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**Rubber, vulcanized or  
thermoplastic — Determination of  
hardness —**

Part 4:  
**Indentation hardness by durometer  
method (Shore hardness)**

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*Caoutchouc vulcanisé ou thermoplastique - Détermination de la  
dureté —*

*Partie 4: Dureté par pénétration par la méthode au duromètre  
(dureté Shore)*

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ISO copyright office  
CP 401 • Ch. de Blandonnet 8  
CH-1214 Vernier, Geneva  
Phone: +41 22 749 01 11  
Fax: +41 22 749 09 47  
Email: [copyright@iso.org](mailto:copyright@iso.org)  
Website: [www.iso.org](http://www.iso.org)

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 2, *Testing and analysis*.

This first edition of ISO 48-4 cancels and replaces ISO 7619-1:2010 which has been technically revised.

The main changes compared to the previous edition are as follows:

- a new standard number has been given.
- in the Introduction, an explanation of the purpose of the grouping work has been added.
- in [6.3.1](#), the description has been improved to distinguish hand-held instruments and on-a-stand instruments more clearly.
- in [Clause 8](#), the description for the required time for conditioning has been improved for better understanding.
- in [9.2](#), the use of talcum powder has been removed.
- in [Annex A](#), precision results from ITPs that were carried out in 1985 and 2007 have been included.

A list of all parts in the ISO 48 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

ISO/TC 45/SC 2 established a principle that it would be helpful for users if standards on the same subject but covering different aspects or methods were grouped together, preferably with an introductory guidance standard, rather than being scattered throughout the numbering system. This has been achieved for some subjects, for example curemeters (ISO 6502) and dynamic properties (ISO 4664).

In 2017, it was decided to group standards for hardness and, subsequently, it was agreed that they would be grouped under the ISO 48 number. The new standards together with the previously numbered standards are listed below.

- ISO 48-1: former ISO 18517
- ISO 48-2: former ISO 48
- ISO 48-3: former ISO 27588
- ISO 48-4: former ISO 7619-1
- ISO 48-5: former ISO 7619-2
- ISO 48-6: former ISO 7267-1
- ISO 48-7: former ISO 7267-2
- ISO 48-8: former ISO 7267-3
- ISO 48-9: former ISO 18898

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The hardness of rubber, as measured by a durometer (Shore hardness) or an IRHD pocket meter, is determined from the response of the rubber to an applied indentation. The response is complex and will depend on:

- a) the elastic modulus of the rubber;
- b) the viscoelastic properties of the rubber;
- c) the thickness of the test piece;
- d) the geometry of the indenter;
- e) the pressure exerted;
- f) the rate of increase of pressure;
- g) the interval after which the hardness is recorded.

Because of these factors, it is inadvisable to relate results using a durometer (Shore hardness) directly to IRHD values, although correlations have been established for some individual rubbers and compounds.

Durometers were originally portable hand-held instruments that have proved to be particularly convenient for making measurements on products. By now a lot of laboratories also use them on a stand with a weight applied to the pressure foot in order to improve precision significantly.

NOTE ISO 48-2 specifies hardness measurements for determination of hardness between 10 IRHD and 100 IRHD. Further information on the relationship between the durometer values and IRHD values is given in References [5][6][7].

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# Rubber, vulcanized or thermoplastic — Determination of hardness —

## Part 4: Indentation hardness by durometer method (Shore hardness)

**WARNING 1** — Persons using this document should be familiar with normal laboratory practice. This document does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to determine the applicability of any other restrictions.

**WARNING 2** — Certain procedures specified in this document might involve the use or generation of substances, or the generation of waste, that could constitute a local environmental hazard. Reference should be made to appropriate documentation on safe handling and disposal after use.

### 1 Scope

This document specifies a method for determining the indentation hardness (Shore hardness) of vulcanized or thermoplastic rubber using durometers with the following scales:

- the A scale for rubbers in the normal-hardness range;
- the D scale for rubbers in the high-hardness range;
- the AO scale for rubbers in the low-hardness range and for cellular rubbers;
- the AM scale for thin rubber test pieces in the normal-hardness range.

### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 48-9, *Rubber, vulcanized or thermoplastic — Determination of hardness — Part 9: Calibration and verification of hardness testers*

ISO 23529, *Rubber — General procedures for preparing and conditioning test pieces for physical test methods*

### 3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

## 4 Principle

An indenter of specified dimensions is pressed into a test piece under a specified load and the depth of indentation measured. This indentation is converted to a hardness value by means of a specified relation.

