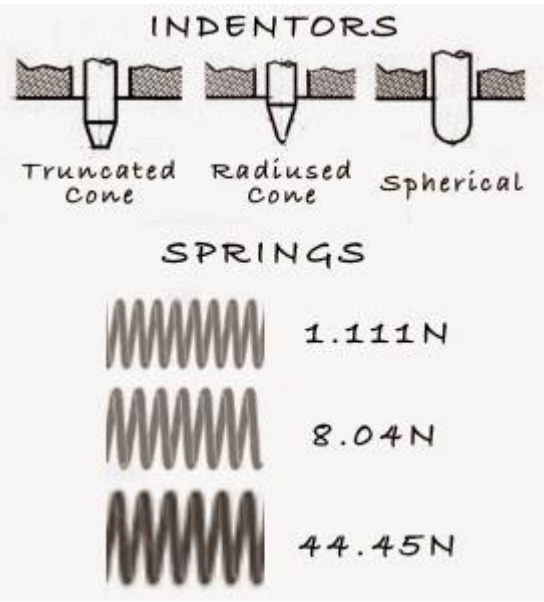
ADIS GAUGES & TOOLS MFG. CO.

DUROMETER INSTRUCTION MANUAL



See ISO or ASTM for dimensions and spring rates.

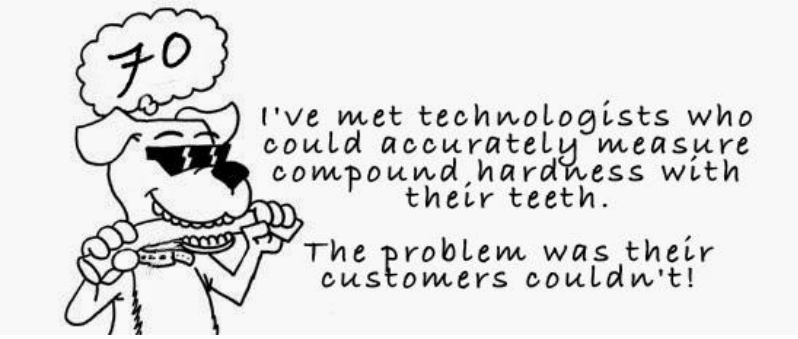
Durometer A	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5
Durometer B	85	81	76	71	66	62	56	51	47	41	36	32	27	22	18	12	6			
Durometer C	77	71	60	51	47	41	38	32	29	24	20	17	14	11	9					
Durometer D	58	47	40	33	29	26	21	19	16	14	12	10	8	7	6					
Durometer O					84	80	75	71	70	65	60	57	53	49	42	35	28	20	15	8
Durometer OO					98	97	95	94	93	91	90	87	86	83	80	76	70	62	55	54

How the test works

Shore hardness (also known as 'Durometer hardness') is determined by measuring the penetration of the Durometer's spring loaded indenter into the sample. The operator applies the instrument to the sample with sufficient contact force, in a consistent manner and without shock. During application the indentation reading may creep (decreases) over time because of the resilient nature of rubbers and plastics, so the test duration should reported along with the hardness number e.g. 3 seconds. Likewise sample temperature must be controlled and recorded as it can alter the result, the colder generally the harder.

Sample size is important and 6mm of thickness is generally accepted as the norm, samples can be plied but results may be softer. The sample should have a surface area such that it permits at least 5 test points each being at least 12mm apart and from the edge.

The results are a useful measure of relative resistance to indentation of various grades of polymers. However, the Shore hardness test does not serve well as a predictor of other properties such as strength or resistance to scratches, abrasion, or wear, and should not be used alone for product design specifications. Shore hardness is often used as a proxy for flexibility (flexural modulus) for the specification of elastomers. The correlation between Shore hardness and flexibility holds for similar materials, especially within a series of grades from the same product line, but this is an empirical and not a fundamental relationship.



