Shin-Etsu Silicone

Liquid Silicone Rubbers

for Electrical, Electronic and General Industrial Use

Room Temperature Vulcanizing Rubber

MEETING THE DEMANDS OF A VARIETY OF APPLICATIONS

Shin-Etsu Silicone's electrical, electronic and general industrial use liquid silicone rubber, in liquid or paste form, has been developed primarily for the gluing, sealing, and potting of electrical and electronic equipment. As electrical and electronic equipment becomes smaller, lighter, and more sophisticated, ever higher quality and performance is required of their structural components and materials. Shin-Etsu Silicone's high-performance liquid silicone rubber products can meet a wide variety of needs, offering outstanding heat and low-temperature resistance, weather resistance, and electrical properties. Our wide range of products contributes to increased reliability of electrical and electronic equipment and communications equipment.

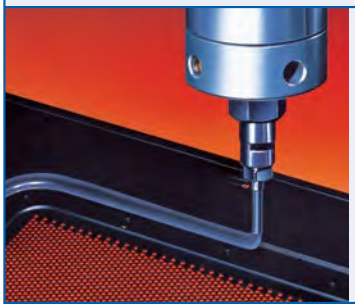
Liquid silicone rubber changes from a liquid state to a solid (or elastic body) by a variety of curing methods. Our lineup features Shin-Etsu's original products of different viscosities, with various distinctive properties. You can choose products that meet the needs of your specific application.

Contents

Features of Liquid Silicone Rubber

1 Heat and cold resistance

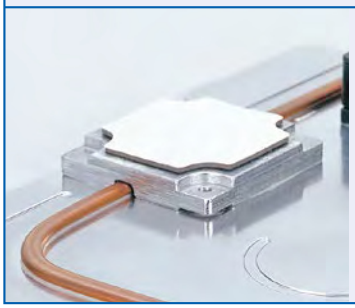
Suitable for heat-resistant seals of heating devices such as microwave ovens.



They can be used at temperatures ranging from -50°C to +250°C. They remain flexible even when used continuously from -40°C to +180°C.

2 Adhesion

Suitable for heat-dissipating seals of heat pipes.



They exhibit outstanding adhesive strength on numerous materials including metals, glass, and plastics. There are types available that suit a variety of different applications, substrates, and usage conditions. For certain substrates, the use of a primer is recommended.

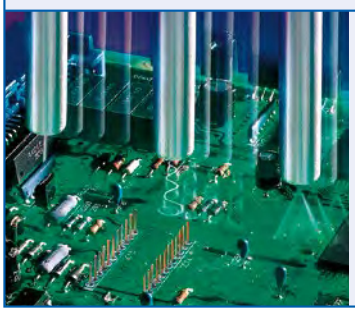
3 Electrical properties

For moisture-proof coating of electrodes and other applications.

Their ability to maintain stable electrical properties even through environmental changes such as temperature and humidity changes makes them ideal for insulation sealing applications in electrical and electronic equipment.

4 Non-solvent formulations

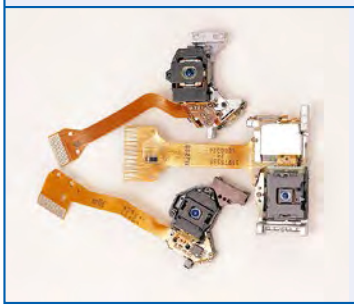
For coating various substrates.



Non-solvent adhesives and coating agents are available. (There are also solvent types available.)

5 Shock resistance

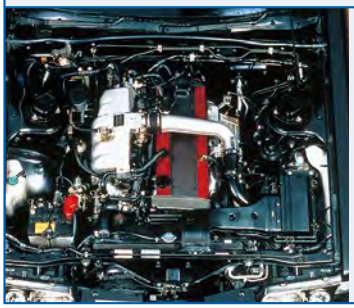
For applications such as vibration insulation of optical pickups.



After curing, they absorb shock and vibration, which prevents damage to electrical and electronic components, glass, and other delicate objects.

6 Oil and chemical resistance

For sealing and potting of equipment and sensors for automotive use.



Resistance to chemicals and oils is far better than that of organic rubber. Products include gasoline-resistant and engine-oil-resistant formulations.

7 Weather resistance

For sealing equipment used outdoors.

With superior resistance to ultraviolet rays, ozone and water, these products can be exposed to outdoor conditions for long periods of time resulting in little if any deterioration.

8 Waterproof and airtight

Suitable for sealing various household ceramics.

After curing these products exhibit outstanding waterproof and airtight performance. They are ideal for sealing electronic parts and equipment that are vulnerable to moisture, and for sealing in the bathroom, kitchen, or wherever water is used.

Types of curing reactions

Shown below are liquid silicone rubbers of different reaction types, each with distinctive characteristics.

Curing reaction types and characteristics of liquid silicone rubbers

Curing reaction	Characteristics	Generated gas	Liquid classification	Handling classification
Condensation reaction	The curing reaction begins upon exposure to atmospheric moisture. Small quantities of gases are generated during curing.	Acetone	Acetone type	Room-temperature curing type
		Alcohol	Alcohol type	
		Oxime*2	Oxime type	
	Shrinkage (weight): about 4%	Acetic acid	Acetic acid type	
Addition reaction	Heating will accelerate the curing process with almost no curing shrinkage.	None	Addition type	Heat curing type Room-temperature curing type
UV reaction *1	Cures rapidly through exposure to UV rays.	None	UV type	—

*1 UV cure products require detailed explanation, so please contact the nearest Shin-Etsu Sales Department directly.
*2 Oxime gas: MEKO (Methyl ethyl ketoxime)