## 5 Choice of durometer

When using durometers, the scale should be chosen as follows:

- for values less than 20 with a type D durometer: type A;
- for values less than 20 with a type A durometer: type AO;
- for values over 90 with a type A durometer: type D;
- for thin test pieces (less than 6 mm thick): type AM.

## 6 Apparatus

### 6.1 Durometer types A, D and AO

These durometers consist of the components specified in [6.1.1](#) to [6.1.5](#).

#### 6.1.1 Pressure foot

The pressure foot for types A and D shall have a diameter of 18 mm ± 0,5 mm and a central hole of diameter 3 mm ± 0,1 mm. For type AO, the pressure foot shall have a minimum area of 500 mm<sup>2</sup> with a central hole of diameter 5,4 mm ± 0,2 mm. The tolerances on the dimension of the central hole and the requirement for the size of the pressure foot only apply to instruments used on a stand.

#### 6.1.2 Indentor

The indentor shall be formed from a hardened-steel rod of diameter 1,25 mm ± 0,15 mm to the shape and dimensions shown in [Figure 1](#) for type A durometers and [Figure 2](#) for type D durometers. Type AO durometers shall have a round indentor with a radius of 2,5 mm ± 0,02 mm in accordance with [Figure 3](#).

#### 6.1.3 Indicating device

This is a device for allowing the extent of protrusion of the point of the indentor beyond the face of the pressure foot to be read. It shall be calibrated directly in terms of units ranging from 0 for the maximum protrusion of 2,50 mm ± 0,02 mm to 100 for zero protrusion obtained by placing the pressure foot and indentor in firm contact with a suitable flat, hard surface (e.g. glass).

#### 6.1.4 Calibrated spring

This is used to apply a force,  $F$ , expressed in millinewtons, to the indentor in accordance with one of the following formulae:

- For type A durometers:

$$F = 550 + 75H_A$$

where  $H_A$  is the hardness reading taken from the type A durometer.

- For type D durometers:



$$F = 445H_D$$

where  $H_D$  is the hardness reading taken from the type D durometer.

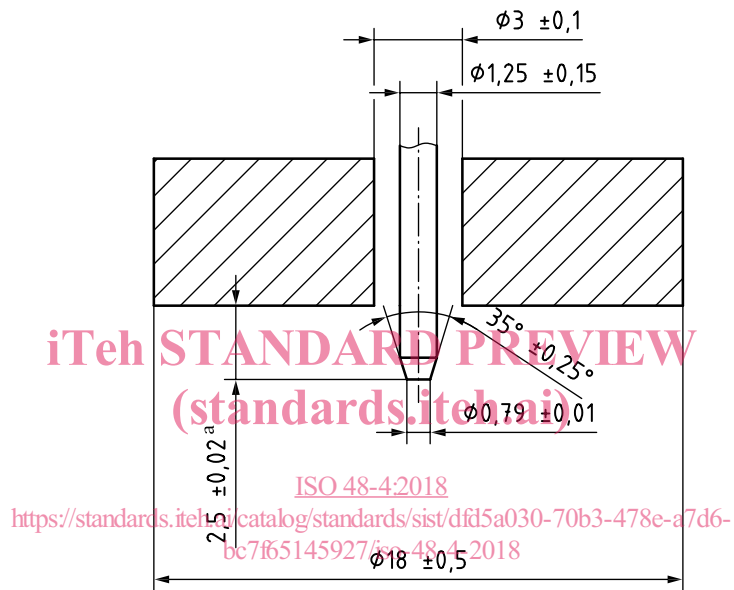
— For type AO durometers:

$$F = 550 + 75H_{AO}$$

where  $H_{AO}$  is the hardness reading taken from the type AO durometer.

NOTE The rubber industry uses the term equation for the relationships herein termed formula. The term formula is used to describe the table of ingredients in a rubber compound.

