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International Standard



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## Rubber or plastics covered rollers — Specifications — Part 1 : Requirements for hardness

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## Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 6123/1 was developed by Technical Committee ISO/TC 45, *Rubber and rubber products*, and was circulated to the member bodies in January 1981.

It has been approved by the member bodies of the following countries:

Australia	Hungary	South Africa, Rep. of
Austria	India	Spain
Belgium	Italy	Sri Lanka
Brazil	Korea, Dem. P. Rep. of	Sweden
Canada	Korea, Rep. of	Switzerland
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Denmark	Poland	United Kingdom
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Germany, F. R.	Romania	USSR

The member body of the following country expressed disapproval of the document on technical grounds:

France

# Rubber or plastics covered rollers — Specifications — Part 1 : Requirements for hardness

## 0 Introduction

Covered rollers are cylindrical cores, generally of metal, with a cover of rubber or plastics for a particular use. They are manufactured in a wide variety of sizes and hardness grades depending on the intended use.

Requirements for surface characteristics and dimensional tolerances will form the subjects of parts 2 and 3 of this International Standard respectively.

## 1 Scope and field of application

This part of ISO 6123 specifies requirements for the measured hardness of rubber or plastics covered rollers.

## 2 References

ISO 471, *Rubber — Standard temperatures, humidities and times for the conditioning and testing of test pieces.*

ISO 7267, *Rubber covered rollers — Determination of apparent hardness*

Part 1 : IRHD method.<sup>1)</sup>

Part 2 : Shore durometer method.<sup>1)</sup>

Part 3 : Pusey and Jones indentation method.<sup>1)</sup>

## 3 Specification of hardness

The hardness of rubber or plastics covered rollers shall be specified in one of the following units, as agreed between the interested parties :

- a) international rubber hardness degrees (IRHD);
- b) Shore hardness degrees (Shore A or Shore D);
- c) Pusey and Jones indentation values.

As hardness can be affected by temperature, the application temperature should be specified, if necessary.

### NOTES

1 A basic correlation is recognized between IRHD, Shore hardness degrees and Pusey and Jones indentation values for a determined quality. An equivalence exists between IRHD and Shore A hardness degrees. If medium accuracy is required, the use of a Shore A durometer instead of an IRHD hardness tester is possible, but it should be noted that the values are not in any case identical, due to differences in the intervals between taking readings.

2 All hand-operated hardness meters are subject to variations in reading from one operator to another. With meters of the IRHD or the Pusey and Jones type, the reading is influenced by the rate of application of the load and whether or not the force applied has a component other than perpendicular. With spring-loaded meters of the Shore type, the reading is additionally dependent on the pressure exerted.

3 Since hardness is measured by indentation, the thickness of the rubber or plastics material can affect the hardness reading obtained. The hardness reading of a cover compound on a roller and the true hardness of that compound under standard laboratory conditions will only be comparable when the cover thickness is :

- a) for IRHD hardness :
  - up to 50 IRHD : not less than 9 mm,
  - over 50 IRHD : not less than 6 mm;
- b) for Shore hardness :
  - up to 50 Shore A : not less than 9 mm,
  - over 50 Shore A and for Shore D hardness : not less than 6 mm;
- c) for Pusey and Jones indentation values :
  - over 200 P and J : not less than 18 mm,
  - over 100 up to 200 P and J : not less than 12 mm,
  - over 40 up to 100 P and J : not less than 9 mm,
  - up to 40 P and J : not less than 6 mm.

1) At present at the stage of draft.

## 4 Determination of hardness

### 4.1 Methods

#### 4.1.1 IRHD hardness

The determination shall be carried out, using a hardness meter calibrated in international rubber hardness degrees (IRHD), by the method specified in ISO 7267/1. The meter shall be equipped with a suitable base plate for use with curved surfaces and to accommodate a jig for holding small rollers of diameter less than 150 mm. A Pusey and Jones type support is suitable, as well as any other support permitting the measurement of hardness of a curved surface.

#### 4.1.2 Shore hardness

The determination shall be carried out by the method specified in ISO 7267/2, using a type A Shore durometer for hardnesses up to 90 Shore A degrees, and a type D Shore durometer for higher hardnesses.

#### 4.1.3 Pusey and Jones hardness

The determination shall be carried out by the method specified in ISO 7267/3, using a Pusey and Jones indentation instrument with a 3,175 mm ball.

