

Methods of test for

Brake linings materials

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Foreword

This British Standard, which is published under the authority of the Automobile Industry Standards Committee of the BSI, is based upon data sheet SMMT C-3E:1964 (as revised in February 1967) of the Society of Motor Manufacturers and Traders Limited.

It should be noted that the tests in this standard are not intended to replace the testing of brakes on a vehicle or dynamometer, it being accepted that a full assessment of a lining can be made only under operating conditions. The tests may, however, be used for checking the consistency of manufacture. For this purpose, the supplier and the purchaser should reach agreement on the selection of the tests, the sampling procedures and the limits to apply to the results.

The test procedures described are for the determination of certain physical and chemical properties; they can be used for any lining material, and as a quality control check on that material.

The properties should be identified with a particular brake lining and not with the brake or vehicle on which this lining is used.

The test procedures are not intended to assist the designer to find suitable materials for any particular application since the properties do not necessarily bear any direct relationship to the performance of the lining in service.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 15 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Amendments issued since publication

Amd. No.	Date	Comments

This British Standard, having been approved by the Automobile Industry Standards Committee and endorsed by the Chairman of the Engineering Divisional Council, was published under the authority of the General Council of the Institution on 30 January 1968

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The following BSI reference relates to the work on this standard:
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1 Scope

This British Standard gives methods for testing brake lining friction materials to determine certain physical and chemical properties. The tests given include:

- 1) Density
- 2) Hardness (Brinell and Rockwell)
- 3) Crossbreaking strength, for drum brake linings
- 4) Acetone extract
- 5) Loss of weight by ignition
- 6) Assessment of friction and wear

2 Terms and definitions

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

2.1

brake lining

a piece of friction material made to a shape specified by a brake manufacturer

2.2

sample

a selection of brake linings taken from any batch or delivery of a particular material

2.3

specimen

that part of a sample brake lining on which tests are performed

3 Tests

3.1 General. Specimens taken from samples of brake linings shall be subjected to the tests described in this standard. The size of the sample and the number of specimens tested from the sample shall be agreed between the purchaser and the manufacturer. Where alternative methods of testing are given the manufacturer shall, unless otherwise agreed with the purchaser, select the method he considers most suitable for the particular material.

3.2 Density. Two alternative methods are given:

3.2.1 Method 1). The weight in grammes of the specimen shall be determined within an accuracy of ± 0.1 %. The mean dimensions of the specimen shall be determined within an accuracy of ± 0.25 % and the volume computed in cubic centimetres. The shape of the specimen will determine how this is done; in the case of an undrilled specimen which is in the form of an arc, the volume V is given by:

$$V = \frac{(A_1 + A_2)bt}{2}$$

where, V = volume in cm^3

A_1 = mean length of outer curved surface in centimetres

A_2 = mean length of inner curved surface in centimetres

b = mean width } The mean values in centimetres shall be determined by measurements
 t = mean thickness } equally spaced along the specimen.

The density of the specimen shall be computed as follows:

$$\text{Density} = \frac{W}{V} \text{ g/cm}^3$$

where W = weight of specimen in grammes

3.2.2 Method 2. Suspend the specimen from a balance pan hook by means of a length of thin thread and determine the weight of the specimen in air within an accuracy of $\pm 0.1\%$.

Immerse the specimen in water at a temperature between $18\text{ }^{\circ}\text{C}$ and $24\text{ }^{\circ}\text{C}$ in such a way that it is freely suspended and does not touch the surface of the water or the walls of the water-container, and re-weigh within an accuracy of $\pm 0.1\%$.

If the weight of the thread is small (less than 0.05%) compared to the weight of the specimen, it may be ignored.

In weighing the specimen in water, air bubbles adhering to the specimen shall be removed. Their removal can be facilitated by the presence of a trace (e.g. one part in 10 000) of detergent in the water, or by dipping the specimen momentarily into industrial methylated spirit, provided that it is known that the material is not affected by this treatment. If the latter procedure is adopted, care shall be taken that the minimum amount of spirit is transferred to the water in which the specimen is weighed.

The specimen must be weighed as quickly as possible after immersing in water.

The density of the specimen shall be computed as follows:

$$\text{Density} = \frac{W_a}{W_a - W_b} \text{ g/cm}^3$$

where, W_a = weight in air in grammes

W_b = weight in water in grammes

3.3 Hardness. Two alternative methods are given:

3.3.1 Method 1. Brinell hardness. This test which is based on the Brinell principles described in BS 240-1¹⁾, shall be carried out with a hardness testing machine fitted with a ball indenter of 5 or 10 mm diameter. The test shall be applied to the working surface of the specimen. If necessary, a small amount of material may be removed from this surface by grinding in order to provide a smooth surface for the test. The ambient temperature at the machine shall be between $18\text{ }^{\circ}\text{C}$ and $24\text{ }^{\circ}\text{C}$.

The specimen shall be firmly held in position with adequate support from below with the working surface normal to the direction of application of the load, and a piece of aluminium foil 0.020 mm thick, located on the surface of the specimen so that the result may be observed on the foil.

The indenter shall be applied with the specified load for a period of 15 seconds. The load and ball size, selected from one of the following scales, shall be such that the impressed diameter is between one quarter and half of the ball diameter:

Scale	Ball diameter	Load
	mm	kgf ^a
A	10	30
B	10	100
C	5	75

^a 1 kgf = 9.806 65 N

Where two of these scales will give results within the above limitation, the scale selected shall be that which gives the greater diameter of impression.

The impression created on the foil shall be examined and its mean diameter, taken as the average length of two diameters taken at right angles to each other, measured in millimetres. The specimen underneath the foil shall also be examined; if it is evident that the indenter has struck a hard inclusion or other particle liable to falsify the result, the reading shall be discarded and another obtained.

The result for each specimen shall be determined from the arithmetic mean of the measurements from at least three indentations. These indentations shall be at least 12 mm from any edge and uniformly spaced along the specimen.

The hardness shall then be determined as the quotient of the applied load divided by spherical area of the impression. For the scale used and the average diameter of impression obtained in millimetres the Brinell hardness number can be obtained from Table 1, Table 2 or Table 3.

¹⁾ BS 240, "Method for Brinell hardness test", Part 1, "Testing of metals".