Shore A hardness of a rubber cot and its restrictions in measuring the hardness value under mill conditions

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Abstract

Shore hardness

Generally Shore hardness of a rubber cot is measured by using an instrument called 'Durometer' and the value is expressed in A scale

Cots are available in wide shore hardness ranging from 63° to 90° shore. These ranges are offered to mills based on the following parameters.

- Nature of raw material processed
- Linear density of material.
- Type of application / process / mechanical conditions
- Maintenance aspects.
- Ambient conditions.

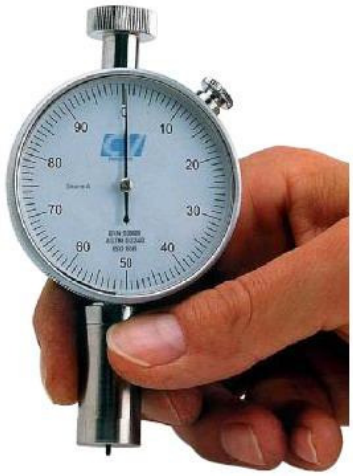
A wide spread phenomenon in the industry is that a softer cot having 65° shore A should give relatively better quality yarn as compared to a cot having higher shore A value say,70° shore A. At the same time soft cots have their own drawbacks like wear out rate is faster, damage to the cot's surface will be more. If ambient condition in the spinning shed is not well maintained, the soft cot will display greater for lapping.

In terms of maintenance aspect, the grinding machine operator should be highly skilled for achieving good surface characteristics.

Definition of shore hardness

Hardness may be defined as the resistance to indention under conditions that do not puncture the rubber. It is called elastic modulus of rubber compound. These tests are based on the measurement of the penetration of the rigid ball into the

rubber test piece under specific conditions. The measured penetration is converted into hardness degrees.

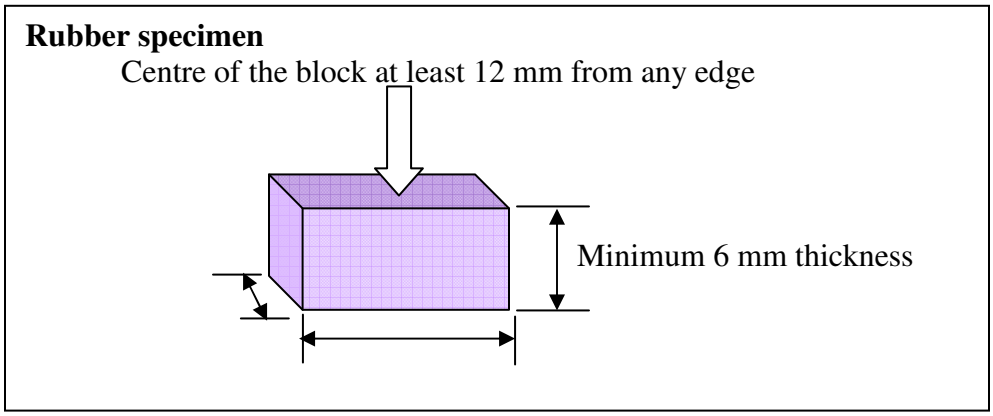


Normally spring loaded pocket size Durometer is commonly used for measuring hardness of the elastomers. Shore A Durometer is used for measuring soft solid rubber compounds. Other scales are also used like Shore D which is used to measure the hardness of very hard rubber compounds including ebonite. The main drawback is in reproducibility of results by different operators. So, a practical tolerance of 5° is acceptable.

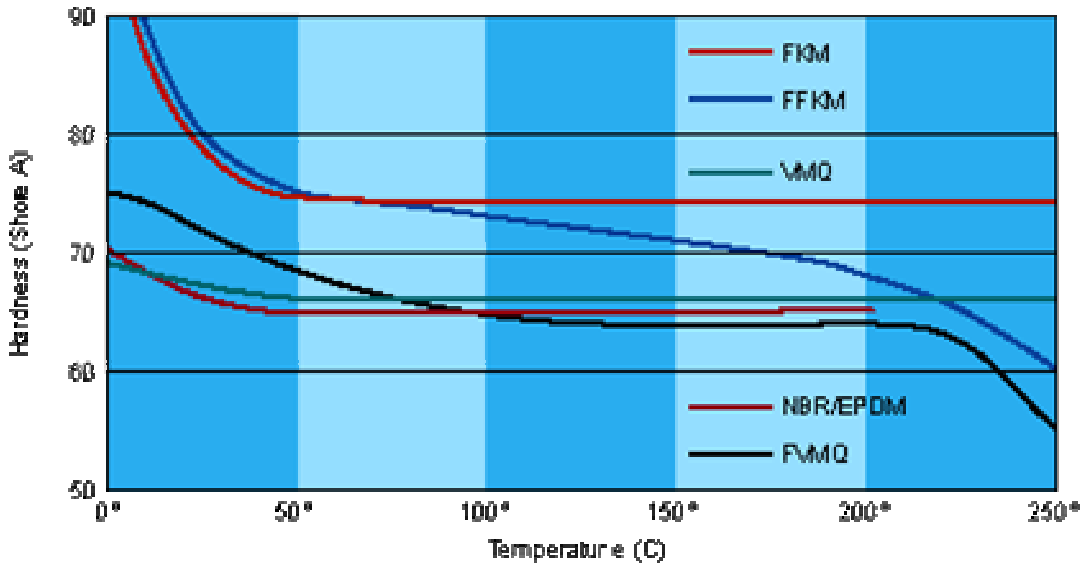
Better reproducibility is obtained by dead weight loading. Here the hardness is expressed in IRHD International Rubber Hardness Degrees .**Both IRHD, Durometer tests requires rubber specimen of definite dimensions**. As per the ASTM (D 2240 – Defines apparatus to be used and its sections such as

