

Physical testing of rubber —

**Part A26: Method for determination of
hardness (hardness between 10 IRHD
and 100 IRHD)**

ICS 83.060

Committees responsible for this British Standard

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- British Railways Board
- British Rubber Manufacturers' Association Ltd.
- GAMBICA (BEAMA Ltd.)
- Malaysian Rubber Producers' Research Association
- Ministry of Defence
- RAPRA Technology Ltd.
- SATRA Footwear Technology Centre
- Coopted member

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National foreword

This Part of BS 903 has been prepared by Technical Committee PRI/22. It is identical with ISO 48:1994 *Rubber, vulcanized or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD)*, including amendment 1:1999, published by the International Organization for Standardization (ISO). This edition supersedes BS 903-A26:1969 which is withdrawn.

This edition of BS 903-A26 differs from the 1969 edition as follows.

- a) The apparent hardness of rubber-covered rollers is now the subject of BS 7442-3.1.
- b) Hardness is expressed and reported to the nearest whole number on the entire hardness range (see clause 12).

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Electronic Catalogue under the section entitled “International Standards Correspondence index”, or by using the “Find” facility of the BSI Standards Electronic Catalogue.

The Technical Committee has reviewed the provisions of ISO 1826:1981 and ISO/TR 9272:1986, to which normative reference is made in the text, and has decided that they are acceptable for use in conjunction with this standard.

A British Standard related to ISO 1826:1981 is BS 903-A19:1986 *Methods of testing vulcanized rubber — Part A19: Heat resistance and accelerated ageing*.

ISO 7267-1:1986, ISO 7267-2:1986 and ISO 7267-3:1988 on the apparent hardness of rubber-covered rollers are identical with BS 7442-3.1:1991, BS 7442-3.2:1991 and BS 7442-3.3:1992 respectively.

Additional information In the UK the standard temperature (see clause 9) is $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$.

NOTE The “standard temperature” is commonly referred to as the “standard laboratory temperature”

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 14, an inside back cover and a back cover

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Introduction

The hardness test specified in this International Standard is intended to provide a rapid measurement of rubber stiffness, unlike hardness tests on other materials which measure resistance to permanent deformation.

Hardness is measured from the depth of indentation of a spherical indenter, under a specified force, into a rubber test piece. An empirical relationship between depth of indentation and Young's modulus for a perfectly elastic isotropic material has been used to derive a hardness scale which may conveniently be used for most rubbers.

When it is required to determine the value of Young's modulus itself, an appropriate test method should be used, for example that described in ISO 7743:1989, *Rubber, vulcanized or thermoplastic — Determination of compression stress-strain properties*, for determination of compression stress-strain properties.

1 Scope

This International Standard specifies four methods for the determination of the hardness of vulcanized or thermoplastic rubbers on flat surfaces:

Method N	Normal test
Method H	High-hardness test
Method L	Low-hardness test
Method M	Microtest

and four methods for the determination of apparent hardness of curved surfaces using methods N, H, L and M, respectively:

Methods CN, CH, CL and CM.

The methods differ primarily in the diameter of the indenting ball and the magnitude of the indenting force, these being chosen to suit the particular application. The range of applicability of each is indicated in Figure 1.

Method N: The normal test for hardness is the appropriate method for test pieces of thickness greater than or equal to 4 mm and is preferably used for rubbers in the range 35 IRHD to 85 IRHD but may be used for those in the range 30 IRHD to 95 IRHD.

Method H: The appropriate method for test pieces of thickness greater than or equal to 4 mm and hardness in the range 85 IRHD to 100 IRHD.

Method L: The appropriate method for test pieces of thickness greater than or equal to 6 mm and hardness in the range 10 IRHD to 35 IRHD.

NOTE 1 The value of hardness obtained by method N within the ranges 85 IRHD to 95 IRHD and 30 IRHD to 35 IRHD may not agree precisely with that obtained using method H or method L, respectively. The difference is not normally significant for technical purposes.

