Tigers Polymer
Tubes and Extruded
Products
Silicone and Fluoro Rubber

TIGERS POLYMER CORPORATION

Silicone Rubber Features

What is Silicone Rubber?

In spite of silicone taking diversified forms, its construction is represented by the siloxane bond … Si-O-Si … and methyl radical. It is derived from the main materials of metallic silicon and methanol of which both are abundantly available natural resource materials that do not directly rely on petroleum.
Silicone can be said to be a unique polymer from this point as well.

Heat Resistance

The heat resistance of silicone is very excellent in comparison with general organic rubbers.
Natural rubber deteriorates in a short time and cannot be used when 100℃ is exceeded which is the same with general synthetic rubbers when 150℃ is exceeded whereas silicone rubber can be continuously used even in temperatures exceeding 180℃.
The standards of used temperature and usable length of time in simple heat aging environments are shown in the table.
Heat resistance life cycle significantly depends on its environmental condition, so please confirm when using other than under simple heat aging environment.

Operating temperature and usable length of time

Temperature (℃)	Usable Length of Time (hr) (Continuous)
150	15,000
200	7,500

※ However, severe deterioration of more than expected will take place in a sealed state due to depolymerization taking place. For such reason, it is necessary to design so that at least one portion of the silicone rubber is exposed to the outside.

Cold Resistance

Silicone rubber excels in cold resistance because it is essentially non-crystalline and low in temperature dependence. The brittleness temperature of even general silicone rubber is -60 to -80℃ making them usable in the range of -40 to -50℃. Furthermore, the brittleness temperature of silicone rubber for ultra-low temperature is -115℃ and maintains its flexibility and is usable even at -90℃.

Gas Permeability

The gas permeability of silicone rubber is extremely high in comparison with other organic rubbers and plastics as well as it is well known that silicone rubber film exhibits excellent selective permeability against gases.

● Permeability of Major Gas

Unit: 1×10^{-9}cc·cm/cm^2·sec·cmHg

Gas		Gas Permeability	Gas		Gas Permeability
Hydrogen	H_2	55	Nitrogen Dioxide	NO_2	635
Helium	He	30	Sulfur Dioxide	SO_2	1,250
Nitrogen	N_2	25	Methane	CH_4	80
Oxygen	O_2	50-60	Ethane	C_2H_6	210
Argon	Ar	50	Ethylene	C_4H_4	115
Xenon	Xe	171	Ethanol	C_2H_5OH	1,160
Ammonia Gas	NH_3	500	Carbon Tetrachloride	CCl_4	5,835
Vapor	H_2O	3,000	Freon	Freon11	1,290
Carbon Dioxide	CO_2	270-320	Freon	Freon12	107

Silicone Rubber Features

Ozone/Weather Resistance

Silicone rubber excels in stability against oxygen, ozone and ultraviolet rays, and the heat resistance is extremely favorable in comparison with general organic rubbers by reason that the main chain consists of siloxane bonds and the skelton does not contain unsaturated bonds.
In outdoor exposure tests of the past 10 years, deterioration phenomena such as cracks and sticking by softening could not be observed.

Chemical Resistance

Silicone rubber has an excellent resistance on inorganic chemicals such as various acid, base, salt, etc., and on animals and plants oil, and on polar organics such as alcohol or acetone. Although the volumetric change stays at about 10 - 15%, it swells 150 - 200% for fuel oil or nonpolar solvent such as gasoline, benzene, toluene, carbon tetrachloride, etc.

■ Chemical Resistance

Chemicals	Condition	Evaluation
酸 Acid		
塩酸 Hydrochloric Acid (35%)	25℃	×
蟻酸 Formic Acid	70℃	△
クロム酸 Chromic Acid (10%)	25℃	×
硝酸 Nitric Acid	25℃	×
氷酢酸 Glacial Acetic Acid	25℃	×
硫酸 Sulfuric Acid (50%)	25℃	×
アルカリ Alkali		
アンモニア Ammonia	25℃	○
水酸化ナトリウム Sodium Hydroxide	70℃	×
次亜塩素酸ナトリウム Sodium Hypochlorite	25℃	△
その他の無機薬品 Other Inorganic Chemical		
塩素 Chlorine	25℃	×
臭素 Bromine	25℃	×
水 Water	70℃	○
ケトン・エーテル類 Ketone, Ether		
アセトン Acetone	25℃	○
メチルエチルケトン Methyl Ethyl Ketone	25℃	△
メチルエーテル Methyl Ether	25℃	△
塩素系溶剤 Chlorinated Solvent		
二酸化メチレン Methylene Dioxide	25℃	○
クロロホルム Chloroform	25℃	×
四塩化炭素 Carbon Tetrachloride	25℃	×
トリクロロエチレン Trichlorethylene	25℃	×
トリクロロエタン Trichloroethane	25℃	×
アルコール類 Alcohol		
イソプロピルアルコール Isopropyl Alcohol	25℃	◎
グリセリン Glycerin	70℃	○
ブチルアルコール Butyl Alcohol	25℃	○
エチルアルコール Ethyl Alcohol	25℃	○
メチルアルコール Methyl Alcohol	25℃	◎

