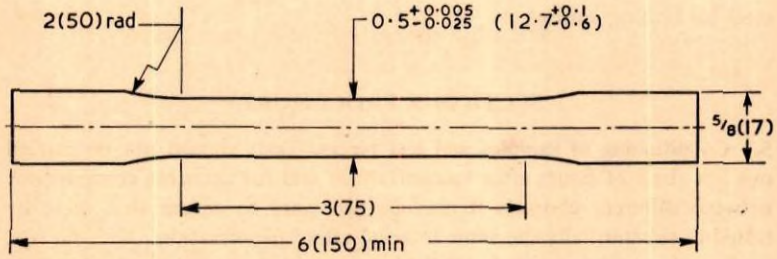
SECTION 3 TEST PIECE

The test piece shall be prepared from sheet material. The thickness of the test piece shall be that of the sheet; but because of the capacity of the test machine available (see Section 4), it may, if necessary, be machined to reduce the thickness to not less than ⅛ in. (3 mm), one original surface being retained. The test piece shall be machined to the shape shown in Fig. 1. A milling cutter of 2 in. (51 mm) radius is convenient to shape the narrow portion.

NOTE. Although 6 in. (150 mm) minimum is specified it may be found desirable to use a length of 8 in. (200 mm) in order to improve the grip of the test pieces in the machine.

In the narrow part of any one dumb-bell the width shall nowhere deviate by more than 0·002 in. (0·05 mm) from the mean, and the thickness shall nowhere deviate by more than 2 per cent from the mean.

Any test piece showing irregularities or imperfections shall not be used.



All dimensions in inches with millimetres in parentheses.

Fig. 1. Tensile test piece

SECTION 4 APPARATUS

The tensile testing machine shall be power-driven and of such capacity that the load required for the test is not greater than 85 per cent or less than 15 per cent of the maximum of the scale. The rate of traverse of the

driven grip shall be adjustable (an available speed range from 0·2 in. to 0·75 in. (5–19 mm) per minute is suitable) and the power shall be sufficient to maintain the selected rate substantially constant up to the maximum load capacity of the machine. The machine shall record the maximum load reached during the test.

The machine shall be provided with self-tightening grips which exert a uniform pressure across the widened ends of the dumb-bell. Each grip shall incorporate a means for positioning so that all test pieces are inserted to the same depth and are in plane and axial alignment with the direction of pull.

The calibration of the tensile testing machine shall be as follows:

(i) The load scale shall be calibrated by a convenient method at least once every six months to ensure that the error does not exceed 1·5 per cent of the applied load or 0·3 per cent of the maximum of the scale, whichever is the greater. (Grade B machine, B.S. 1610,* Part 1.)

(ii) For a machine equipped with a mechanism for the autographic recording of the stress-strain curve, the load scale and recording mechanism shall be calibrated at least once every three months to ensure that the load scale error does not exceed that specified in (i) above.

Methods for calibrating the load scale of tensile testing machines are defined in B.S. 1610, Part 1, but a simpler and quicker method is to use steel calibrating springs.

SECTION 5 PROCEDURE

5.1 Conditioning of samples and test pieces. Tests should not be carried out less than 24 hours after vulcanization, and for accurate comparisons between different ebonites it may be necessary to ensure that these be tested at substantially the same interval after vulcanization.

Samples and test pieces shall be protected from light as completely as possible during the interval between vulcanization and testing.

The test pieces shall be conditioned at a temperature of 20 ± 5°C for not less than 18 hours immediately before test.

If the test is to be carried out at a temperature other than 20°C, the test pieces shall finally be conditioned for one hour at the test temperature immediately before the test.

NOTE. See Note under Clause 5.4. Temperature of test.

5.2 Measurement of test pieces. The thickness and width of the test piece shall be measured to the nearest 0·002 in. (0·05 mm) at the centre and

* B.S. 1610, Part 1, ' Verification of testing machines, Part 1, Methods of load verification; and verification of tensile and compression machines '

near each end of the narrow part. The average thickness and width shall be used in calculating the area of the cross-section.

5.3 Determination of tensile strength. A test piece shall be inserted in the grips of the tensile testing machine, care being taken to adjust it symmetrically so that the tension will be distributed uniformly across the cross-section. The machine shall then be started and the travel of the driven grip adjusted to a constant rate such that the test piece breaks in 30 ± 15 seconds. The maximum load applied to the test piece shall be recorded.

Tensile strength shall be calculated by dividing this load by the original area of cross-section of the test piece. The median of four results shall be reported, excluding the result on any test piece which breaks more than 1¼ in. (32 mm) from the centre of the narrow part.

5.4 Temperature of test. The test shall normally be carried out at 20 ± 5°C.

NOTE. A single temperature of 20 ± 5°C for conditioning and testing is not yet practicable for all countries. In tropical countries it is very difficult to maintain conditioning chambers or laboratories at this temperature, and an alternative temperature of 27 ± 5° is therefore permitted.

SECTION 6 REPORT

The report shall state:—

1. Tensile strength in lb/sq. in. or kg/sq. cm.
2. Thickness of test piece and of sheet from which it was prepared.
3. Temperature of test.

BRITISH STANDARDS INSTITUTION

The British Standards Institution was founded in 1901 and incorporated by Royal Charter in 1929.

The principal objects of the Institution as set out in the charter are to co-ordinate the efforts of producers and users for the improvement, standardization and simplification of engineering and industrial materials; to simplify production and distribution; to eliminate the waste of time and material involved in the production of an unnecessary variety of patterns and sizes of articles for one and the same purpose; to set up standards of quality and dimensions, and to promote the general adoption of British Standards.

In carrying out its work the Institution endeavours to ensure adequate representation of all viewpoints. Before embarking on any project it must be satisfied that there is a strong body of opinion in favour of proceeding and that there is a recognized need to be met.

The Institution is a non-profit-making concern. It is financed by subscriptions from firms, trade associations, professional institutions and other bodies interested in its work, by a Government grant and by the sale of its publications. The demands on the services of the Institution are steadily increasing and can only be met if continuing and increased financial support is provided.

Membership of the Institution is open to British subjects, companies, technical and trade associations, and local public authorities.

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