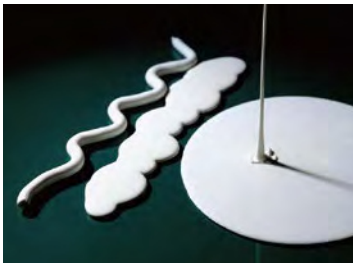
Characteristics / Reaction type	Cure speed	Anti-corrosiveness	Tack free	Storability	Hermetic heat resistance	Brief description
Acetone type	○	◎	◎	○	◎	Non-corrosive and quick-drying, with excellent hermetic heat resistance
Alcohol type	○	◎	○	△	×	Low corrosiveness and low odor with excellent stress crack characteristics
Oxime type	○	△	○	○	△	Oxime generated during curing is corrosive to copper
Acetic acid type	○	×	○	○	△	Strong odor and metal corrosion due to generated acetic acid gas during curing
Addition type (one-component)	◎	◎	—	△	—	Rapid curing and strong adhesion by heat-curing
Addition type (two-component)	◎	◎	—	◎	—	Both heat-curing and room-temperature-curing types are available

● Hermetic heat resistance: the heat resistant stability of the uncured product when stored hermetically.
● Stress cracks: cracks which occur when plastic or other materials under strain come in contact with adhesives containing solvents, etc.
◎ : excellent ○ : good △ : fair × : poor — : n/a

Viscosity and workability

● Viscosity before curing

Generally speaking, liquid silicone rubber products start as a liquid and cure to become an elastic body. The viscosity values listed in this catalog should provide a guideline as to workability. Flowable, low viscosity products are suitable for potting and coating. Medium viscosity products and non-flowable high viscosity products (paste consistency) are suitable for sealing and adhesion or fastening of parts.

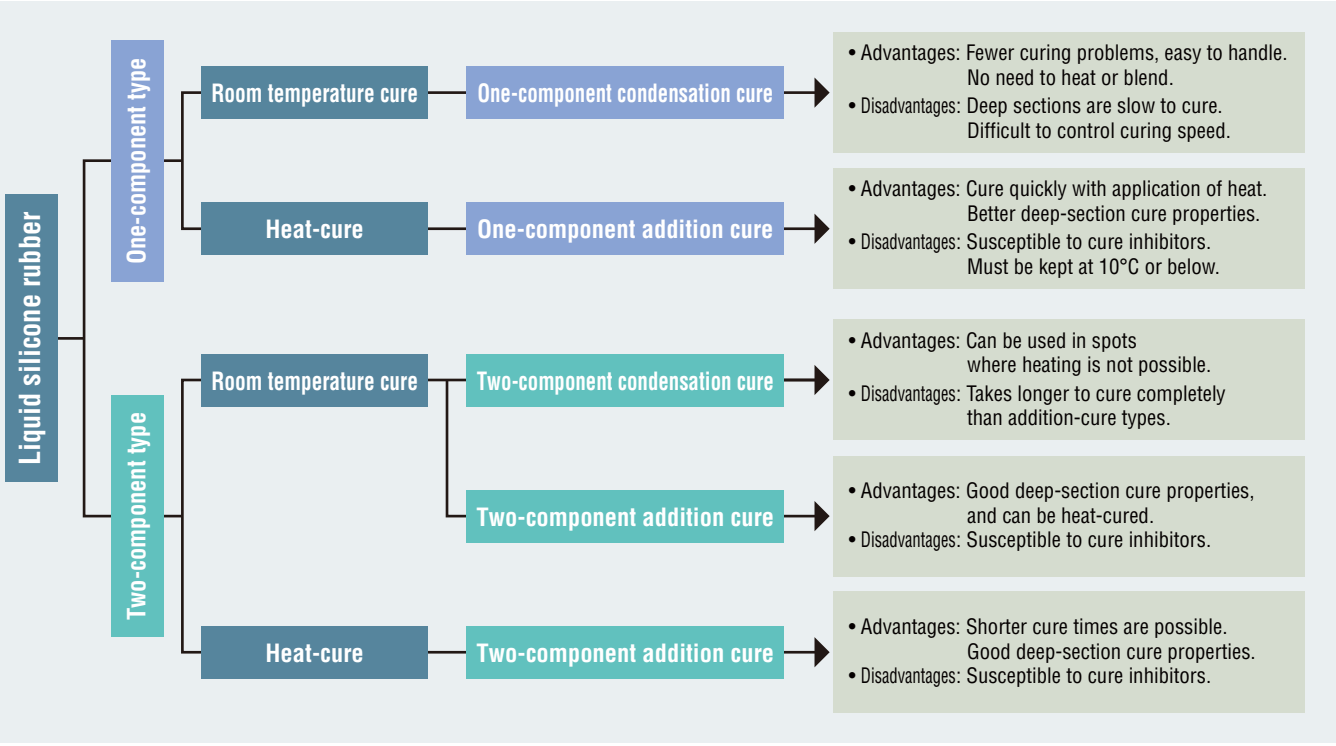


One-component type

Two-component type

Liquid silicone rubbers each have their respective workability and storability characteristics, and are divided into one-component and two-component types.

Types of liquid silicone rubber



Parameter	One-component type		Two-component type	
	Room-temperature-curing type	Heat-curing type	Room-temperature-curing type	Heat-curing type
Blending	Unnecessary	Unnecessary	Required	Required
Deaeration*1	Unnecessary	Unnecessary	Required	Required
Deep-curing	Inferior	Excellent	Excellent*2	Excellent
Cure speed regulation	Impossible	Impossible	Possible	Possible
Accelerated curing	Impossible	Heating	Impossible	Heating
Storability	Airtight, room-temperature storage	Refrigeration required	Room-temperature storage	Room-temperature storage

*1 Deaeration: the process of allowing a substance to stand, or degassing to remove interfused air bubbles that may degrade dielectric properties.
*2 Please refer to the handling precautions on page 31.

