BARRY CONTROLS

DEFENSE & INDUSTRY
Antivibration

Question: What is rubber durometer, and how does it relate to isolator stiffness?

Answer: Durometer is an industry standard hardness measurement for elastomers. A durometer gauge measures the resistance to the penetration of an indenter point into the surface of a molded elastomer specimen. When measuring durometer, the reading may be taken immediately or after a very short specified time if relaxation effects are to be considered. Elastomers used in vibration and shock isolators generally fall in the range of 35-75 durometer on the Shore A scale. (ASTM D2240 establishes 12 durometer scales which are determined by the probe/spring configuration used to indent the elastomer)

Durometer is an indirect measure of the stiffness, or more correctly the modulus, of an elastomeric material.

Modulus, in turn, is a property of elastomers, analogous to the same property of metals, which is the ratio of stress to strain in the elastomer at some loading condition (i.e. the slope of the stress-strain curve). Unlike metals which typically have a linear stress-strain curve below their yield point, the stress-strain relationship of elastomers is non-linear over a range of loading conditions (see Figure 1) and can be significantly influenced by ambient temperature. As a result, the modulus of an elastomer is highly dependent on the conditions under which it is measured. This fact makes the understanding of elastomers and their properties important in the understanding of the performance of elastomeric vibration and shock isolators.

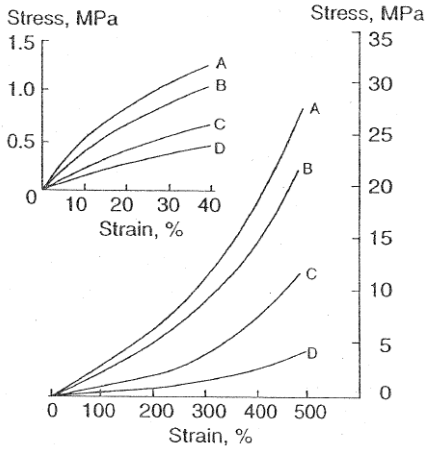

Figure 1 – Examples of Stress-Strain curves typical of elastomeric materials
(from "Engineering Design with Natural Rubber", Malaysian Rubber Producers Research Association)

In a relative sense, low durometer or hardness correlates to a low modulus or stiffness. Similarly, as durometer increases so does modulus and vice-versa. However, the correlation between durometer and modulus is not directly proportional, i.e. a doubling in durometer value does not equate to a doubling in modulus.

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Isolator stiffness is a direct function of elastomer modulus and part geometry. So, as with the relationship between durometer and elastomer modulus above, part stiffness can not be estimated for a known durometer. However, part stiffness will increase with an increase in durometer, part stiffness will decrease with a decrease in durometer, etc.