

Urethane Properties

Item	Unit	Urethane Rubber					Low Rebound Urethane	Super Low Hardness Urethane	Vulkollan®		High Abrasion Resistant Urethane		Heat Resistant Urethane
		95	90	70	50	30	70	15	92	68	90	70	90
Hardness	Shore A												
Specific Gravity	-	1.13	1.20	1.15	1.20	1.03	1.02	1.26	44.6	31.3	44.6		
Tensile Strength	Mpa	44.1	44.6	31.3	27.4	18.5	11.8	0.6	46.5	60.0	44.6	31.3	44.6
Elongation	%	400	530	650	690	600	250	445	690	650	530	650	530
Heat	°C	70					70	80	80 (120 for short time)		70	120	
Low Temp. Resistance	°C	-40	-20			-20	-40	-20		-20	-20	-20	

The characteristic values of tensile strength and elongation are tested based on the JIS standard K6251.

Urethane (Ether Type, Ester Type) Properties Comparison

Properties	Ether Type (Shore A95 - 90)	Ester Type (Shore A70 - 50 - 30)
Tensile Strength		○
Elongation		○
Tear Strength		○
Impact Resilience	○	
Abrasion Resistance	Slip Wear	○
	Shock Wear	○
Hydrolysis Resistance	○	
Oil Resistance		○
Strength		○
Durability		○
Acid Resistance, Alkali Resistance	○	

Discoloration of Urethane

Urethane may experience discoloration and yellowing with age. Discoloration is distinct especially with antistatic urethane (gray), but physical property or characteristics remain unchanged.

- Aging Discoloration



* Time to turn to yellow and level of yellowing differ greatly depending on operating environment etc.

White rubber may experience yellowing as well, which please note.

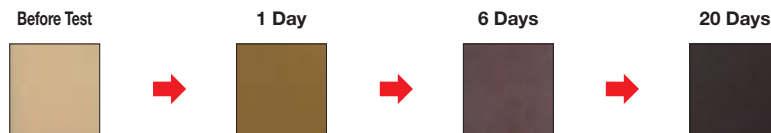
Super Abrasion Resistant Urethane: Vulkollan®

Vulkollan® is a super abrasion resistant urethane which is far superior to conventional urethanes in abrasion resistance and load bearing. It is six times higher in abrasion resistance and half as much again in material strength. (MISUMI's internal test) Vulkollan® withstands up to 80°C in long-time uses, and up to 120°C in short-time uses about for 15-20 mins.



Discoloration of Vulkollan®

Discoloration of Vulkollan® has poorer color stability against ultraviolet rays than general urethanes due to its unique composition. Pictures below show the process of change in colors of a sample exposed to outdoor sunlight.



* No change in physical property or characteristics due to discoloration.

Abrasion Resistant Urethane

Unique composition realized abrasion resistance 2.5 times higher than general urethane at low cost. Color is dark brown.

-Vulkollan® / Abrasion Resistant Urethane Taber Abrasion Test Results

Test	Material	General Urethane	High Abrasion Resistant Urethane	Super Abrasion Resistant Vulkollan®
Abrasion Test (Taber Method)				
Abraded Volume (mm³)		197.3	73.8	33.9

Testing Method
JIS K 7204:1999 "Plastics-Determination of resistance to wear by abrasive wheels"
Abrasive Wheel : H - 22
Load : 9.8N
No. of Strokes : 1,000
Test Parameter : 1

Abrasive wheels are applied to the sample using a fixed weight for a specified number of cycles. From the weight loss of the sample it is possible to measure the abrasion resistance of a material.
* The above values are not guaranteed but an experiment log.

Advantages

High abrasion resistance and material strength provide longer product life and replacement interval.

Heat Resistant Urethane

This urethane has greater heat resistance up to 120°C (general urethane withstands up to 70°C). Suitable for use in applications where high material strength in high-temperature range is required, such as work receiver for hot air dryer.

* Product color is brown.

Vulkollan® / Abrasion Resistant Urethane / Heat Resistant Urethane Products

Washer	Cushion	Sheet	Gasket Products
P.362	P.366 P.373	P.385	P.423 Heat Resisting Urethane only

Urethane is a difficult-to-adhere material. MISUMI offers Adhesives only for Urethane. For Instant Adhesives only for Urethane, please refer to P.448

Rubber Properties

Item	Unit	Nitrile Rubber		Chloroprene Rubber	Ethylene Rubber	Butyl Rubber	Fluoro Rubber		Silicon Rubber		High Strength Silicon Rubber	Low Elasticity Rubber	
		70	50	65	65	65	80	60	70	50	50	57	32
Hardness	Shore A												
Specific Gravity	-	1.6	1.3	1.6	1.2	1.5	1.8	1.9	1.2	1.2	1.2	1.3	1.2
Tensile Strength	Mpa	12.7	4.4	13.3	12.8	7.5	12.5	10.8	7.4	8.8	7.8	8.3	10.3
Elongation	%	370	400	460	490	380	330	270	300	330	400	810	840
Maximum Operation Temperature	°C	90	99	100	120	120	230		200		200	60	
Temperature of Continuous Use	°C	80		80	80	80	210		150		150	30	
Low Temp. Resistance	°C	-10		-35	-40	-30	-10		-70		-50	10	

The characteristic values of tensile strength and elongation are tested based on the JIS standard K6251.

