

Characteristics of Urethane, Rubbers and Sponges

Features of High Performance Urethane and Rubber

Urethane Properties

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

Item	Unit	Urethane															
		Standard					Vulkollan®		Abrasion Resistant		Ceramic Urethane				Heat Resistant	Low Rebound	Extra Low Hardness
Hardness	Shore A	95	90	70	50	30	92	68	90	70	95	90	70	50	90	70	15
Specific Gravity	-	1.13	1.13	1.20	1.20	1.20	1.26		1.20		1.13	1.13	1.20	1.15	1.13	1.03	1.02
Tensile Strength	MPa	44	27	56	47	27	46.5	60	44.6	31.3	42	26	53	45	44.6	11.8	1.5
Elongation	%	380	470	720	520	600	690	650	530	650	360	440	680	490	530	250	385
Heat resistance	°C	70					80 (120 deg. for Short Time)		70		70				120	70	80
Low Temp. Resistance	°C	-40		-20			-20		-20		-20				-20	-20	-40

Urethane (Ether Type, Ester Type) Property 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. Urethane turns yellow by aging, but physical property or characteristics remain unchanged. Discoloration is distinct especially with antistatic urethane and Vulkollan®. See the explanation below.

• Aging Discoloration of Antistatic Urethane



• Discoloration of Vulkollan®

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.



Features of Various Urethanes

Material	Features
Standard Urethane Ether / Ester Polyurethane	Excels in strength in repeat use and shock-absorbing properties. Can be used for applications such as Mechanical Stoppers. Ester Type is Hydrolytic. Do not use in humid and wet areas.
Antistatic Urethane	Excels in antistatic effect. Can be used where mechanical strength and anti-static measures are required.
Heat Resistant Urethane	C This urethane has up to 120°C heat resistance. (70 deg. for the standard urethane) Suitable for use in applications where high material strength in high-temperature range is required.
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. Excels in tearing strength, 6 times higher in abrasion resistance and 1.5 times in material strength than the standard urethane.
Abrasion Resistant Urethane	Unique composition realized abrasion resistance 2.5 times higher than standard urethane at low cost. Helps to reduce the exchange frequency. Color is dark brown.
Ceramic Urethane	These MISUMI original urethane sheets are unique mixture of ceramic particles. Vulkollan® and Wear Resistant Urethane have resistant property against "surface", and the Ceramic Urethane has resistance against "line". Compared to the Standard Urethane and various rubbers, the Ceramic Urethane is relatively smooth in its machined surfaces though it is lower in hardness. Note that cutting due to contact may cause dust.

• Characteristic Values of Antistatic Urethane

Specific Volume Resistivity	2.1x10 ¹⁰ Ω · cm
Surface Resistivity	4.0x10 ⁹ Ω

(Test Conditions: Temperature 30°C Humidity 60%)
All other properties are equal to those of urethane of the same hardness.

• Taber Abrasion Test Results

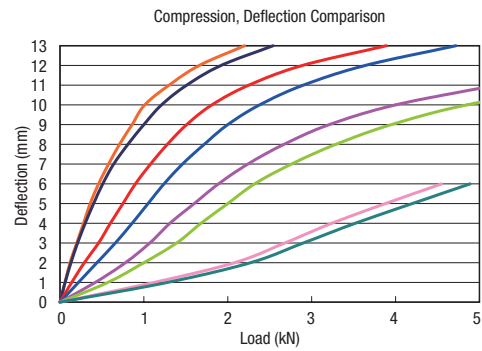
Material	Standard Urethane	Super Abrasion Resistant Urethane	Abrasion Resistant Urethane	Ceramic Urethane
Abrasion Test (Taber Method)	197.3	33.9	73.8	101
Abrasion Volume (mm ³)				

Testing Method
JIS K 7204: 1999 "Plastics - Determination of Resistance to Wear by Abrasive Wheels"
Abrasive Wheel: H, 22 Load: 5.0N
Number of Strokes: 1,000 Test Parameter: 1
The values are not guaranteed but measured ones.