Method M: The microtest for hardness is essentially a scaled-down version of the normal test method N, permitting the testing of thinner and smaller test pieces. It is the appropriate method for test pieces of thickness less than 4 mm and is preferably used for rubbers in the range 35 IRHD to 85 IRHD but may be used for those in the range 30 IRHD to 95 IRHD.

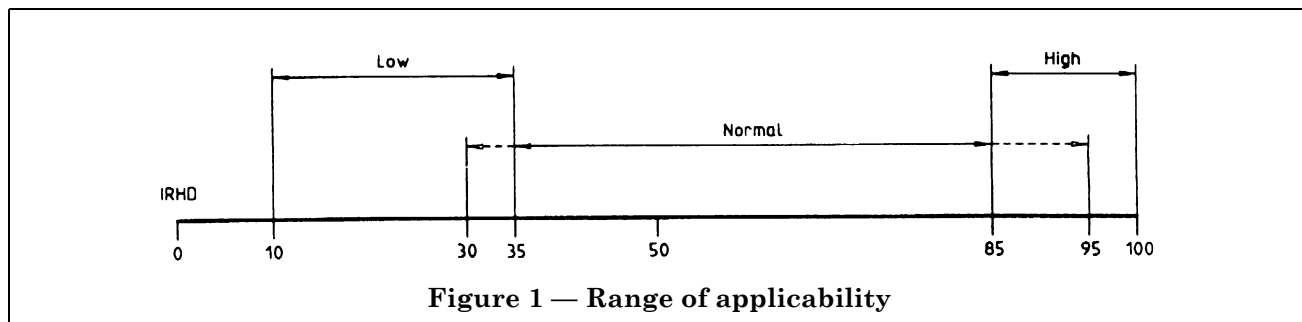
NOTE 2 Because of various surface effects in the rubber and of any slight surface roughness (produced, for example, by buffing), the microtest will not always give results agreeing with those obtained by the normal test.

Methods CN, CH, CL and CM: Apparent-hardness tests on curved surfaces.

These methods are modifications of methods N, H, L and M for cases where the rubber surface tested is curved. Two cases exist, depending whether

- the test piece or article tested is large enough for the hardness instrument to rest upon it;
- it is small enough for both the test piece and the instrument to rest upon a common support.

A variant of b) would be where the test piece rests on the specimen table of the instrument.



The procedures described cannot provide for all possible shapes and dimensions of test pieces but cover some of the commonest types such as “O” rings. Determination of the apparent hardness of rubber-covered rollers is dealt with separately in ISO 7267-1:1986, *Rubber-covered rollers — Determination of apparent hardness — Part 1: IRHD method*, ISO 7267-2:1986, *Rubber-covered rollers — Determination of apparent hardness — Part 2: Shore-type durometer method* and ISO 7267-3:1988, *Rubber-covered rollers — Determination of apparent hardness — Part 3: Pusey and Jones method*.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 471:—¹⁾, *Rubber — Times, temperatures and humidities for conditioning and testing*.

ISO 1826:1981, *Rubber, vulcanized — Time-interval between vulcanization and testing — Specification*.

ISO 3383:1985, *Rubber — General directions for achieving elevated or subnormal temperatures for test purposes*.

ISO 4661-1:1993, *Rubber, vulcanized or thermoplastic — Preparation of samples and test pieces — Part 1: Physical tests*.

ISO/TR 9272:1986, *Rubber and rubber products — Determination of precision for test method standards*.

3 Principle

The hardness test consists in measuring the difference between the depths of indentation of a ball into the rubber under a small contact force and a large total force. From this difference, multiplied when using the microtest by the scale factor 6, the hardness in international rubber hardness degrees (IRHD) is obtained by using Table 3, Table 4 and Table 5 or on graphs based on these tables or a scale, reading directly in international rubber hardness degrees, calculated from the tables and fitted to the indentation-measuring instrument. These tables and curves are derived from the empirical relationship between indentation depth and hardness given in Annex A.

¹⁾ To be published. (Revision of ISO 471:1983).