Features of Low Rebound Urethane / Low Elasticity Rubber (Hanenaito®)

Hanenaito® is a registered trademark of Naigai Rubber Industry Co., Ltd.

- Low Rebound Urethane

It has the same properties as urethane, and excels in shock absorption. With more resistance to compression than normal urethane, it is hard to deform. Not suitable for the absorption of large impact energy because its tensile strength and elongation are weaker than that of urethane of the same hardness.

- Low Elasticity Rubber (Hanenaito®)

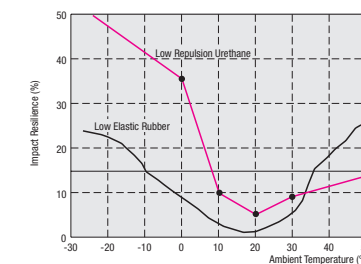
It is used as cushioning material pallet damper, conveyor machine, precision instrument etc, because of its good elongation and shock absorption. Also it is used as vibration absorption materials of various precision instruments because of its excellent vibration absorption.

Reference: Compression set of low-rebound urethane

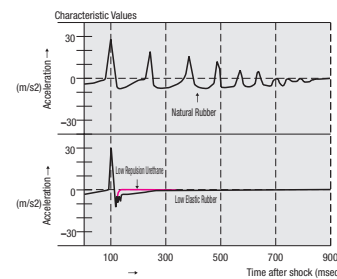
Low Rebound Urethane	1%
Urethane (Shore A70)	25%

* The above data is measured at room temperature 23°C.
* 70°Cx24H 25% Compression

Impact Resilience Variation by Temperature of Low Elasticity Rubber / Low Rebound Urethane



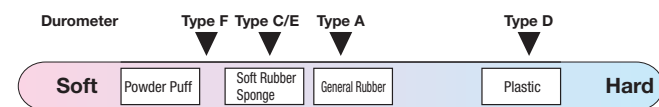
Comparison of Shock Absorption of Low Elasticity Rubber / Low Rebound Urethane



* Above data are standard values, not guaranteed values.

Hardness of Shock Absorbing Materials

-Types of durometers and objects of measurement

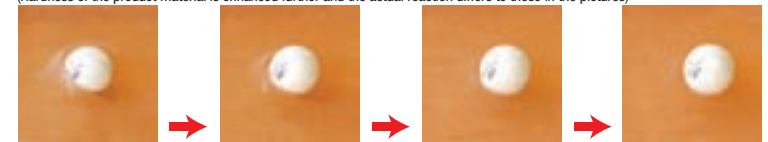


There are various types of durometer, instrument to measure the hardness of a material, depending on the property of the measured material. For urethane and rubber, Type A (Asker Durometer Type A) is most commonly used. Hardness of materials softer than urethane and rubber is measured by Asker Type C or Type E. Shock-absorbing gel is soft and super flexible material whose hardness is measured by Asker Type F.

Shock Absorbing Gel

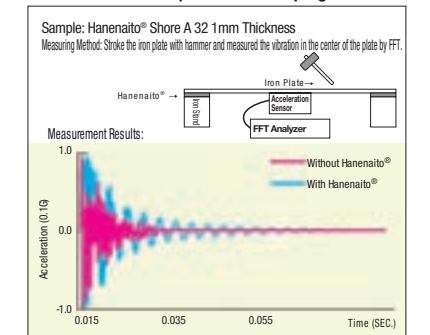
Shock absorbing gel is extremely soft gel which has an Asker F hardness. Being an urethane-based synthetic rubber, it has high material strength. A major characteristic is the three-dimensional slow recovery, the function to recover after compression slowly and in multiple directions.

* The material slowly recovers its shape in 1 - 2 seconds, after pressed with a golf ball. (Hardness of the product material is enhanced further and the actual reaction differs to those in the pictures)



For the shock absorbing capability of the bumpers made of this material, please see gravitational acceleration comparison test data on P.379.

Hanenaito® Comparison of damping effects



-Correlation of hardness and rebound force of shock absorbing materials

	Rebound	Hardness	
		Extra Low (F Hardness)	High (A Hardness)
Low		Shock Absorbing Gel	Low Rebound Urethane Low Elasticity Rubber
Large			General Purpose Urethane General purpose rubber

- Properties of Shock Absorbing Gel

Item	Unit	Shock Absorbing Gel
Specific Gravity	-	1.0
Hardness	Asker F	75
Tensile Strength	Mpa	0.81
Elongation	%	885
Heat	°C	100
Low Temp. Resistance	°C	-10

* Above figures are the measured values for the shock absorbing gel as a material, and there are slight differences between the values for the bumping products made with the material, featured on P.379

Low rebound urethane / Low elasticity rubber/ Shock absorbing gel products

	Washer	Cushion	Sheet
Low Elasticity Rubber Hanenaito®	P.363	P.369	P.399
Low Rebound Urethane	-	P.367 P.372	P.388
Shock Absorbing Gel	-	P.379	-