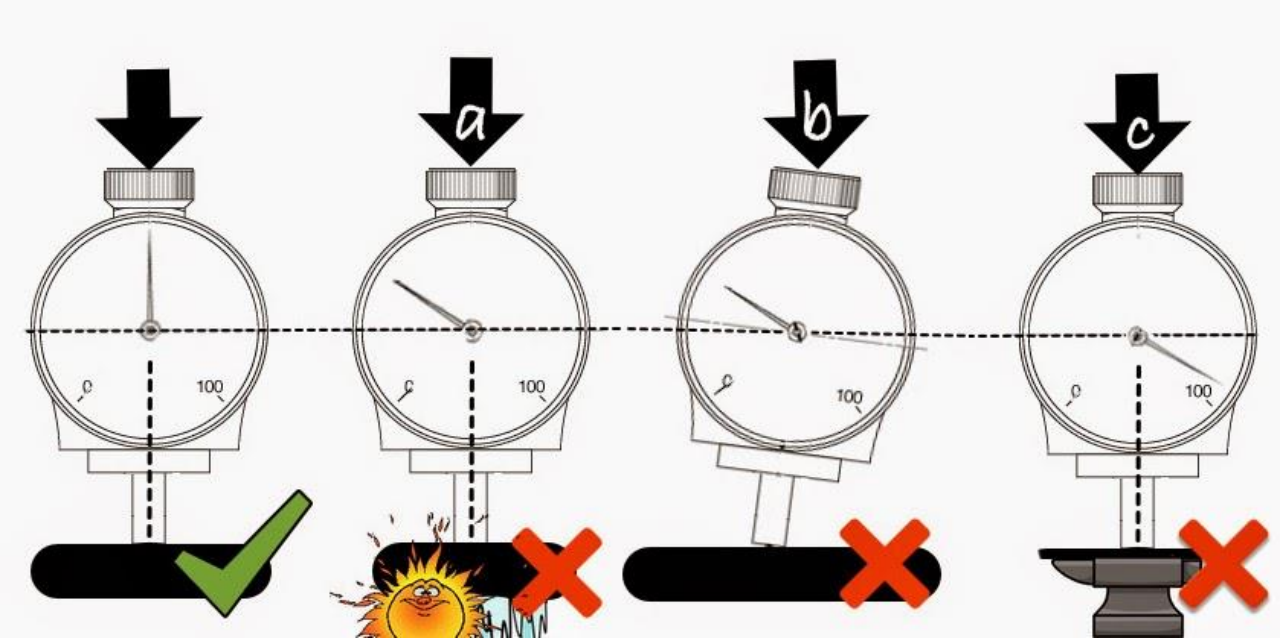
Remember polymers will have a specification which allows for a tolerance, ± 3 Shore for example. This means that you will need to accumulate the errors in the durometer (usually ± 1) and the durometer operation.

➤ Avoiding simple mistakes

It's easy to make a simple mistake when testing. If you combine one or more you can compound the error. Repeatability, reproducibility and reliability are the 3 R's of testing.

Here is a list of basic errors to avoid when testing by hand, it is by no means comprehensive.

- *Wrong scale of durometer.*
- *Result < 20 Shore or > 90 Shore.*
- *Sample too warm or too cool (a).*
- *Incorrect surface contact (b).*
- *Sample to thin (c).*
- *Sample surface irregular.*
- *Taking a measurement from, or near, a previous location.*
- *Measuring too close to the edge.*
- *Test time period inconsistent.*
- *Durometer out of specification.*

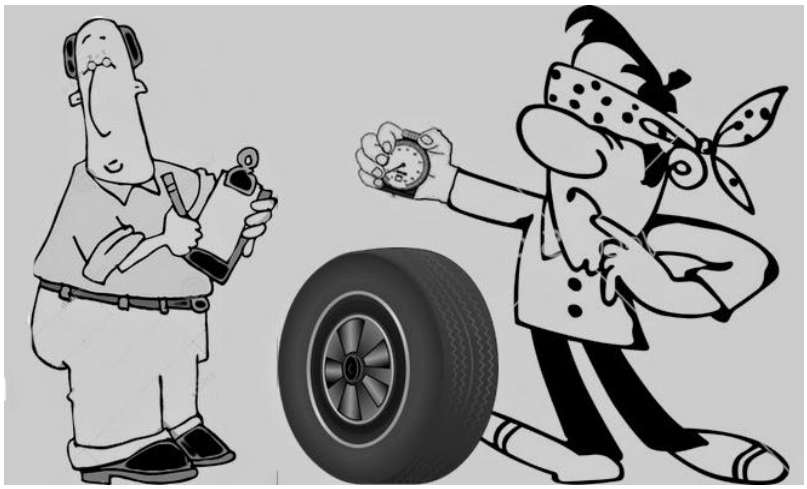


Does the test test the operator or the sample?

One problem with applying a durometer by hand is the operators ability to manipulate the result sub-consciously by applying a little too much, or slightly insufficient, pressure.

Here a couple of simple experiment to test the effectiveness of durometer testing in your company. Have a mixture of operators, regular operators and random staff, around a table. Give a basic demonstration of how to use a durometer. Pass the durometer around with a selection of samples, keep the results a secret until the end and compare the variability of results. Repeat the test with the hardness known and see how much closer the results are.

Alternatively try some blind testing. We have established how the application of the durometer onto the sample is imperative in achieving repeatable results. If your testing using a digital durometer with a hold function, carry out the test but without watching the display - lift the durometer off and read the held result. This can also be done with an analogue durometer with the help of a college to record the value before lifting the durometer off (just don't copy the technique below).