diameter , length of the indentor , force of spring and D 1415 –Defines specimen size) , DIN, BRITISH & ISO Standards following test conditions have been laid for measuring SHORE A HARDNESS of rubber products

1. The specimen should be at least 6 mm in thickness.
2. The surface on which the measurement made should be flat.
3. The lateral dimension of the specimen should be sufficient to permit measurements at least 12 mm from the edges.

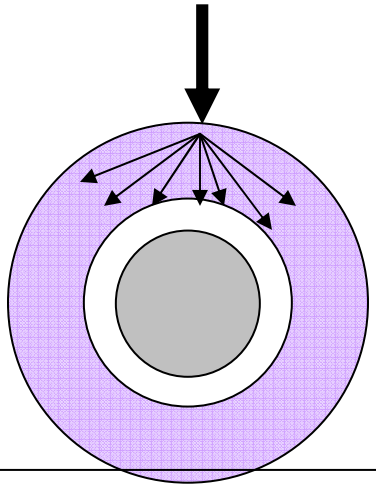
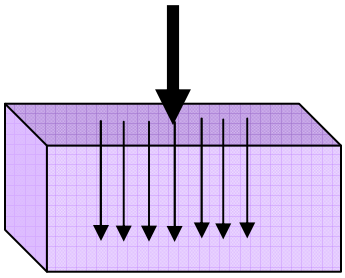


Impact of temperature on hardness measurements on various rubbers:

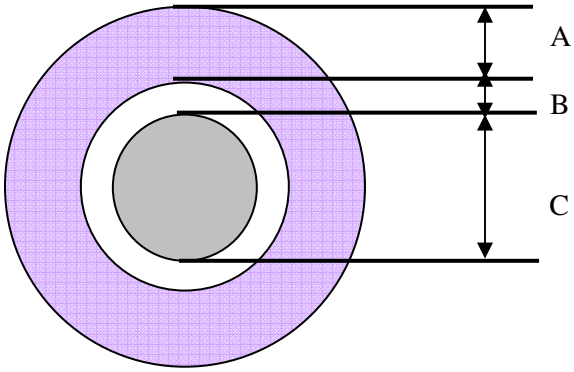


While testing Synthetic rubber cots in finished product state the following factors plays very important role:

1. Most of the R/F & S/F cots have wall thickness < 6.0 mm.
2. If the thickness of “Core” is considered then the thickness of rubber layer goes further.
3. Surface on which hardness is tested is not ‘Flat’ its in constant curvature.
4. Pressure applied will vary in each test.

Shore hardness tester Pointer	Shore hardness tester Pointer
	
Load will be radially diverted and the impre -ssed force will not be return back thus Not showing true hardness of the specimen	Load will be equally act on rubber specimen and the impressed force will be return back showing true hardness of the specimen

Cot Side view



A – Wall thickness of rubber portion
B – Thickness of core used in rubber cot
C – Inner diameter of the cot

A< 6.0 mm in most of the Ring frame and speed frame cots

Results	Effect
The hardness reading on the cot's surface has an impact of the "cot's core hardness" which is of metal or harder polymer.	1. Hardness measured on cot will be generally higher than the designated hardness by 2 – 3 degree 2. Softer the cot, higher is the impact of 'Core' hardness as shown in the fig. 3. With the reduction in diameter of the cots after repeated buffing , the impact of core hardness increases (Please refer the below table)

Impact of reduction in cot diameter on shore A Hardness in different qualities:

S.No	Cot Dia (mm)	65°	70°	75°	83°
1	29.00	66	72	76	81
2	28.50	67	73	77	82
3	28.00	68	73	77	83
4	27.50	68	74	78	83
5	27.00	69	75	79	83