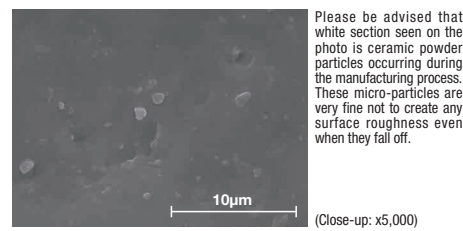
Features of Ceramic Urethane

• Deflection Comparison of Standard Urethane and Ceramic Urethane

Deflection between the ceramic urethane and the standard urethane differs when the same load is applied. Careful consideration should be given for replacement.

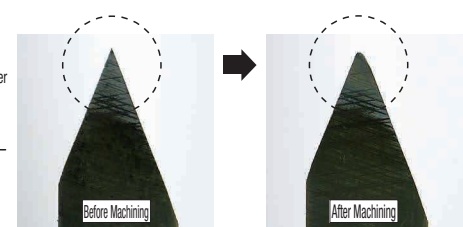


• Enlarged View of Ceramic Urethane



• Change after Ceramic Urethane is Machined

Change after ceramic urethane round bar is machined (Lath: 600rev./min.) for 2 minutes.



Rubber Properties

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

Item	Unit	Nitrile Rubber (NBR)		Chloroprene Rubber (CR)	Ethylene Rubber (EPDM)	Butyl Rubber (IIR)	Fluororubber (FPM)		Silicon Rubber (SI)		Low Elasticity Rubber (Hanenaito®)		Natural Rubber (NR)	
		70	50	65	65	65	80	60	Standard	High Strength	57	32	45	
Hardness	Shore A	70	50	65	65	65	80	60	70	50	57	32	45	
Specific Gravity	-	1.6	1.3	1.6	1.2	1.5	1.8	1.9	1.2	1.2	1.3	1.2	0.9	
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	16.1
Elongation	%	370	400	460	490	380	330	270	300	330	400	810	840	730
Maximum Operating Temperature	°C	90	99	100	120	120	230	230	200	200	60	60	70	
Temperature of Continuous Use	°C	80	80	80	80	80	210	210	150	150	30	30	70	
Low Temp. Resistance	°C	-10	-10	-35	-40	-30	-10	-10	-70	-50	10	10	0	

Reference: Compression Set of Low Rebound Urethane

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

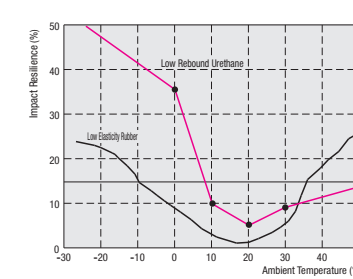
* The above data is measured at room temperature 23°C.
* 70°Cx24H 25% Compression

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

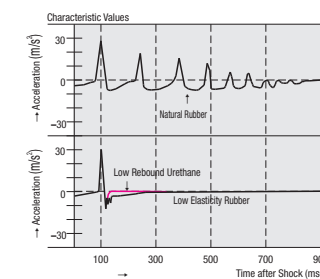
Low Rebound Urethane
It has the same properties as urethane, and excels in shock absorption. With more resistance to permanent compression than standard urethane, it is hard to deform. Not suitable for absorption of large impact energy because its tensile strength and elongation resistance are weaker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

Low Elasticity Rubber (Hanenaito®)
Hanenaito® is a registered trademark of Naigai Rubber Industry Co., Ltd. It is used as cushioning material for 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.

• Impact Resilience Variation by Temperature of Low Elasticity Rubber and Low Rebound Urethane

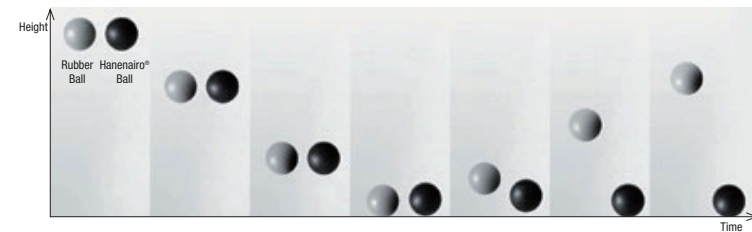


• Shock Absorption Comparison of Low Elasticity Rubber and Low Rebound Urethane



Listed values are for reference, not guaranteed.

