

BRITISH STANDARD
METHODS OF TESTING
VULCANIZED
RUBBER

PARTS D 1 & D 2. DETERMINATION OF
PLASTIC YIELD OF EBONITE

B.S. 903 : Parts D 1 & D 2 : 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 January, 1957.

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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 12s. 6d.

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/10/6 Draft for comment CW(RUC) 1213

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 department 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

London Advisory Committee for Rubber Research
(Ceylon and Malaya)

Ministry of Housing and Local Government

Ministry of Works

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

Parts D 1 and D 2.
Determination of Plastic Yield of Ebonite

FOREWORD

This British Standard has been published under the authority of the Rubber Industry Standards Committee. In deciding to issue a revision of the 1950 edition it has also been considered desirable to publish B.S. 903 in separate parts. The present part D 1 is a new method, and the present part D 2 replaces Part 37 of 1950 from which it differs principally in the size of test piece used and the layout.

The group of parts in which the prefix letter 'D' is used covers methods of testing the physical properties of ebonite.

PART D 1.
PLASTIC YIELD TEMPERATURE

SECTION 1 INTRODUCTION AND EXPLANATORY NOTE

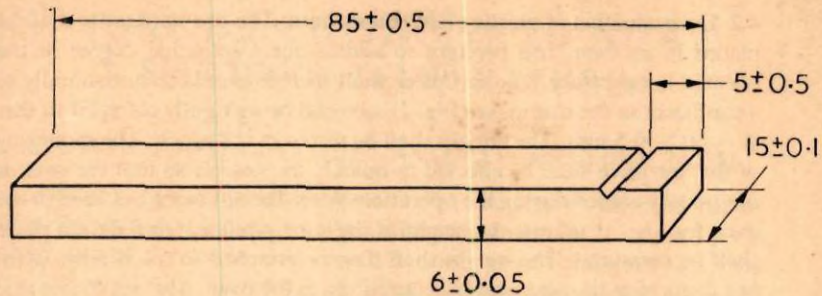
Plastic yield temperature is determined by measuring the deformation of bar-shaped test pieces of given dimensions when stressed under specified conditions at a number of different temperatures, plotting a temperature-deformation graph and estimating the temperature corresponding to a prescribed yield.

The deformation measured in this test is partly plastic and partly elastic.

The value of temperature obtained by this test is not to be considered as necessarily indicating safe working temperature; this can only be determined definitely by tests on finished parts under service conditions. However, the applied stress, deformation and time of test specified have been chosen to give approximately the maximum safe working temperature in the majority of cases where moderate mechanical stresses are involved.

SECTION 2 TEST PIECE

The test piece shall be a bar 85 ± 0.5 mm long, 15 ± 0.1 mm wide and 6 ± 0.05 mm deep, with a V-notch across one side 5 ± 0.5 mm from the end (see Fig. 1).



All dimensions in millimetres.

Fig. 1. Test piece

SECTION 3 APPARATUS

The apparatus shall consist of a clamp for mounting the test piece as a cantilever together with a stirrup for applying the load (see Fig. 2). The stirrup shall be of such shape that it will rest in the notch of the test piece and distribute the load uniformly across its width. The weight of the stirrup and of any other attachment shall not exceed 9 g.

A weight shall be provided for attaching to the stirrup so that the total applied load including the weight of the stirrup, etc., is 180 ± 1 g.

A thermostatically controlled air oven capable of being controlled to a given temperature within one Centigrade degree.

Suitable means for measuring the vertical movement of the test piece.

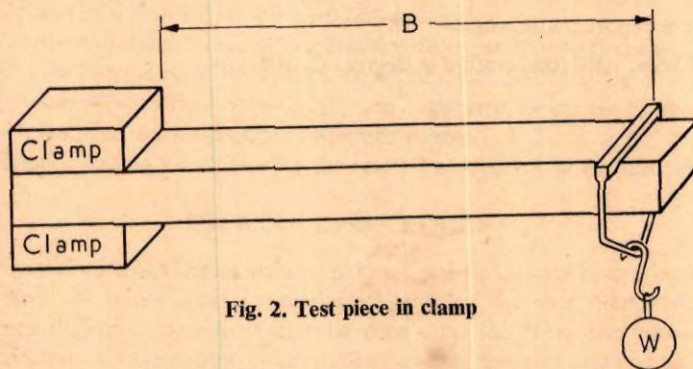


Fig. 2. Test piece in clamp

SECTION 4 PROCEDURE

4.1 Conditioning of samples and test pieces. Tests should not be carried out less than 24 hours after vulcanization and for accurate comparison between different ebonites it may be necessary that these are 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.