Comparison with other resins

General properties of silicone rubber (comparison)
[Coefficient of linear expansion / Tensile modulus of elasticity]

	Coefficient of linear expansion ppm/°C	Tensile modulus of elasticity N/mm²
Silicone	$2\text{-}4\times10^{-4}$	0.01-20
Epoxy	$5\text{-}8\times10^{-5}$	2,000-5,000
Polyurethane	$10\text{-}20\times10^{-5}$	70-3,000
Acrylic	$10\text{-}20\times10^{-5}$	

(Room temperature: 23°C)

■ Curing properties

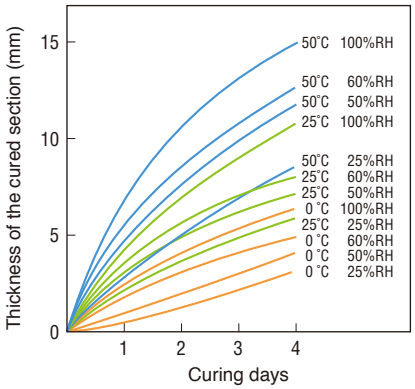
Condensation cure type
(One-component type)

The required curing time for one-component condensation cure type liquid silicone rubber is dependent on the thickness of the rubber, the air temperature, and the relative humidity. Curing begins on the surface, so as the thickness increases, the curing time required for the inner portion increases accordingly. Generally, cure speed will accelerate as temperature and humidity rise. At 23°C / 50%RH*, surface curing normally begins after 1 to 60 minutes – a 2 mm sample will become a fully elastic body in about 24 hours. Please note that 3 days are required to achieve full mechanical strength, and about 7 days are required for the product to exhibit certain characteristics including electrical and adhesion properties.

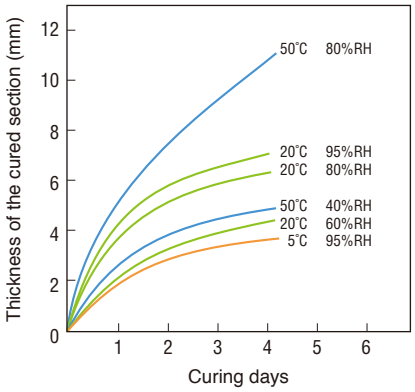
* RH is the abbreviation for Relative Humidity.
It is 100 times the value of the water vapor actually contained in the air divided by the saturated water vapor at that air temperature.

■ Relationship between cure speed and temperature and humidity

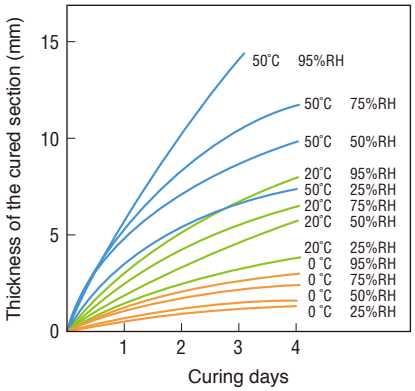
KE-42
(acetic acid type)



KE-348
(acetone type)

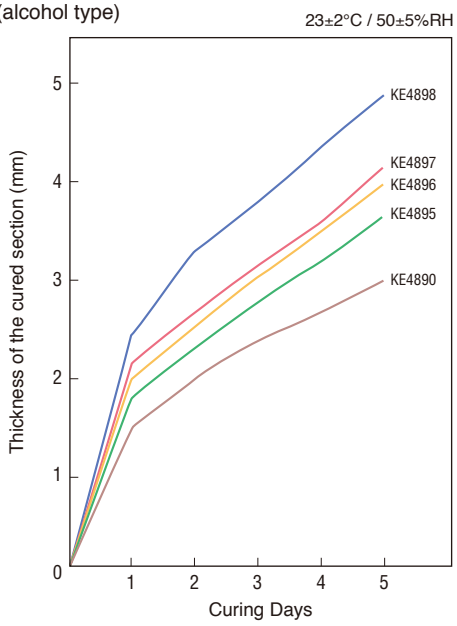


KE-45
(oxime type)



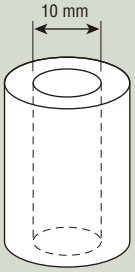
■ Cure speed

KE-489 Series
(alcohol type)



Measuring cure speed

To measure the relationship between rubber thickness and cure time, a polyethylene container is filled with liquid silicone rubber. The inside diameter of the container is 10 mm. The cure time will vary as the thickness of the cured part, temperature and humidity change.



* The data shown is that of typical products. Related products will exhibit similar tendencies.

Addition cure type
(One-component type)

General one-component addition cure type liquid silicone rubber will cure in 30 minutes to 1 hour when heated to between 100°C and 150°C. They exhibit excellent deep-cure properties and cure uniformly, regardless of thickness. However, curing may be slower in spots where heat is not easily transmitted. As the following chart shows, physical properties are achieved by heating to 100°C for 1 hour, but some products will not cure even after an hour if not heated to above 80°C.

Note: some products will cure at 80°C but will not possess adhesive strength.

■ Curing conditions and physical properties

KE-1820

Parameter \ Heating temperature °C	80	100	120			150
Heating time h	1	1	1	2	3	1
Hardness Durometer A	Does not cure	37	40	41	41	45
Elongation at break %		690	650	660	670	550
Tensile strength MPa		5.8	5.4	5.5	5.7	5.1
PBT Adhesive shear strength MPa		1.6	2.0	2.0	2.3	2.0
PBT cohesion break rate %		100	100	100	100	100

Testing method: complies with JIS K 6249.