### 4.2 Test conditions

#### 4.2.1 Test temperature

The test shall be carried out, whenever possible, at a standard laboratory temperature ( $23 \pm 2$  °C or  $27 \pm 2$  °C) in accordance with ISO 471. The covered roller shall be brought to the test temperature prior to testing to ensure temperature equilibrium.

As hardness can be affected by temperature, the same test temperature shall be used throughout any one test or series of tests intended to be comparable. If this condition cannot be met, it is necessary to consider the influence of temperature on the hardness of the used compound in order to compare the results correctly.

The test temperature shall be recorded.

#### 4.2.2 Cover surface

The test shall be made on smooth, ground, clean surfaces, unless otherwise agreed between the interested parties.

### 4.3 Procedure

For rollers having up to 2,5 m of cover length, the hardness shall be measured at five points :

— three points, each 120° apart, around the circumference in the middle of the roller;

— one point at each end, at a distance of 10 % of the cover length from the end.

For rollers having over 2,5 m of cover length, the hardness shall be measured at nine points :

— three points, each 120° apart, around the circumference in the middle of the roller;

— at each end three points, each 120° apart, around the circumference, and each at a distance of 10 % of the cover length from the end.

### 4.4 Expression of results

The hardness of the covered roller shall be reported as the average of all readings taken in accordance with 4.3, rounded to the nearest integer.

## 5 Nominal hardness

Rubber or plastics covered rollers are available in a wide range of hardness values; the particular hardness to be supplied shall be specified by agreement between the interested parties in accordance with clause 3, as an integer as follows :

a) for IRHD hardness : 99 — 98 — 97 — 95 IRHD,

and multiples of 5 for values below 95 IRHD (for example 90, 85, 80 IRHD);

b) for Shore hardness : multiples of 5 (for example 40, 45, 50, 55 Shore hardness degrees);

c) for Pusey and Jones indentation values :

1) multiples of 3 for P and J indentation values from 0 to 15 P and J,

2) multiples of 5 for P and J indentation values over 15 up to 100 P and J,

3) multiples of 10 for P and J indentation values over 100 up to 200 P and J,

4) multiples of 25 for P and J indentation values over 200 P and J.

## 6 Tolerance on nominal hardness

Unless otherwise agreed (see, however, clause 8), the permitted deviation of the measured hardness (i.e. the average value reported in accordance with 4.4) from the nominal hardness shall be as follows :

a) for IRHD hardness : see table 1;

Table 1

Nominal IRHD hardness		Permitted deviation
>	<	
	40	± 4
40	90	± 3
90	95	± 2
95		± 0,5

b) for Shore hardness : ± 5 Shore A or Shore D hardness degrees;

c) for Pusey and Jones indentation values : see table 2.

Table 2

Nominal P and J indentation value		Permitted deviation
3	< 15	
16	< 49	± 4
50	< 60	± 5
> 60	< 70	± 6
> 70	< 80	± 7
> 80	< 90	± 8
> 90	< 100	± 9
> 100	< 150	± 10
> 150	< 250	± 25

The permitted deviation for rollers with a nominal P and J indentation number over 250 shall be agreed between the interested parties.

### 7 Hardness variation in a single roller

The variation in hardness in a single roller shall be taken as the difference between the highest and lowest values measured at the points specified in 4.3. Unless otherwise agreed (see, however, clause 8), the permitted maximum variation of hardness within the roller shall be as follows :

a) for IRHD hardness : see table 3;

Table 3

Nominal IRHD hardness		Permitted variation
>	<	
	40	3
40	90	2
90	98	1
98		0,5

b) for Shore hardness : 4 Shore A or Shore D hardness degrees;

c) for Pusey and Jones indentation values : see table 4.

Table 4

Nominal P and J indentation value		Permitted variation
> 20	< 20	
> 60	< 60	4
> 100	< 100	5
> 150	< 150	7
> 200	< 200	10
> 200	< 200	15

### 8 Compliance with specifications

Hardness tolerances (clause 6) and hardness variation (clause 7) shall be considered separately.

If the purchaser desires closer tolerances than permitted by clause 6, or smaller variations than permitted by clause 7, such values cannot be safely guaranteed, since raw materials, processing, core construction and reproducibility of testing apparatus (see clause 3, note 2) preclude greater precision.

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