Chemicals	Condition	Evaluation
油・油脂類 Oils and Fats		
エチレングリコール Ethylene Glycol	70℃	◎
シリコーンオイル Silicone Oil	70℃	△
綿実油 Cotton Oil	70℃	◎
ASTM No.3 オイル ASTM No.3 Oil	70℃	△
JIS 1号油 JIS No.1 Oil	70℃	○
燃料油 Fuel Oil		
ガソリン Gasoline	25℃	△
重油 Heavy Oil	25℃	○
ディゼル油 Diesel Oil	70℃	×
芳香族系炭化水素 Aromatic Hydrocarbon		
ベンゼン Benzene	25℃	×
トルエン Toluene	25℃	×
キシレン Xylene	25℃	×
フェノール Phenol (10%)	70℃	◎
脂肪族系炭化水素 Aliphatic Hydrocarbon		
n-ヘキサン n-Hexane	25℃	×
シクロヘキサン Cyclohexane	25℃	×
イソオクタン Isooctane	25℃	○

◎ : Little-affected
○ : Some affect, but no prevention in use.
△ : Unadvisable due to certain amount of affection.
× : Not applicable due to heavy affection.

Above listed data indicates rough chemical resistant behavior based on swelling rate, etc. It is not provide any guarantees of chemical resistance. Confirm with a test considering use conditions before use.

Silicone Rubber Features

Nonflammability

Silicone rubber does not burn easily even when brought close to flames but has a property to continue to burn when once ignited, however, there is an improved nonflammable self-extinguishing silicone rubber available to cope with UL and standards of electrical appliances. Nonflammable organic rubbers and plastics are available in addition to silicone rubber but many of these are formulated with a large amount of organic halogen compound which is a flame retarding agent due to which toxic gases may be produced at time of burning. Conversely, nonflammable silicone rubber is minimum in the production of toxic gases by reason of consisting of a unique flame retarding mechanism (platinum compound added) making this a major characteristic feature.

Saturated Steam Resistance

Rapid hydrolysis of siloxane bond takes place with silicone rubber under pressurized steam.
It requires attention due to the rubber's short life cycle when using under steam pressure

Other Properties

Thermal conductivity

Thermal conductivety is about 0.2W/(m·K) and is roughly twice of natural rubber · synthetic rubber.

Thermal expansion coefficient

Coefficient of cubic expansion is 6-8 $\times 10^{-4}$/℃, and linear expansion coefficient is 2-3 $\times 10^{-4}$/℃.
It is roughly twice to 2.5 of natural rubber · synthetic rubber.

Silicone Rubber Extruded Products

Properties

Properties / Grade	General Properties				TR		CS % 150℃×24h	Standard Color	Features and Applications
	Hs Type A	TB MPa	TB {kg f/cm²}	EB %	N/mm	{kg f/cm}			
SR 1554	54	11.8	{120}	530	25.8	{26}	18	Translucent	For general tube SR 1554 tube is a standard grade
SR 1563	59	9.10	{93}	630	28.5	{29}	15	Translucent	
SR 1573	70	9.80	{100}	560	31.4	{32}	16	Translucent	
SR 141	40	10.5	{107}	600	24.5	{25}	37	Translucent	
SR 151	53	10.8	{110}	480	25.5	{26}	29	Translucent	
SR 161	58	9.21	{94}	420	27.0	{28}	30	Translucent	
SR 171	70	8.53	{87}	420	20.6	{21}	33	Translucent	
SR 1050	49	10.3	{105}	600	33.0	{34}	—	Light yellow	High-strength
SR 1055	55	9.85	{100}	635	27.7	{28}	15	Translucent	High-strength and application uder severe-bending fatigue such as roller pump
SR 1102	59	8.2	{84}	292	21.0	{21}	—	White	Flame resistance: Equiv. to V-O with 1mm
SR 1151	55	6.86	{70}	400	13.7	{14}	27	Red	Equiv. to V-O with 5.08mm
SR 1158	60	10	{102}	220	14.5	{15}	29	Grayish black	Equiv. to V-O with 0.2mm
SR 1260	59	8.9	{91}	350	14.5	{15}	29	Light yellow	Steam-proof
SR 1350	50	9.4	{96}	540	21.0	{21}	22	Light yellow	For higher temperature use than general silicone rubber
SR 1402	68	5.39	{55}	210	15.0	{15}	—	Black	
SR 1560	59	9.8	{100}	450	24.5	{25}	18	Translucent	Extremely low type of eluted substance
SR 1570	71	10.3	{105}	410	19.6	{20}	20	Translucent	