(Not specified values)

Addition cure type
(two-component type)

Curing occurs after 5 minutes to 1 hour when heated to temperatures from 80°C to 150°C.
The higher the curing temperature, the shorter the cure time. Please note that changing the amount of curing agent will not greatly affect cure speed.

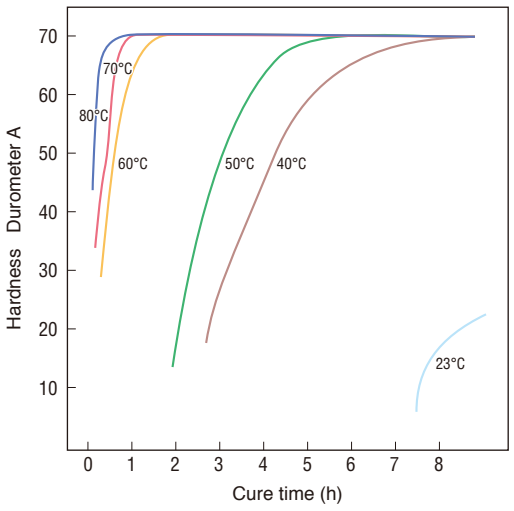
■ Relationship between temperature and cure time

KE1204A/B

Temperature °C	Cure time
25	24~48 h
50	5~6 h
60	1.5~2 h
80	1 h
100	10~15 min
120	5~10 min
150	5 min

■ Temperature's effect on cure state

KE1204A/B



Curing inhibition

When addition cure type liquid silicone rubber comes in contact with sulfur, phosphorous, nitrogen compounds and substances containing organometallic salts (such as amine-based epoxy curing agents, urethane isocyanates, sulfur vulcanized rubber and soldering flux) defective curing may occur at the point of contact. Please refer to the information about additives on page 14.

■ Adhesion

Condensation cure type
(one-component type)

With the exception of special materials such as polyolefin-based resins and fluororesins, condensation cure products exhibit superior adhesion to most materials.

■ Adhesion to various materials

KE-348 (acetone type)

Adherend		Adhesion
Metal	Aluminum	◎
	Stainless steel	△
	Iron	△
	Chrome	○
	Copper	○
	Melamine-coated board	○
	Vinyl-coated steel plate	○
Stone	Glass	◎
	Mortar	×
	Tile face	○
	Tile back	△
Plastic	Phenol	◎
	PVC (hard)	○
	PVC (soft)	○
	Epoxy	◎
	Acrylic	×
	FRP	△
Rubber	Neoprene	×
	Butyl rubber	×
Wood	Cedar	○

◎: most suitable ○: suitable △: will adhere, but caution required ×: not suitable

KE-489 Series (alcohol type)

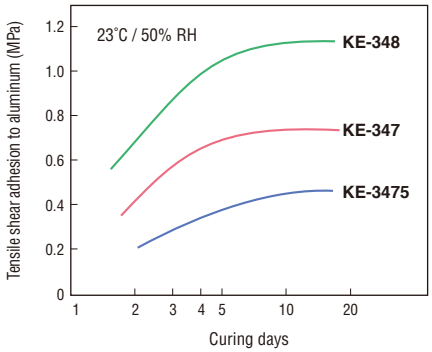
unit: MPa

Adherend \ Grade	KE-4898	KE-4897	KE-4896	KE-4895	KE-4890
Aluminum	1.0	0.7	0.6	0.4	1.3
Stainless steel	0.7	0.5	0.4	0.2	1.2
Copper	0.8	0.5	0.4	0.3	1.4
Glass	1.0	0.6	0.5	0.4	1.3
Polycarbonate	0.7	0.5	0.3	0.2	0.3
ABS	0.8	0.5	0.3	0.2	1.4
Noryl	0.8	0.5	0.4	0.2	1.4
Epoxy	0.8	0.5	0.3	0.2	1.5
PBT	0.7	0.5	0.4	0.2	1.2
Acrylic	0.8	0.5	0.3	0.2	0.4

Curing conditions: 23±2°C / 50±5% RH for 7 days, measured in compliance with JIS K 6249. (Not specified values)
Tensile speed: 50 mm/min

■Change in adhesive strength over time

KE-3475 / KE-347 / KE-348 (acetone type)



As shown in the graph, the adhesive strength increases as curing progresses. Although it varies depending on the thickness of the rubber, a cure time of at least 7 days is usually required to reach full adhesive strength.

Testing method: complies with JIS K 6249.

■ Lap shear strength with various materials

KE-3427/KE-3428 (acetone type)

Adherend	Lap shear strength MPa (cohesion break rate %)	
	KE-3427	KE-3428
Glass	0.7 (100)	1.4 (100)
Aluminum	0.4 (100)	1.3 (100)
SUS	0.4 (100)	1.3 (100)
Copper	0.4 (100)	1.1 (100)
Iron	0.4 (100)	1.1 (100)
Brass	0.4 (100)	0.9 (100)
Acrylic	0.4 (100)	0.9 (70)
ABS	0.4 (100)	0.9 (100)
Epoxy	0.3 (100)	1.2 (100)
Nylon 6	0.3 (100)	1.1 (100)
Nylon 66	0.3 (100)	1.1 (100)
Noryl	0.5 (100)	1.0 (100)
PVC (hard)	0.4 (100)	1.0 (100)
Polyester	0.4 (100)	0.9 (100)
PBT	0.4 (100)	1.1 (100)
Bakelite	0.4 (100)	1.1 (100)
Polystyrol	0.4 (100)	1.3 (100)
PPS	0.4 (100)	—
SPS	0.5 (100)	1.1 (100)

(Not specified values)

Condensation cure type
(two-component type)

KE-200 (two-component acetone type)

Adherend	Lap shear strength MPa	Cohesion break rate %
Epoxy	0.27	100
Polyester	0.32	100
PBT	0.16	0
PVC	0.25	100
Acrylic	0.14	0
Polycarbonate	0.30	100
Phenol	0.26	100
Nylon 66	0.27	100
Nylon 6	0.27	100
Iron	0.30	100
Copper	0.30	100
Stainless steel	0.28	100

(Not specified values)

Curing conditions: 23±2°C / 50±5% RH for 3 days.
Testing method: complies with JIS K 6249.

