



The more you know...

Unique Glove Design Uses Urethane To Help Skiers Get A Grip On Cold Weather

An oil-filled, hand shaped bladder made with urethane is part of an innovative ski glove designed to keep hands warm. This "liquid heat transfer" bladder, fabricated by Sealtech, Inc., of Athens, Tennessee, distributes warmth from a heat source across the skier's entire hand. The design has been so effective that it is being adapted for use in the military to keep pilots' and mechanics' hands warm in cold weather.

The combination of durability, flex fatigue resistance and oil resistance provided by Stevens Urethane makes it an essential part of this innovative solution to the problem of cold hands on ski slopes. Other materials such as vinyl and rubber lacked one or more of the essential characteristics needed for this application.

The Winning Combination For Urethane

The oil-filled urethane bladder is inserted into the glove, which also includes a small pocket for an iron oxide heat pack or "hand warmer". When this heat pack is activated



and placed in the pocket, the oil in the bladder moves across it, picking up the heat and transferring it to the wearer's hand. The warm oil is distributed by the motion of the hand opening and closing.

Flex Fatigue Resistance

These premium ski gloves have a long working life of many years, so strength, durability, flex fatigue resistance and high oil resistance were essential for the bladder material. Sealtech found that polyurethane was the only material durable enough to withstand the frequent flexing of the wearer's hand, both while skiing and to spread the warmth from the heat pack.

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Why Stevens Urethane from JPS Elastomerics was chosen

PRODUCT	LOW TEMP FLEX	TEAR STRENGTH #/IN (GRAVES)	FLEX STRENGTH	THERMAL PROPERTIES	CHEMICAL RESISTANCE
PVC	Good	100-400	Poor	Fair	Poor to fair in strong base and acid; excellent in weaker solutions
URETHANE	Good - Excellent	400-800	Excellent	Excellent	Poor to fair in strong base and acid; excellent in weaker solutions

Strength

Because of its exceptional tensile and tear strength, urethane provides better performance at thinner gauges than other flexible materials. With urethane, Sealtech was able to use an 8 mil sheet of material for the bladder, which helped streamline the glove design without compromising the bladder's integrity. By comparison, a PVC sheet would have needed to be 20-25 mil, more than twice as thick, to achieve the same performance, which would have made the glove more bulky and less flexible.

Thermal Properties

The ability to retain its strength and flexibility through frequent temperature variations is another important benefit of urethane. The bladder undergoes repeated heating and cooling cycles, and is also exposed to the often freezing temperatures and wind chill found on ski slopes. Stevens Urethane is unaffected by temperature changes. Other plastics such as vinyl contain plasticizers that may cause stiffness or cracking at low temperatures or when faced with repeated hot-cold cycles.

Oil Resistance

Not only must the bladder withstand the warming and cooling cycles, but it must continue to do so for years, while filled with oil. Stevens Urethane has excellent oil resistance, obviously essential to this application. It is also resistant to hydrocarbons, ozone, bacteria, fungus, and moisture, as well as many different chemicals.

About TPUs

- Stevens Urethane is a thermoplastic polyurethane, or TPU. TPUs are versatile elastomers that combine the best properties of both rubber and plastic to offer a unique combination of high performance properties.
- Stevens Urethane offers exceptional strength and durability, so a thinner gauge of TPU can be used when compared to PVC and other materials.
- TPU offers excellent resistance to a wide range of chemicals, as well as moisture and fungus.
- TPU is non-irritating, and is ideal for applications requiring contact with human skin.
- Because it contains no plasticizers, TPU offers excellent low temperature performance. It also lasts longer whether stored or in use.
- TPU can be produced in a wide range of durometers, 75-95 Shore A, from a relatively stiff material to a soft material with a non-plastic feel.
- Stevens Urethane is available as sheet, film, tubing, cord and profile extrusions. A range of colors, opacities, and surface finishes suits any application's aesthetic requirements.
- Stevens Urethane is easy to work with and can be fabricated in many ways: die-cut, radio frequency sealed and thermally bonded, vacuum formed, heat laminated, and

Product Features of Stevens Urethane

	MP-1880	MP-1882	MP-1890
Tensile Properties (D638)			
Modulus @ 100% strain psi	1000	800	1500
Modulus @ 300% strain psi	2000	1100	3000
Modulus at break psi	7000	6000	8000
Modulus of elasticity up to 10% strain psi	35	25	50
Elongation @ break, %	450	550	400
Set @ break, %	35	40	25
Tear Properties			
Die C, D624, pli	400	375	500
Abrasion Resistance			
Mg. weight loss per 1000 cycles, 1000 gm. load, H18, C501, mg.	30	100	25
Maximum Service Temperatures			
Continuous, °F	-60 to 200	-65 to 175	-60 to 225
Durometer (D2240)			
	87A	82A	90A
Thermal Properties			
Melting point range, °F	350 to 390	290 to 330	380 to 420
Specific Gravity (D792)			
	1.12	1.14	1.14
Yield Factors			
Square feet/pound/mil thickness	171.8	168.8	168.8
Humid Aging Resistance			
90% relative humidity at 160°F / 70°C	Excellent	Excellent	Excellent

adhesive bonded to itself or other materials. It can also be printed or silk-screened.

- JPS Elastomerics' technical support includes chemists, quality control personnel, technical sales staff and production experts. These people are ready to work with you to find the best solution to your design challenge.

STEVENS
Urethane
Film & Sheet