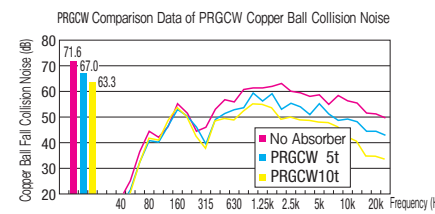
Drop Comparison of Rubber Ball and Hanenaito® Ball



Features of Shock Absorbing Foam P435

Excellent sound damping and vibration absorbing characteristics. Flexible material can be pasted on curved surfaces with ease. Lightweight material can be applied on large panel areas. Best suited for human body protection. Can be pasted in multi-layers where more protection is needed.

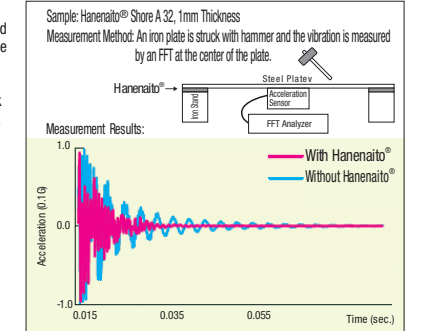
Steel Ball Collision Noise Level Test



Item	No Absorber	PRGCW5	PRGCW10
Collision Noise (dB)	71.6	67	63.3
Sound Pressure	-	40% Reduced Sound Pressure	60% Reduced Sound Pressure

* A steel ball (Ø20, 36g) is dropped on a wooden base from a 55cm height, and the sound pressure level is measured with a microphone at a distance of 50m, positioned 50cm above the ground.

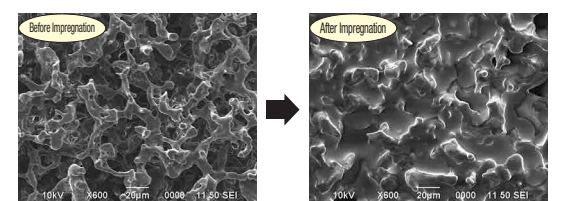
Hanenaito® Comparison of Damping Effects



Features of Special Urethane Foam SOFRAS® P446

This special urethane foam excels in water retention and abrasion resistance allowing it to be used in industrial purposes such as application and moisture absorption. SOFRAS® excels in abrasion resistance and requires less concerns about dust shedding, whereas the use of sponges and felts may result in shedding of dust and felt fiber.

• Enlarged Photo of Grease-impregnated Special Urethane

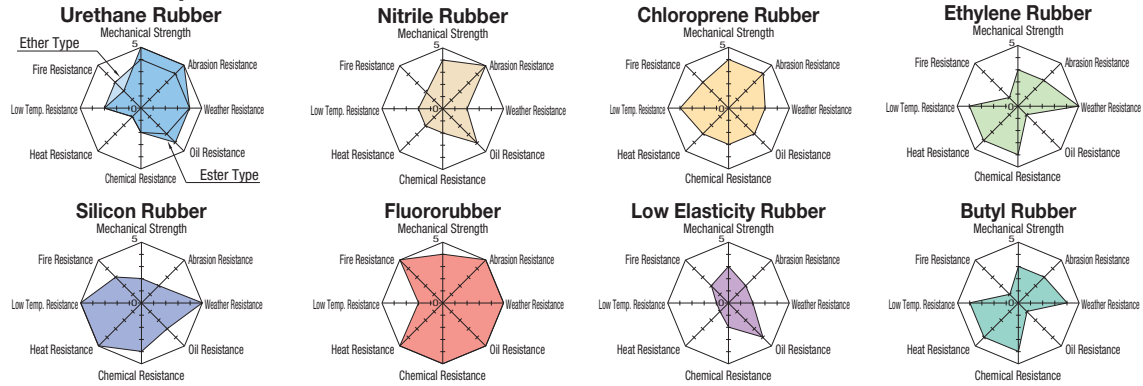


Rubber Properties

Note that, for some of the types shown here, order might be unable to be received by the MISUMI Malaysia, Indonesia and/or India offices.