✻ Cohesion break: a condition in which the materials do not separate at the surface, but break in the materials themselves, or in which all material is left on the surface.

Addition cure type
(one- and two-component types)

Addition cure type liquid silicone rubbers exhibit superior adhesion to epoxy (non-amine-based) and aluminum. There are also products available that adhere to engineering plastics such as PBT and PPS.

■ Lap shear strength with various materials

(one-component type)

Adherend	Lap shear strength MPa (cohesion break rate %)		
	KE-1820	**KE-1830**	**FE-61**
Glass	2.7 (100)	2.5 (100)	0.90 (100)
Aluminum	2.5 (100)	2.5 (100)	0.90 (100)
Stainless steel	2.1 (100)	2.5 (100)	1.0 (100)
Nickel	2.1 (100)	2.0 (100)	0.90 (100)
Chrome	2.5 (100)	2.3 (100)	0.90 (100)
Copper	2.1 (100)	1.9 (100)	0.90 (100)
Epoxy	2.0 (100)	1.8 (100)	0.90 (100)
Polycarbonate	0.50 (0)	0.79 (0)	0.73 (50)
PBT	2.0 (100)	2.5 (100)	0.90 (100)

Testing method: complies with JIS K 6249.

(Not specified values)

KE1802A/B/C (three-component type)

Adherend	Lap shear strength MPa
Epoxy	2.3
Unsaturated polyester	2.3
Phenol	2.0
Noryl	1.8
PBT	2.1
Polycarbonate	1.8
Aluminum	1.8
Copper	1.7
Stainless steel	2.3
Mild steel	2.0
Chrome	2.0
Nickel	1.6

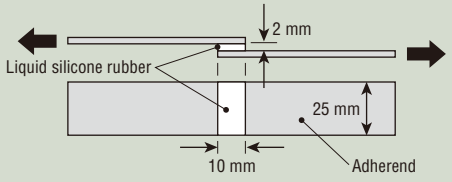
(Not specified values)

✻ will also adhere to materials including glass, ceramics, and film.

Testing method: complies with JIS K 6249.

Testing the lap shear strength

The liquid silicone rubber is applied as shown in the figure.
After curing, shear adhesion is measured using a tension tester.



Curing conditions : condensation cure type 23±2°C / 50±5% RH for 7 days.
addition cure type 120°C for 1 hour.
Liquid silicone rubber thickness: 2 mm
Adhesive surface : 10 × 25 mm
Tensile speed : 50 mm/min

■ Electrical properties

Condensation cure type (one-component type)

KE-489 Series (alcohol type)

Parameter \ Conditions			Initial: 25°C	100°C×200 h	200°C×200 h	100°C×500 h	200°C×500 h
KE-4898	Volume resistivity	TΩ·m	30	30	30	40	50
	Dielectric breakdown strength (1 mm)	kV	25	25	25	25	25
	Dielectric constant 50 Hz		2.8	2.8	2.7	2.8	2.7
	Dissipation factor 50 Hz		2×10^{-3}	2×10^{-3}	2×10^{-3}	2×10^{-3}	2×10^{-3}
KE-4896	Volume resistivity	TΩ·m	50	50	20	20	20
	Dielectric breakdown strength (1 mm)	kV	24	24	24	24	24
	Dielectric constant 50 Hz		2.8	2.8	2.7	2.7	2.7
	Dissipation factor 50 Hz		1×10^{-3}	1×10^{-3}	2×10^{-3}	3×10^{-3}	1×10^{-3}
KE-4890	Volume resistivity	TΩ·m	6	30	30	20	20
	Dielectric breakdown strength (1 mm)	kV	25	25	24	25	23
	Dielectric constant 50 Hz		3.4	3.3	3.4	3.3	3.4
	Dissipation factor 50 Hz		1×10^{-3}	1×10^{-3}	1×10^{-3}	1×10^{-3}	1×10^{-3}

Testing method: complies with JIS K 6249.
Curing conditions: 23±2°C / 50±5% RH for 7 days.
(Not specified values)

Addition cure type (two-component type)

KE1204A/B

Parameter \ Conditions		Initial	150°C×500 h	200°C×500 h	250°C×500 h
Volume resistivity	TΩ·cm	2	0.1	2	0.1
Dielectric breakdown strength (1 mm)	kV	27	27	28	29
Dielectric constant	50 Hz	3.3	3.3	3.3	3.2
	1 MHz	3.3	3.2	3.2	3.1
Dissipation factor	50 Hz	2×10^{-3}	1×10^{-3}	1×10^{-3}	1×10^{-3}
	1 MHz	1×10^{-4}	1×10^{-4}	1×10^{-4}	1×10^{-4}

Testing method: complies with JIS K 6249.
Conditions used to produce the test specimen: 100°C for 30 min.
(Not specified values)

■ Heat resistance

Condensation cure type (one-component type)

KE-3417 (heat-resistant, acetone type)

	Deterioration (day count)	Hardness (Durometer A)	Elongation %	Tensile strength MPa
Heat resistance Physical properties of rubber (300°C)	Initial	35	200	1.4
	7 days	30	240	1.2
	14 days	40	150	1.1
	30 days	52	100	0.9