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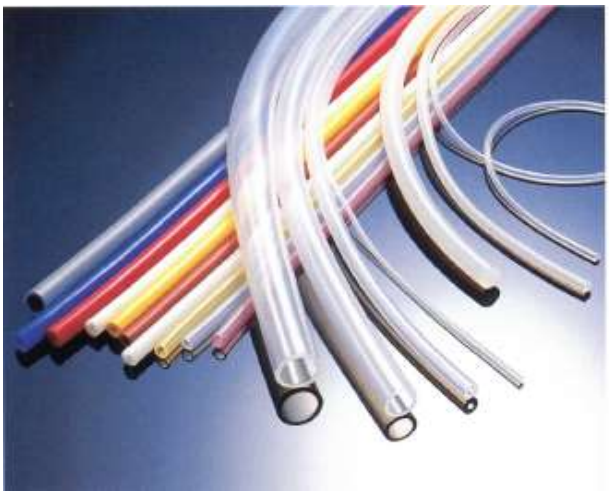
Contact us for each grade other than listed above.

Contact us for desired shape and material, etc. for irregular shape.

It can be colored freely for which the standard color is transparent or translucent grade.



Silicone Rubber Extruded Products

Features

- Suited to packing etc. because the lengthy goods are available.
- Excels in heat resistance and generally available to 200℃.
- Excels in ozone and weather resistance.
- Meet Food Sanitation Law (Notice No. 85, Ministry of Health and Welfare)　(Exclude silicone sponge)

※ Please check the adequacy and safety of the relevant product before use.

Applications

Tube for physical and chemical appliances
Hose for food transfer
Heat resistant protection cover
Hose for hot-water circulating device of bath
Vending machine tube
Packing for pressure cooker (Round cord)
Material for O ring (Round cord)
Packing for drier (Irregular shape)
Packing for environment tester (Irregular shape)
Electromagnetic shielding packing for information equipment such as computer (Conductive property)

Main Dimension Table of Silicone Rubber Extruded Products

Standard product is SR1554. Special material is also available. (Basically the dimension is available from ϕ1 to 38. Contact us for more detail)
Special grade materials are available such as high-strength, flame resistant, steam-proof, ultra heat resistant, etc. Also an irregular shape available other than tube, round cord, and square cord.