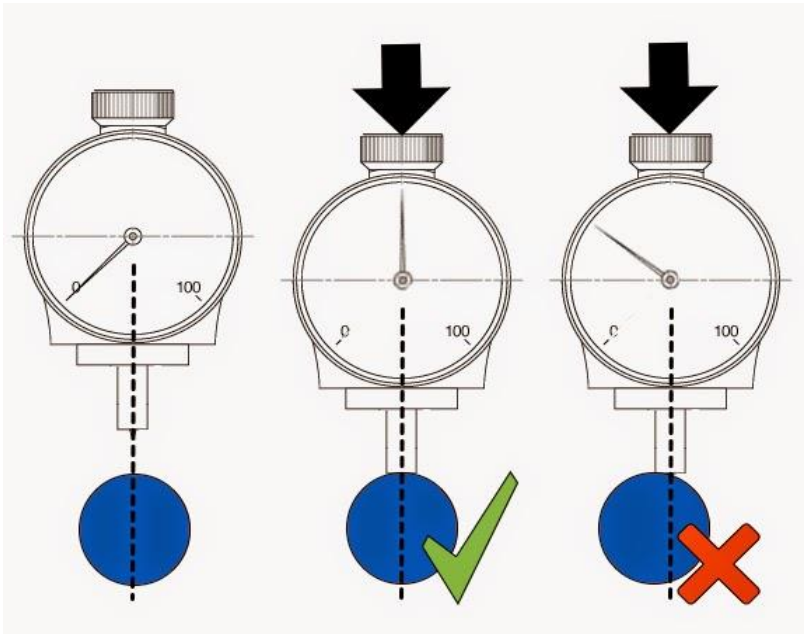


These exercises are useful to illustrate the repeatability, reliability and accuracy of the test - the differences that experience brings to the test procedure - the likelihood of disputes.

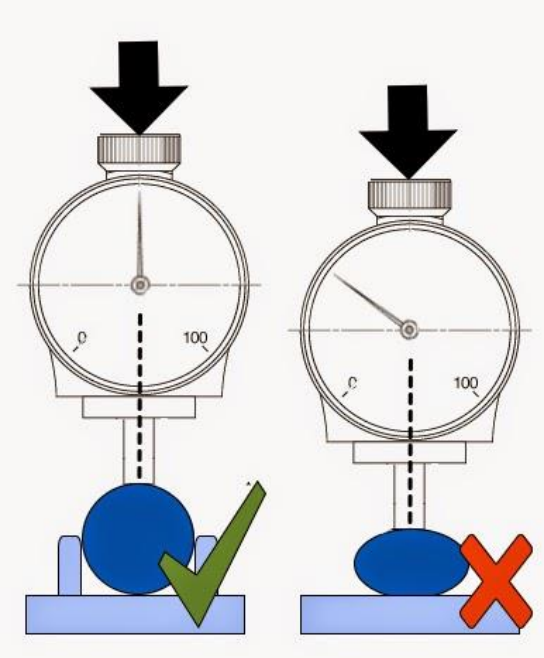
They also highlight the importance of mounting the durometer onto a stand to eliminate variability's.

Testing irregular shaped samples

Testing these products it's possible but with such a wide variety it would be impossible to cover them all here. Rubber Rollers are a typical example of a non-standard sample shape. Here the technique is to rotate the durometer, with a maximum hand fitted, around the circumference.



Testing at Top Dead Centre is paramount or low readings will result.



It's also important to support small samples (like O-Rings) correctly, to eliminate deformation

➤ Testing v Checking

We should not compare hand-held durometers with a stand mounted Shore Hardness Tester. The hand-held durometer will check hardness, when used by a competent operator, and is perfectly valid form of first-line quality control. A stand mounted Shore Hardness Tester (which may or may not incorporate a durometer) will give a definitive hardness value.
It would be folly to stop production based on the result of a hand-held check, but it would be prudent to pause it and apply a definitive test…

Shore A and D Durometer Calibration Procedure:

1. Get a very flat steel surface (or other flat surface which can't be penetrated).

2. Place Durometer on the steel surface. Make sure that Durometer foot surface is fully contact with steel surface. It should read 100 ± 1 on the Durometer. **(WARNING: THIS IS NOT RECOMMENDED FOR TYPE D DUROMETERS. THE GAUGE MAY BE SEVERELY DAMAGED)**.

3. Place test block on the steel surface. Put Durometer on top of the test block and push the needle down through center hole on test block until Durometer foot surface gets fully contact with test block. It should read ± 1 Shore as per the value mentioned on test block.

4. Please hold Durometer firm and perpendicular to testing material.