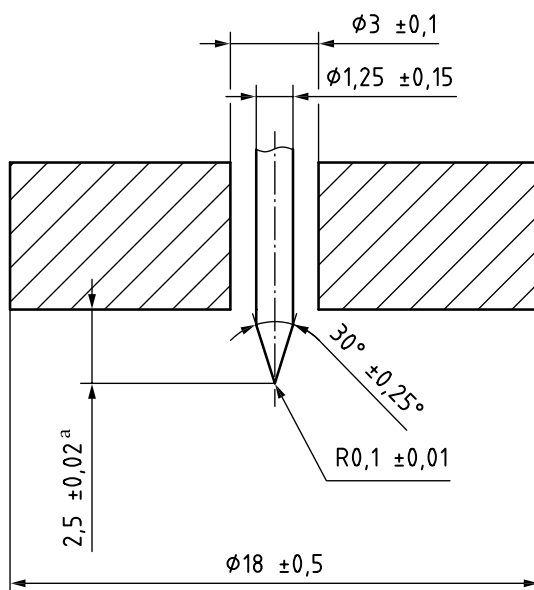
Dimension in millimetres



<sup>a</sup> The protrusion shown is valid for a reading of 0.

**Figure 1 — Indentor for type A durometer**

Dimension in millimetres

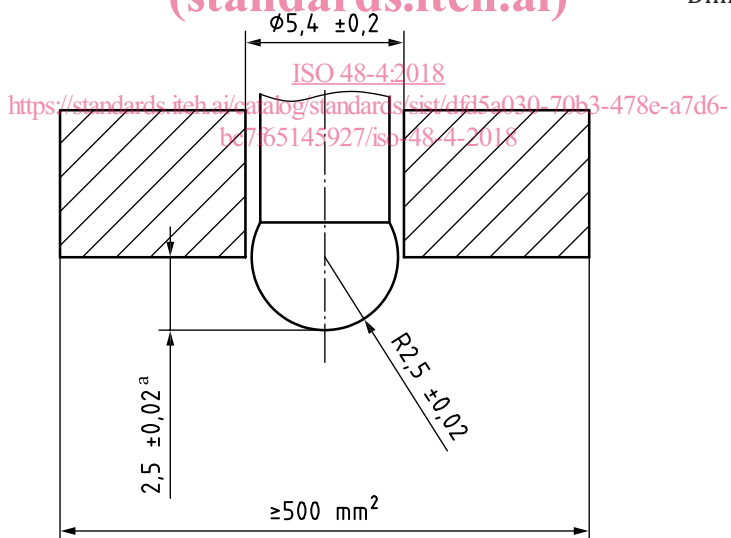


<sup>a</sup> The protrusion shown is valid for a reading of 0.

Figure 2 — Indenter for type D durometer

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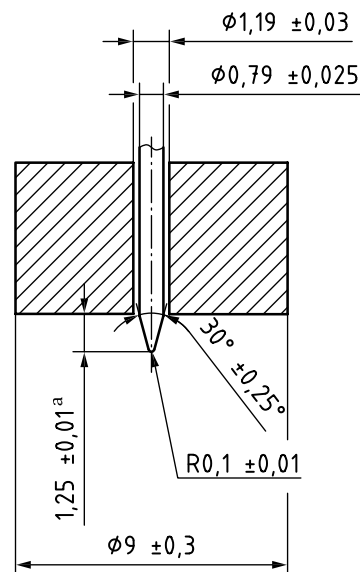
Dimension in millimetres



<sup>a</sup> The protrusion shown is valid for a reading of 0.

Figure 3 — Indenter for type AO durometer

Dimension in millimetres



a The protrusion shown is valid for a reading of 0.

**Figure 4 — Indenter for type AM durometer**

### 6.1.5 Automatic timing device (optional)

The timer shall be automatically activated when the pressure foot is in contact with the test piece and shall indicate the end of the test time or lock the test value at its completion. Use of a timing device for the test time improves precision. When the instrument is used on a stand, the time tolerance shall be  $\pm 0,3$  s.

## 6.2 Durometer type AM

This durometer consists of the components specified in 6.2.1 to 6.2.5.

### 6.2.1 Pressure foot

The pressure foot shall have a diameter of  $9 \text{ mm} \pm 0,3 \text{ mm}$  and a central hole of diameter  $1,19 \text{ mm} \pm 0,03 \text{ mm}$ .

### 6.2.2 Indenter

The indenter shall be formed from a hardened-steel rod of diameter  $0,79 \text{ mm} \pm 0,025 \text{ mm}$  to the shape and dimensions shown in [Figure 4](#).

### 6.2.3 Indicating device

This is a device for allowing the extent of protrusion of the point of the indenter beyond the face of the pressure foot to be read. It shall be calibrated directly in terms of units ranging from 0 for the maximum protrusion of  $1,25 \text{ mm} \pm 0,01 \text{ mm}$  to 100 for zero protrusion obtained by placing the pressure foot and indenter in firm contact with a suitable flat, hard surface (e.g. glass).