Tube

ID (mm)	OD (mm)	Thickness (mm)	Tolerance (mm)		Scale (m)	ID (mm)	OD (mm)	Thickness (mm)	Tolerance (mm)		Scale (m)
			ID	Thickness					ID	Thickness	
1	2	0.5	±0.1	±0.05	100	7	12	2.5	±0.2	±0.2	50･100
1	3	1	±0.1	±0.1	100	7	13	3	±0.2	±0.2	100
2	3	0.5	±0.1	±0.05	100	8	10	1	±0.2	±0.1	50･100
2	3.5	0.75	±0.1	±0.1	100	8	11	1.5	±0.2	±0.2	100
2	4	1	±0.1	±0.1	100	8	12	2	±0.2	±0.2	50･100
2	5	1.5	±0.1	±0.2	100	8	13	2.5	±0.2	±0.2	100
2	6	2	±0.1	±0.2	100	8	14	3	±0.2	±0.2	50･100
3	5	1	±0.1	±0.1	100	8	15	3.5	±0.2	±0.2	50
3	6	1.5	±0.1	±0.2	100	9	12	1.5	±0.2	±0.2	50･100
3	7	2	±0.1	±0.2	100	9	13	2	±0.2	±0.2	50･100
3	8	2.5	±0.1	±0.2	100	9	15	3	±0.2	±0.2	50
4	6	1	±0.1	±0.1	100	10	12	1	±0.2	±0.1	100
4	7	1.5	±0.1	±0.2	100	10	13	1.5	±0.2	±0.2	100
4	8	2	±0.1	±0.2	100	10	14	2	±0.2	±0.2	50･100
4	9	2.5	±0.1	±0.2	100	10	15	2.5	±0.2	±0.2	50
5	7	1	±0.15	±0.1	100	10	16	3	±0.2	±0.2	50
5	8	1.5	±0.15	±0.2	100	12	14	1	±0.3	±0.1	100
5	9	2	±0.15	±0.2	100	12	15	1.5	±0.3	±0.2	50
5	10	2.5	±0.15	±0.2	100	12	16	2	±0.3	±0.2	50･100
5	11	3	±0.15	±0.2	100	12	18	3	±0.3	±0.2	50
6	8	1	±0.15	±0.1	100	12	20	4	±0.3	±0.2	50
6	9	1.5	±0.15	±0.2	100	15	20	2.5	±0.3	±0.2	50
6	10	2	±0.15	±0.2	100	18	24	3	±0.3	±0.2	50
6	11	2.5	±0.15	±0.2	100	19	25	3	±0.3	±0.2	50
6	12	3	±0.15	±0.2	100	20	28	4	±0.3	±0.2	20･50
7	9	1	±0.2	±0.1	100	25	33	4	±0.4	±0.2	50
7	10	1.5	±0.2	±0.2	100	32	42	5	±0.5	±0.3	10
7	11	2	±0.2	±0.2	100	38	48	5	±0.5	±0.3	10

Contact us for other dimension.　※ Requirement is avilable for color tube and special materials.

Round Cord

Diameter (mm)	Tolerance (mm)	Scale (m)
3	±0.1	100
4	±0.1	100
5	±0.15	100
6	±0.15	100
7	±0.2	100
8	±0.2	100
9	±0.2	100
10	±0.3	50･100
12	±0.3	50･100
15	±0.3	50

Contact us for a dimension other than listed above.

Square Cord

Extrusion is available
for □3 to 30 (Square cord)

Contact us for more detail.

Silicone Rubber Sponge Extruded Products

Features

- Suited to construction gasket, joint sealing, door sealing etc. because the lengthy goods are available.
- Excels in heat resistance and generally available at -60～200℃.
- Thermal conductivity : $6～9\times10^{-2}$ W/(m·K)

Applications

- Joint gasket for PC sheet (Fire resistant for 1～3 hours)
- Seal material for metal roofing material
- Gasket for drier
- Roller for copier
- Heat insulator at hot condition part

Properties

Properties / Grade	Apparent Density g/cm³	General Properties				CS 150℃×24h×40% compression %	Color Standard	Features and Applications
		Hs Asker C	TB		EB %			
			MPa	{kgf/cm²}				
SR 210	0.28	10	0.29	{3.0}	150	53	Black	Open cell, high-foaming, general purpose material
SR 215	0.35	15	0.49	{5.0}	140	55	Black	
SR 220	0.38	20	0.87	{8.9}	120	21	Red	
SRF 210	0.33	10	0.31	{3.6}	190	23	Black	Construction fire resistant gasket
SR 225	0.37	25	1.00	{10}	270	52	Red	General purpose material
SH 20	0.30	23	0.64	{6.5}	140	60	Red	For small lot, general purpose
SH 25	0.36	26	1.08	{11}	250	—	Red	For small lot, general purpose

JIS K 6250, SRIS0101

Please consult us for each grade other than listed above.
Please consult us for desired shape and material, etc. for profile shape.
Specification may be modified for quality improvement.
SRF type is for construction fire resistant gasket. Please consult us for its shape.

Dimension

Product size which we can form is different depending on its material grade.
Please refer to the following table, and consult us for more details.

Shape	SR type		SH type	
	Min. sz (mm)	Max. sz (mm)	Min. sz (mm)	Max. sz (mm)
Square cord	5×5	35×35	3.5×3.5	30×30
Rectangle code	3×6	30×60	2.5×4	5×100
Tube	φ5×φ8	φ15×φ40	φ4×φ9	φ15×φ35
Round cord	φ7	φ30	φ3	φ25

Features of Fluoro Rubber

Ozone Resistance and Weather Resistance

Exhibits the maximum resistance among rubber elasticity under environments of ozone or light. The taking place of ozone cracking could not be observed when exposed for 1,000 hrs in ozone of 100ppm, and similarly is not attacked when exposed to extremely high pressure oxygen.

