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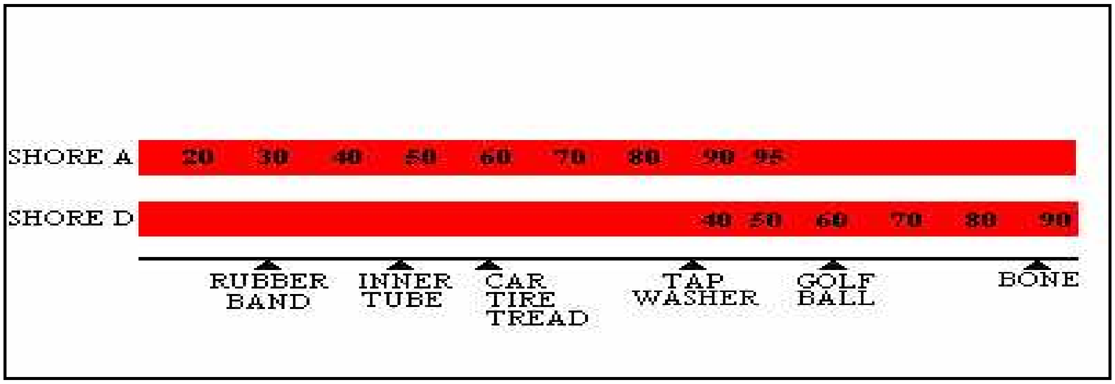
Durometer - Hardness Scale Guide



Physical Properties of Polyurethane Elastomers

- **Hardness** Elastomer Engineering manufactures elastomers ranging from a measurement of 60 on the Shore A scale (approximately as soft as the tread of an automobile tire) to a measurement of 80 on the Shore D scale (as hard as bone).
- **Abrasion** In applications where severe wear is a problem, polyurethanes often outperform rubber, plastics, or even metals. This durability often means that a part made from polyurethane can be made with less material and weight, reduced maintenance, and lower cost.
- **Compression** This is an important advantage in the design of some designs, i.e., springs. In addition to high load-bearing properties in both tension and compression, urethanes have a high load-bearing capacity in shear.
- **Mechanical Properties** At lower hardness levels, practically all elastomeric materials bend under impact. As they are compounded up to a higher degree of hardness, they tend to lose elasticity and crack under impact. However, even at their highest hardness levels, they have significantly better impact resistance than most plastics.
- **Resilience** Formulations are possible in a wide range of resiliencies. For very shock-absorbing uses, urethane can be made with rebound values of 10-25%. For applications requiring quick recovery, or where high-frequency vibrations are a factor, they can be made with rebound values from 40-70%.
- **Flexibility** Polyurethane elastomers resist cracking under repeated flexing. Since cracking under heavy flexing may be reduced by decreasing the thickness of the part, polyurethanes offer an advantage in that they can be used practically in very thin sections because of their strength.
- **Friction** Polyurethanes can be formulated with co-efficients of friction varying from very low, for items like bushings, bearings, or wear strips, or very high, for items like tires or rollers.
- **Temperature** Many polyurethane elastomers remain flexible at very low temperatures and possess outstanding resistance to thermal shock. The low temperature resistance of polyurethanes has led to many applications in arctic conditions. In addition, polyurethanes can withstand sudden and dramatic temperature drops without cracking. Polyurethanes can withstand continuous use up to 90°C (194°F) with ease. Polyurethanes can be made flame resistant by incorporating flame retardants into their formulas.
- **Water** Polyether-based polyurethanes remain stable in water as warm as 50°C (122 °F) for long periods. (Th ey are not recommended for continuous use in water over 70°C (158°f). Water absorption is a very low .3% t o 1% by weight and volume swell is negligible, enabling operation at close tolerance in water lubricated applications. Polyester-based urethanes are generally not recommended for water uses.
- **Other materials** Polyurethanes resist a wider range of substances in comparison with other rubbers and plastics, making them suitable for products that come in contact with a number of substances. Formulations are available that resist mold, mildew, and fungus growth as well, making them suitable for high-humidity or tropical environments.
- **Electricity** Most polyurethanes have very good insulating properties and are used in many encapsulating applications.
- **Oxygen and Ozone** Polyurethanes that are pigmented are highly resistant to degradation by atmospheric oxygen and ozone and are immune to attack by normal atmospheric concentrations. This makes them highly successful when used around electrical equipment, without hardening or cracking. Unpigmented polyurethanes are not resistant to ozone.
- **Radiation** Of all elastomers, polyurethanes have the best resistance to gamma-ray radiation.