	Deterioration (day count)	Glass	Aluminum
Heat resistance Shear adhesive strength (300°C) MPa	Initial	0.7	0.6
	7 days	0.9	0.6
	14 days	0.6	0.5
	30 days	0.8	0.7

Testing method: complies with JIS K 6249.
(Not specified values)

Addition cure type (two-component type)

KE1204A/B

Parameter \ Conditions		Initial	200°C			250°C
			100 h	500 h	1,000 h	100 h
Hardness JIS-A		70	76	77	76	70
Tensile strength	MPa	3.5	4.6	4.3	4.3	4.1
Elongation at break	%	90	70	90	70	60
Weight variation	wt%	—	-1.7	-3.4	-3.8	-2.2

Testing method: complies with JIS K 6249.
Conditions used to produce the test specimen: 100°C for 30 min.
(Not specified values)

■ Weather resistance and durability

Condensation cure type
(one-component type)

■ KE-45 (Oxime type) – Results of outdoor exposure testing

Physical properties of rubber

Parameter / Exposure period	Hardness Durometer A	Tensile strength MPa	Elongation at break %	Estimated luminous intensity J/m²			Estimated precipitation mm
				Ultraviolet rays	Visible light rays	Infrared rays	
Initial	30	2.3	350	—	—	—	—
1 month	35	2.0	370	1.60×10^{7}	6.44×10^{7}	9.13×10^{7}	21
3 months	34	2.0	330	5.46×10^{7}	2.81×10^{8}	3.00×10^{8}	63
6 months	37	2.0	360	1.44×10^{8}	7.74×10^{8}	8.80×10^{8}	335
1 year	37	2.0	320	3.00×10^{8}	1.63×10^{9}	1.59×10^{9}	1,376
2 years	37	1.8	310	5.87×10^{8}	3.33×10^{9}	3.32×10^{9}	2,130

Testing method: complies with JIS K 6249. (Not specified values)
* The PH-11M-2AT actinometer was used in the tests.

Adhesion

Adherend: Glass, PRIMER-C used.

Parameter / Exposure period	Maximum tensile stress N/mm²	Cohesion break rate %	Estimated luminous intensity J/m²			Estimated precipitation mm
			Ultraviolet rays	Visible light rays	Infrared rays	
Initial	0.70	100	—	—	—	—
1 month	0.67	100	1.70×10^{7}	9.39×10^{7}	9.03×10^{7}	28
3 months	0.69	100	6.75×10^{7}	3.98×10^{8}	3.57×10^{8}	123
6 months	0.71	100	1.72×10^{8}	9.79×10^{8}	9.01×10^{8}	413
1 year	0.70	100	3.01×10^{8}	1.70×10^{9}	1.61×10^{9}	1,361
2 years	0.71	100	5.82×10^{8}	3.37×10^{9}	3.31×10^{9}	2,154

Testing method: complies with JIS A 1439. (Not specified values)
* The PH-11M-2AT actinometer was used in the tests.

■ KE-348 (acetone type) – Adhesion after outdoor submersion in water

Substrates / Primer / Measurement parameter: Submersion time (days)			Maximum tensile stress N/mm²	Elongation at break %	Cohesion break rate %
Glass	None	Before submersion	0.66	230	100
		After 7 days	0.58	280	100
		After 30 days	0.49	222	100
JIS aluminum	C	Before submersion	0.72	250	100
		After 7 days	0.68	230	100
		After 30 days	0.68	240	100

Testing method: complies with JIS A 1439. (Not specified values)

■ KE-3423 (acetone type) – Ozone resistance

We tested deterioration in an ozone atmosphere. There is little deterioration even in adverse environments.

Parameter / Deterioration time		Start	200 h	400 h	600 h	800 h	1,000 h
KE-3423	Hardness Durometer A	20	21	20	18	18	18
	Elongation at break %	120	110	100	80	80	100
	Tensile strength MPa	0.3	0.3	0.3	0.3	0.2	0.3

Curing conditions: 23±2°C / 50±5% RH×7 days (Not specified values)
Deterioration conditions: 23°C / 100 ppm×1,000 h

Addition cure type
(one-component type)

■ KE-1830 – Adhesive durability

Test conditions		Tensile shear adhesive strength MPa (cohesion break rate %)	
		PBT	Aluminum
Initial		2.5 (100)	2.5 (100)
Gasoline immersion	25°C×100 h	Release	0.4 (100)
Pressure-cooker test	121°C×50 h	2.3 (100)	2.9 (100)
	121°C×100 h	PBT deterioration	3.0 (100)
Antifreeze	121°C×240 h	—	2.3 (100)
Salt water spray (JIS Z 2371)	35°C×240 h	2.1 (60)	2.5 (100)
High temperature test	150°C×1,000 h	3.2 (100)	3.3 (100)
Ozone resistance (80 ppm)	40°C×300 h	2.7 (100)	2.5 (100)
Shock resistance test 1,000 cycles	between -55°C and 150°C, 1 h each	2.8 (100)	3.2 (100)

(Not specified values)

■ Chemical resistance

Condensation cure type
(one-component type)

■ KE-42-AL (acetic acid type) — Chemical resistance

Chemical \ Parameter: Aqueous solution concentration %		Appearance	Hardness Durometer A	Tensile strength MPa	Elongation at break %
Initial value		No abnormality detected (NAD)	26	2.5	400
Sulfuric acid	5		27	2.2	440
	10		24	2.0	370
	20		25	2.5	500
	50	Surface adhesion	28	1.6	270
Hydrochloric acid	5	NAD	25	2.5	450
	10		26	2.2	430
	20		26	1.3	240
	50		23	1.3	310
Nitric acid	5	NAD	26	2.4	520
	10	Surface adhesion	21	1.7	450
	20		20	0.9	250
Acetic acid	100	Surface adhesion	27	2.5	510
Casein soda	0.5	NAD	24	2.3	440
	2		27	2.5	450
	4		21	2.0	550
	15		24	3.0	460
Ammonia	5	NAD	22	1.8	330
	10		22	1.9	380
	20		22	2.3	370
Pyridine	5	NAD	23	2.3	540
	10		21	1.8	530
	20		20	1.7	510
Carbon disulfide	—	NAD	26	2.5	410