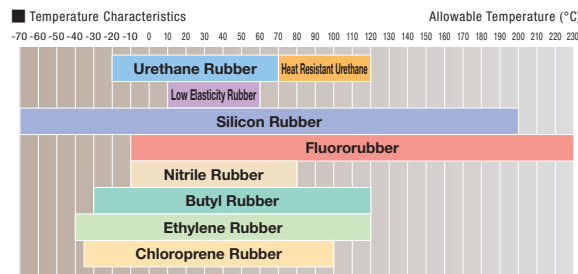
Urethane Washers, Rubber Washers Washer Package

Rubber Properties



Material	Features
Urethane Rubber	Superior in mechanical strength and abrasion resistance to other rubbers. Especially excels in strength in repeat use and shock-absorbing properties. Can be used for applications such as Mechanical Stopper. Excellent in oil resistance but poor in chemical resistance. Ester Type is Hydrolytic. Do not use in humid and wet areas.
Nitrile Rubber (NBR)	Acrylic Nitrile Butadiene Rubber Economical general-purpose rubber excellent in oil resistance. Used for various applications such as O-rings and gaskets.
Chloroprene Rubber (CR)	Chloroprene Rubber Well-balanced synthetic rubber excellent in weather, heat, oil and chemical resistance. Non-staining chloroprene rubber which minimizes contamination from contacting materials is also available.
Ethylene Rubber (EPDM)	Excels in weather, low temperature and chemical resistance. Can be used for general-purpose applications such as gaskets and doorstops.
Silicon Rubber (SI)	Excels in heat resistance and electric property (insulation). Physiologically safe and can be used for medical, food-related and electronic devices which require heat resistance.
Fluororubber (FPM)	Expensive, but widely used with its excellent heat, oil, solvent and chemical resistance. Fluororubber is generally known as fluoropolymer and Viton®. Has the highest resistance to ozone, heat, oil and chemicals in rubbers.
Low Elasticity Rubber (Hanenaito®)	Excels in shock and vibration resistance and absorbs energy without rebound. Physical property and durability are equal to general rubbers. Widely used as components for quiet and low-vibration products.
Butyl Rubber (IIR)	Isobutylene Isoprene Rubber Excellent in heat, cold and weather resistance, and good in water and chemical resistance.

Comparison of Allowable Temperature



Comparison of Chemical Resistance

	Urethane	Nitrile	Chloroprene	Ethylene	Butyl	Fluorine	Silicon	Low Elasticity
Gasoline Light Oil	⊙	⊙	○	×	×	⊙	△	△
Water	△	⊙	⊙	⊙	⊙	⊙	○	△
Strong Acid	×	○	○	○	⊙	⊙	△	△
Strong Alkali	×	○	⊙	⊙	⊙	×	⊙	○
Ether	×	×	×	○	△	×	×	△
Keton	×	×	×	⊙	⊙	×	○	×

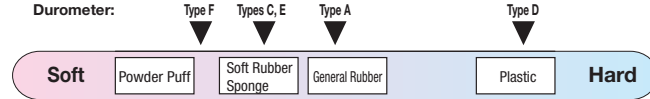
⊙ = Excellent, ○ = Good, △ = Acceptable, × = Not Acceptable

Indication of Hardness

Three hardness categories are used for MISUMI's Urethane, Rubbers and Sponges.