Chemical Resistance

Fluoro rubber has an excellent resistance on wide range of chemicals such as various oil, solvent, acid, etc.
However, attention is required for ketone ester or amine due to its susceptibility.
And it may deteriorate by its low tolerance for strong alkali.

Chemicals	Condition	Evaluation
酸 Acid		
塩酸 Hydrochloric Acid (35%)	40℃	◎
クロム酸 Chromic Acid (10%)	70℃	◎
硝酸 Nitric Acid (60%)	25℃	◎
氷酢酸 Glacial Acetic Acid	25℃	×
フッ酸 Hydrofluoric Acid (50%)	40℃	○
硫酸 Sulfuric Acid (98%)	40℃	◎
アルカリ Alkali		
アンモニア Ammonia	40℃	○
水酸化ナトリウム Sodium Hydroxide	40℃	*△～○
次亜塩素酸ナトリウム Sodium Hypochlorite	40℃	○
その他の無機薬品 Other Inorganic Chemical		
塩素 Chlorine	25℃	○
臭素 Bromine	25℃	○
水 Water	100℃	◎
ケトン・エーテル類 Ketone, Ether		
アセトン Acetone	40℃	×
メチルエチルケトン Methyl Ethyl Ketone	40℃	×
メチルエーテル Methyl Ether	25℃	×
塩素系溶剤 Chlorinated Solvent		
塩化メチレン Methylene Chloride	40℃	*×～○
クロロホルム Chloroform	40℃	*△～○
四塩化炭素 Carbon Tetrachloride	40℃	◎
トリクロロエチレン Trichlorethylene	40℃	◎
トリクロロエタン Trichloroethane	40℃	○～◎
アルコール類 Alcohol		
イソプロピルアルコール Isopropyl Alcohol	25℃	◎
エチルアルコール Ethyl Alcohol	40℃	○
グリセリン Glycerin	70℃	◎
ブチルアルコール Butyl Alcohol	40℃	○
メチルアルコール Methyl Alcohol	40℃	※△～○

Chemicals	Condition	Evaluation
油・油脂類 Oils and Fats		
エチレングリコール Ethylene Glycol	70℃	◎
シリコーンオイル Silicone Oil	175℃	◎
綿実油 Cotton Oil	175℃	◎
ASTM No.3 オイル ASTM No.3 Oil	175℃	◎
JIS 1号油 JIS No.1 Oil	175℃	◎
燃料油 Fuel Oil		
ガソリン Gasoline	40℃	◎
灯油 Heating Oil	40℃	◎
Fuel A	40℃	◎
芳香族系炭化水素 Aromatic Hydrocarbon		
ベンゼン Benzene	40℃	*△～◎
トルエン Toluene	40℃	*△～◎
キシレン Xylene	40℃	*○～◎
フェノール Phenol (10%)	70℃	◎
脂肪族系炭化水素 Aliphatic Hydrocarbon		
n-ヘキサン n-Hexane	25℃	○
シクロヘキサン Cyclohexane	25℃	○
イソオクタン Isooctane	25℃	○

◎ : Little-affected
○ : Some affect, but no prevention in use.
△ : Unadvisable due to certain amount of affection.
× : Not applicable due to heavy affection.
* : Result in differences depends on material grade.

Above listed data indicates rough chemical resistant behavior based on swelling rate, etc. It is not provide any guarantees of chemical resistance. Confirm with a test considering use conditions before use.

Steam Resistance

Fluoro rubber has excellent steam resistance compared to other synthetic rubber.

Fluoro Rubber Extruded Products

Features

- Applicable to heavy machinery packing, chemical use hose, etc. due to its long length.
- Excels in heat resistance and generally available up to 200℃.
- Excels in ozone, weather, and chemical resistance as well as oil resistance.