Curing conditions: 23±2°C / 50±5% RH×7 days
Immersion conditions: 23°C×40 days

(Not specified values)

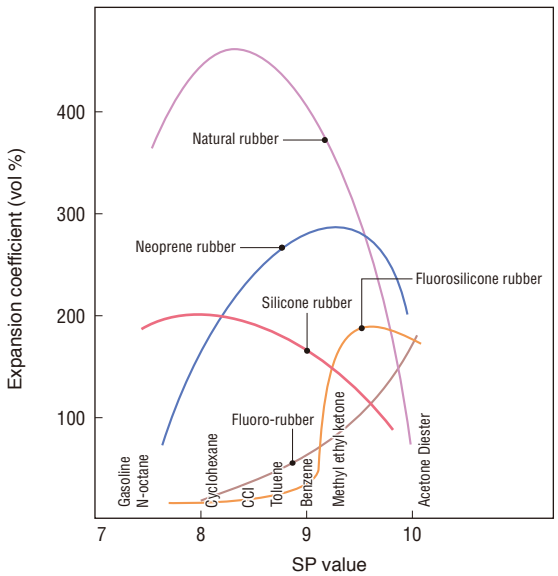
■ KE-3423 (acetone type) — Chemical resistance (coefficient of volumetric expansion)

This was a test of the volumetric expansion of a cured specimen immersed in chemical solutions. The specimen did not dissolve, but did swell.

Sample \ Item	Gasoline	Engine oil	Gear oil	ATF
KE-3423 %	490	7.4	17	9.1

Shape: 30×30×2 mm
Curing conditions: 23±2°C / 50±5% RH×7 days
Immersion conditions: 23°C×40 h

(Not specified values)



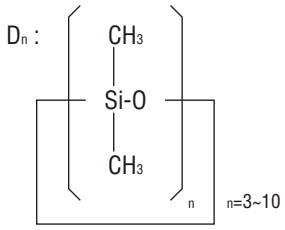
■ Silicone and solubility parameter value
Relationship of solubility parameter values (SP values) of solvents and the expansion coefficient of rubber

Fluorosilicone rubber in particular exhibits outstanding resistance to solvents, but silicone rubber also exhibits superior solvent resistance to that of other rubbers.

■ Low-molecular-weight (LMW) siloxane

● What is LMW siloxane?

The figure at right shows the chemical formula of low-molecular-weight siloxane, a nonreactive cyclic dimethyl polysiloxane (generally D_3-D_{10}), which is volatile and therefore sublimates into the atmosphere both during and after curing. As shown below, LMW siloxane has been reported to cause electrical contact failure under certain conditions.



● Reduced LMW siloxane products (products that offer an answer to the problem of electrical contact failure)

These are products formulated with reduced levels of LMW siloxane, which has been shown to cause electrical contact failure under certain conditions.

Our products are basically ΣDn (n=3~10): below 300 ppm or below 500 ppm. Electrical contact failure can occur under the conditions shown below, and while these products are not an absolute remedy, we do recommend the use of reduced LMW siloxane products for electrical and electronic applications. (For information about these products, please refer to P. 20~21.)

■ Comparison of LMW siloxane concentration in common products and reduced LMW siloxane products (uncured extraction data)

Dn	KE-45 (Common products)	KE-3490 (Reduced LMW siloxane products)
3	10 >	10 >
4	500	10 >
5	260	10 >
6	240	10 >
7	220	10 >
8	160	50
9	170	50
10	220	60
ΣDn (n=3~10)	1,770	160

KE-3490 is a reduced LMW siloxane product, with ΣDn (n=3~10) controlled to below 300 ppm. (Not specified values)

[GC conditions]	GC:gas chromatography
Equipment	capillary gas chromatograph:Shimadzu GC-14A
Column	DURABOND DB-1701
Column Temp.	50°C → 300°C (15°C/min)
Inj. Temp.	300°C
Carrier Gas	He (30 cm/sec)
Detector	FID
Injection rate	2 μl
Extraction solvent	acetone

Electrical contact failure

It has already been noted that various substances may lead to contact failure. Contact failure may be caused by organic materials such as human body oils and organic gases, or inorganic materials such as hydrogen sulfide and ammonia gas. Electric and electronic manufacturers report that LMW siloxane can cause contact failure in the low-voltage, low-current range.

■ Relationship of load conditions to contact reliability

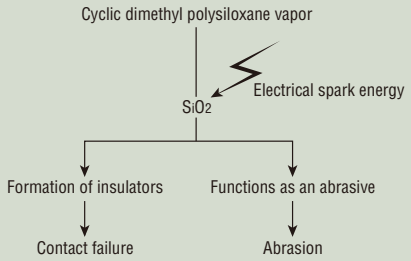
Effects of load on contact reliability (micro-relay)

	Load		Presence of Si accretion at point of contact (Y/N)	Contact resistance
1	DC1 V	1 mA	N	No increase measured
2	DC1 V	36 mA	N	Occasional increase of several ohms
3	DC3.5 V	1 mA	N	No increase measured
4	DC5.6 V	1 mA	Y	No increase measured
5	DC12 V	1 mA	Y	Increase of several ohms, up to infinity
6	DC24 V	1 mA	Y	Around 1,500 times, readings of infinity were seen; at 3,000 times, all were infinity
7	DC24 V	35 mA	Y	Around 3,000 times, readings of infinity were seen; at 4,500 times, all were infinity
8	DC24 V	100 mA	Y	No increase measured
9	DC24 V	200 mA	Y	No increase measured
10	DC24 V	1 A	Y	No increase measured
11	DC24 V	4 A	Y	No increase measured

[Test conditions] Switching frequency: 1 Hz, temp.: room temperature, contact force: 13 g

Presented by: The Institute of Electronics, Information and Communication Engineers (corporation), Yoshimura and Itoh EMC76-41 Feb. 18, 1977.