4.2 Determination of plastic yield temperature. The test apparatus shall be placed in an oven and brought to within one Centigrade degree of the selected temperature. The test piece shall then be mounted horizontally as a cantilever in the clamp (see Fig. 2), one end being rigidly clamped so that $B = 60 \pm 0.5$ mm. The stirrup shall be rested in the notch. The mounting of the test piece shall be effected as quickly as possible so that the oven is not unduly cooled during the operation. After the test piece has been in the oven for 15 ± 1 minute the height of the stirrup relative to a datum point shall be measured. The weight shall then be attached to the stirrup, without disturbing the temperature conditions in the oven. The apparatus and loaded test piece shall then be maintained for 6 hours ± 10 minutes at the temperature. At the end of this period, with the load still in position, the height of the stirrup shall be re-measured. The change in height of the stirrup shall be taken as the plastic yield of the test piece at the test temperature.

The procedure shall be repeated at a number of temperatures using a fresh test piece at each temperature and a yield/temperature graph shall be drawn. From this graph the temperature corresponding to a yield of 2 mm shall be interpolated and shall be taken as the yield temperature. There shall be at least two experimental points above and two below the yield temperature; at least one of the points shall be within 5 Centigrade degrees of the yield temperature.

SECTION 5 REPORT

The report shall state:—

Plastic yield temperature in degrees Centigrade.

PART D 2. PLASTIC YIELD AT A SPECIFIED TEMPERATURE

SECTION 1 INTRODUCTION AND EXPLANATORY NOTE

Plastic yield at a specific temperature is measured as the deformation of a bar-shaped test piece of given dimensions when it is stressed for a given time at the specified temperature under given conditions. This test is appropriate when knowledge of the deformation behaviour of a material at a given temperature is required.

The deformation measured in this test is partly plastic and partly elastic.

SECTION 2 TEST PIECE

The test piece shall be a bar 85 ± 0.5 mm long, 15 ± 0.1 mm wide and 6 ± 0.05 mm deep, with a V-notch across one side 5 ± 0.5 mm from the end (see Fig. 1).

SECTION 3 APPARATUS

The apparatus shall consist of a clamp for mounting the test piece as a cantilever together with a stirrup for applying the load (see Fig. 2). The stirrup shall be of such shape that it will rest in the notch of the test piece and distribute the load uniformly across its width. The weight of the stirrup and of any other attachment shall not exceed 9 g.

A weight shall be provided for attaching to the stirrup so that the total applied load including the weight of the stirrup, etc., is 180 ± 1 g.

A thermostatically controlled air oven capable of being controlled to a given temperature within one Centigrade degree.

Suitable means for measuring the vertical movement of the test piece.

SECTION 4 PROCEDURE

4.1 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 that these are 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.

4.2 Determination of plastic yield at a specified temperature. The test apparatus shall be placed in an oven and brought to within one Centigrade degree of the specified temperature. The test piece shall then be mounted horizontally as a cantilever in the clamp (see Fig. 2), one end being rigidly clamped so that $B = 60 \pm 0.5$ mm. The stirrup shall be rested in the notch.

The mounting of the test piece shall be effected as quickly as possible so that the oven is not unduly cooled during the operation. After the test piece has been in the oven for 15 ± 1 minute the height of the stirrup relative to a datum point shall be measured. The weight shall then be attached to the stirrup, without disturbing the temperature conditions in the oven. The apparatus and loaded test piece shall then be maintained for $6 \text{ hours} \pm 10 \text{ minutes}$ at the temperature. At the end of this period, with the load still in position, the height of the stirrup shall be re-measured. The change in height of the stirrup shall be taken as the plastic yield of the test piece at the test temperature.

SECTION 5 TEMPERATURE OF TEST

The test shall normally be made at a temperature determined by the use to which the material is to be put. In the absence of such information the following temperatures are recommended:—

For unloaded ebonites made from natural rubber: $55 \pm 1^\circ\text{C}$.

For loaded ebonites made from natural rubber: $70 \pm 1^\circ\text{C}$.

SECTION 6 REPORT

The report shall state:—

Plastic yield in millimetres.

Temperature of test in degrees Centigrade.