- Shore A**
Used to describe the hardness of Urethane and Rubbers.
"Shore A 70" means hardness measured by using type-A Durometer in accordance with New JIS Standard K6253.
- ASKER C**
Used to describe the hardness of Sponges.
"Asker C 25" means hardness measured by using a spring type hardness tester Asker C in accordance with SRIS 0101 (Standard by the Society of Rubber Industry, Japan).
For those two above, larger value indicates harder material.
- Penetration**
Used to describe the hardness of gel materials.
JIS K 2207 Standardized testing method. It indicates hardness by the penetrated length that a pin of specified weight penetrates in a sample perpendicularly.
The value is one penetration for 1/10mm length. (Larger value indicates softer material.)

Types of Durometers and Objects of Measurement



There are various types of durometer instrument as shown above 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) compliant with JIS K 6253 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.

Hardness Images

Shore A95	Golf Ball
Shore A90	Baseball
Shore A70	Softball
Shore A50	Plastic Eraser
Shore A30	Bicycle Tube
Shore A15	Firm Gelatin

•Margin of Error: ±5

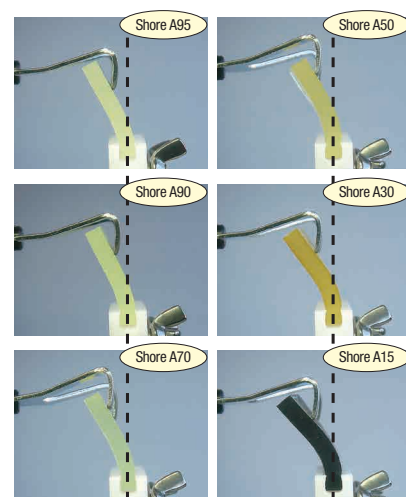
Durometer A (Shore A): 10 20 30 40 50 60 70 80 90

Asker C: 20 30 40 50 60 70 80 90

SRIS 0101 C Type

Ref.: Bending Test by Hardness

Test Conditions: Standard Urethane, Thickness 5mm, Width 30mm, Length 40mm
When pulled by push-pull gauge with the load 5N:



Offers punching-processed washers at reasonable price.

Type	Type	Material	Hardness	Color
Urethane Washers, Rubber Washers - Package No Adhesive	PACK-URWH	Standard Urethane (Ether Polyurethane)	Shore A90	Natural Color
	PACK-URWM		Shore A70	
	PACK-WRBN	Nitrile Rubber	Shore A70	Black
	PACK-WRBC	Chloroprene Rubber	Shore A65	Black

For tolerance, refer to Specification Table.

Notes

Blanking (Punching) may cause concave on the O.D. For T dimension 3, 5mm, the center of the washer may deform into dented shape while it hardly deforms for T dimension 1mm.
Note that Urethane turns yellow by aging, but physical property or characteristics remain unchanged.

• Yellow Discoloration of Urethane



Part Number	Type	D Selection	V Selection	T Selection	Tolerance				Pcs. per Package			
					T1, 3		T5		T1, 3	T5		
PACK-URWH (Urethane, Shore A90) PACK-URWM (Urethane, Shore A70) PACK-WRBN (Nitrile Rubber, Shore A70) PACK-WRBC (Chloroprene Rubber, Shore A65)	8	3	4	1	3	±0.6	0~+0.6	±0.7	0~+0.7	100 pcs.	50 pcs.	
	10	3	4	5	6	±0.8	0~+0.8	±0.9	0~+0.8			
	12	5	6	8	1	3	±0.9	0~+0.9	±1.0			0~+1.0
	15	6	8	10	1	3	±0.9	0~+0.9	±1.0	0~+1.0	50 pcs.	
	20	8	10	12	3	5						
25	10	12	16	3	5							
30	10	12	16	3	5							



Ordering Example: Part Number - V - T
PACK-URWH20 - 10 - 5

Part Number	Type	D Selection	Unit Price												
			PACK-URWH (Urethane, Shore A90)			PACK-URWM (Urethane, Shore A70)			PACK-WRBN (Nitrile Rubber, Shore A70)			PACK-WRBC (Chloroprene Rubber, Shore A65)			
PACK-URWH PACK-URWM PACK-WRBN PACK-WRBC	8														
	10														
	12														
	15														
	20														
	25														
30															