Applications

- Seal for heat exchanger
- Packing for high-temperature vacuum drier
- Seal for oil pressure and lubrication machine
- Seal for dry cleaning equipment
- Cleaning blade for copy machine
- Gasket for steam boiler
- Packing for sanitary pipe
- Valve sheet for butterfly valve

Properties

Properties / Grade	General Properties				TR		CS 150℃×24h %	Features and Applications
	Hs Asker C	TB MPa	TB {kgf/cm²}	EB %	N/mm	{kgf/cm}		
FR 27	71	12.1	{123}	490	27.5	{28}	53	Standard products
FR 57	76	12.7	{130}	300	27.5	{28}	17	Low compression set

JIS K 6250

Major Dimension of Fluoro Rubber Extruded Products

Tube

ID (mm)	OD (mm)	Thickness (mm)	Tolerance (mm)		Scale (m)
			ID	Thickness	
1	3	1	±0.1	±0.15	100
2	4	1	±0.1	±0.15	100
3	5	1	±0.15	±0.15	100
4	6	1	±0.15	±0.15	100
5	7	1	±0.2	±0.15	100
6	8	1	±0.2	±0.15	100
6	9	1.5	±0.2	±0.2	50
7	10	1.5	±0.25	±0.2	50
9	12	1.5	±0.25	±0.2	50
9	13	2	±0.25	±0.25	50
10	13.5	1.75	±0.25	±0.25	50
10	14	2	±0.25	±0.25	30
12	16	2	±0.4	±0.25	30

Contact us for a dimension other than listed above.

Round Cord

Thickness (mm)	Tolerance (mm)	Standard Length (m)
3	± 0.15	100
4	± 0.15	100
5	± 0.2	100
5.7	± 0.2	100
6	± 0.2	100
7	± 0.25	100
8	± 0.25	100
9	± 0.25	50
10	± 0.25	50

Contact us for a dimension other than listed above.

Square Cord

Shape	Dimension (mm)	
	Minimum	Maximum
Square cord	4.0×4.0	24×24
Rectangle	3×5	3×40

Contact us for a dimension other than listed above.
Deformed shape is also available.

Tiger-Flon Tube

Features

- Transparent making it possible to clearly see the flow of liquid inside the fluoro rubber tube.
- Chemical resistance is most excellent among fluoro rubber tubes of the past.
- Almost free of leaching out and eluting caused by solvents, chemicals and foods making it excellent in safety.
  (Passes the Ministry of Health and Welfare Notification No. 20 but hygienic testing is necessary at a time of using for medical purposes depending on the application.)
- Free of the concern of contamination caused by leaching out of vulcanizing agent, vulcanizing accelerator and filler due to consisting of radiation induced crosslinking and not containing such additives.

There were only nontransparent fluoro rubber in the past, but our Tiger-Flon is a excellent fluoro rubber in transparency.

Applications

- For physical and chemical appliances
- For semiconductor industry
- For OA appliances
- For tube which requires transparency under severe working conditions

Properties

General Properties			
Hs	TB		EB
Type A	MPa	{kgf/cm^2}	%
67	15.5	{158}	460

JIS K 6250

※ The tube surfaces have tendency of sticking together.

※ The color will change to a light pink color when a tube is subjected to UV rays, but this is not a change of qualities.

Major Dimension

Tube

ID (mm)	OD (mm)	Thickness (mm)	Tolerance (mm)		Scale (m)
			ID	Thickness	
1	3	1.0	±0.1	±0.15	50
2	4	1.0	±0.2	±0.15	50
3	5	1.0	±0.2	±0.15	50
4	6	1.0	±0.2	±0.15	50
5	7	1.0	±0.2	±0.15	50
6	8	1.0	±0.2	±0.15	50
7	9	1.0	±0.2	±0.15	50
8	10	1.0	±0.2	±0.15	50

Contact us for a dimension other than listed above.

Fluoro Rubber Sponge Extruded Products

Features

- Excels in heat resistance and ozone resistance.
- Excels in chemical resistance, solvent resistance and oil resistance.
- Long-length is available due to continuous vulcanization.
- Color is black.

Applications

- Gasket for industrial machines or devices
- Gasket for heat treater

Properties

Apparent Density g/cm^3	General Properties				TR	
	Hs Asker C	TB MPa	TB {kgf/cm^2}	EB %	N/mm	{kgf/cm}
0.65	35	1.47	{15}	200	4.9	{5.0}

JIS K 6250, SRIS0101

Dimension

Shape	Manufacturable Dimension (mm)
Square cord (Square)	5×5～20×20
Square cord (Rectangle)	Width 5～40 for Thickness 5～8
	Width 9～25 for Thickness 9～15
Round cord	ϕ5～ϕ20
Tube	ϕ10～ϕ15 (Need thickness 5)

Standard length : 30m (20m for more than 3.0cm^2 of section area)
Contact us for deformed shape.