

## SHOCK AND VIBRATION FREQUENTLY ASKED QUESTIONS

### What is Sorbothane®?

Sorbothane® is a proprietary, visco-elastic polymer. Visco-elastic means that a material exhibits properties of both liquids (viscous solutions) and solids (elastic materials). Sorbothane is a thermoset, polyether-based, polyurethane material.

Sorbothane combines shock absorption, good memory, vibration damping characteristics and vibration isolation. In addition, Sorbothane is a very effective acoustic damper and absorber. While many materials exhibit one of these characteristics, Sorbothane combines all of them in a stable material with long fatigue life.

- Sorbothane has low creep rate compared to other polymers (rubber, neoprene, silicone, etc.)
- Sorbothane has a superior damping coefficient over a very wide temperature range compared to any other polymer.
- Unlike fluid-based shock absorbers or foam products, Sorbothane absorbs shock efficiently for millions of cycles.
- Sorbothane eliminates the need for metal springs to return the system to its equilibrium position after absorbing a shock.

### Why use Sorbothane®?

Sorbothane® has wide applications in

- shock absorption in industrial, electronic, athletic and medical applications,
- vibration isolation in industrial, electronic and ergonomic applications,
- vibration damping in industrial, electronic and ergonomic applications,
- gasket / sealing in industrial and electronic applications,
- applications where low cost, high color plastic molding is required,
- high space efficiency acoustic absorption
- high space efficiency acoustic barriers

### What does visco-elastic mean?

Visco-elastic means that a material exhibits properties of both liquids (viscous solutions) and solids (elastic materials). Because visco-elastic behavior is desirable in shock and vibration applications many materials claim to be “visco-elastic.” Technically, they are correct. However, many of these materials have only trace “visco-elastic” properties.

A viscous material (a liquid) deforms under load and transmits forces in all directions. It distributes a small amount of pressure over a large area. It does not recover its shape when the load is removed.

An elastic material deforms under load and returns to its original shape when the load is removed.

### What is a damping coefficient?

A damping coefficient is a material property that indicates whether a material will “bounce back” or return energy to a system. A basketball has a low damping coefficient (a good bounce back). If the bounce is caused by an unwanted vibration or shock, a high damping coefficient will attenuate the response (“Swallow the energy” and reduce the reaction of the system.)

### Where does the “swallowed energy” go in Sorbothane®?

It is converted into a small amount of heat.

### How efficient is Sorbothane® as a shock absorber?

Depending upon the application, Sorbothane® can absorb up to 94.7% of the shock energy.

### How efficient is Sorbothane® as a vibration damper?

Sorbothane® can absorb over 50% of the vibration energy over most of its temperature operating range at frequencies from 10 to 30,000 Hertz.

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### Is Sorbothane® fireproof?

Sorbothane® can be purchased with a fire retardant that allows it to meet the Underwriters Laboratory 94 V2 standard.

### How good is Sorbothane's Chemical Resistance?

Generally, Sorbothane's chemical resistance is very good, similar to other polyurethanes.

Chemicals to avoid: gasoline, alcohol and plastics solvents.

### What is the difference between a vibration isolator and a vibration damper?

A good vibration isolator lowers the natural frequency of a system to below the excitation (or disturbing) frequency. Keeping these two frequencies "out of sync" greatly reduces the problems of vibration.

A good vibration damper takes mechanical energy out of the system.

Properly designed metal springs and rubber mounts can be good isolators but have almost no damping capability.

Oil dampers (dashpots) have good damping capability but no isolation capability.

Foam products can be good isolators but have limited life.

### What are the main considerations in a vibration damper?

- A good damping coefficient,
- Wide temperature range stability,
- A long fatigue life.

### What is the Tangent of Delta?

The tangent of delta is a dimensionless term that expresses the out-of-phase time relationship between a shock impact or vibration and the transmission of the force to the support. It can also be known as tan delta, the damping coefficient, or the loss factor. Generally, the higher the tangent of delta the better the material performance is in shock and vibration.

Different experts use different formulas for these terms but they are fairly interchangeable.

### What is the Loss Factor?

See "What is the tangent of delta?"

### What is the Damping Coefficient?

See "What is the tangent of delta?"

### What is durometer?

Durometer is a measure of hardness used for polymers. For a given polymer a higher durometer frequently indicates a stronger material and possibly other properties.

Sorbothane® is softer than rubber and most other polymers. Sorbothane® is normally measured on the Shore "00" scale.

Most types of rubber and other polymers are specified using the Shore "A" or Shore "D" scales. In comparing hardness, be aware of the scale being used for the material in question.

The hardness values listed on the adjacent table are approximate and should only be used as a durometer selection guide.

### What durometers of Sorbothane® are available?

Sorbothane® parts are normally cast between 30 and 70 durometer on the Shore "00" scale. For special applications (at increased cost) Sorbothane® can be cast as low as 20 durometer (limited strength) and as high as 80 durometer (limited visco-elastic properties).