■ Mechanisms of contact failure



Dimethyl polysiloxane HO-[Si$(CH_3)_2$O]n-H with a degree of polymerization between 200 and 1,000 is used among the prime ingredients of liquid silicone rubber, but the dimethyl polysiloxane derived in the normal manufacturing process does contain ring structures in trace amounts. Because this cyclic dimethyl polysiloxane is nonreactive and volatile, there is sublimation during and sometimes after curing. As shown in the figure above, this sublimated cyclic dimethyl polysiloxane can be a mechanism of contact failure under certain conditions.

■ Various additives

1. Additives used to regulate cure speed

In certain applications and working conditions, you may want to control the cure time of two-component liquid silicone rubbers. In such cases, please use a cure accelerator or cure retardant. These agents are all effective when added in small amounts.

[Precautions]

● Be sure to add the prescribed curing agent in the standard, measured amount.
Without the addition of the curing agent, the product will not cure, even with the addition of cure accelerators of retardants.

● Always measure accurately.
If a cure accelerator is added in excessive amounts, the product may cure during blending, while excessive amounts of a cure retardant can slow curing to such an extent that the product may not be completely cured even after several days.

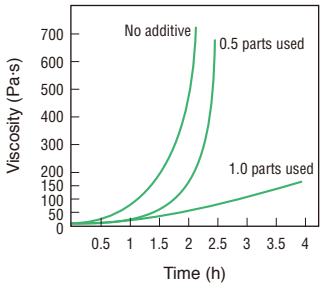
● Additives for condensation cure products and those for addition cure products cannot be used in combination.
For example, if a condensation cure type additive is mistakenly added to an addition cure liquid silicone rubber, a faulty cure will result.

* Please contact the nearest Shin-Etsu Sales Department for details.

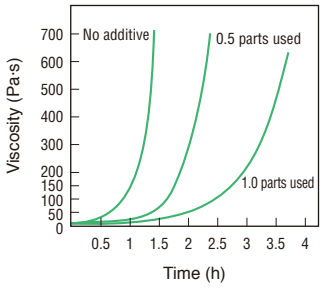
Additive		Characteristics
Cure accelerators	For condensation cure products only CAT-RS	By adding 0.1~ 0.5% CAT-RS in combination with the curing agent, cure time can be greatly reduced. However, the workable time will also be shortened.
	For addition cure products only X-93-405	For example, by adding 1~2% to the base resin, cure time can be cut in half. However, the workable time will also be halved.
Cure retardants	For condensation cure products only WETTER-NO.5	For example, by adding 1~2% to the base resin, cure time and workable time can be doubled.
	For addition cure products only SEIGYOZAI-NO.6-10	For example, by adding 1% to the base resin, cure time and workable time can be lengthened by approx. 2.5 times.

■ Additive quantity and viscosity change

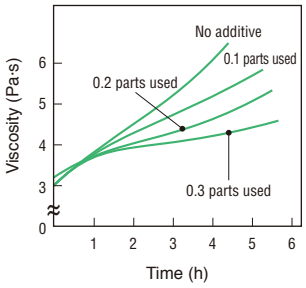
KE-66: Condensation cure type
WETTER-NO.5 (25°C)



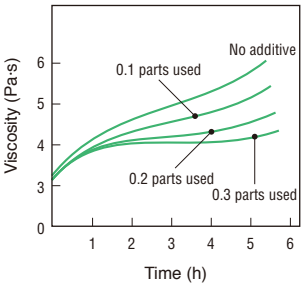
KE-66: Condensation cure type
WETTER-NO.5 (40°C)



KE1212A/B/C: Addition reaction type
SEIGYOZAI-NO.6-10 (25°C)



KE1212A/B/C: Addition cure type
SEIGYOZAI-NO.6-10 (20°C)



2. Diluents

Please use RTV-THINNER or KE-1204-THINNER as a diluent if you want to reduce the viscosity of the curing agent. For example, by adding 10% RTV-THINNER, the viscosity can be reduced by about half. However, excessive amounts of RTV-THINNER or KE-1204-THINNER will have adverse effects on the physical properties, so please refer to the figure at right regarding additive quantities. We recommend 10% or below as a standard additive quantity. RTV-THINNER and KE-1204-THINNER contain no organic solvents such as toluene or xylene.

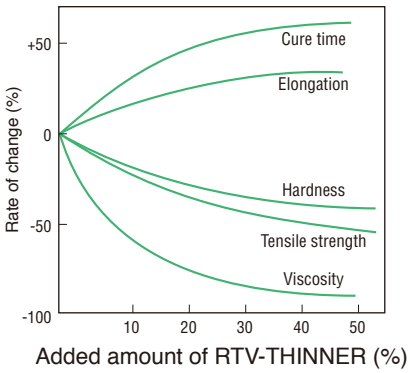
Effects of diluents on various properties

- ●Base resin viscosity → reduction (major effect)
- ●Workable time (cure time) → extension (slight effect)
- ●Hardness, tensile strength → reduction (major effect)
- ●Elongation → enhancement (slight effect)

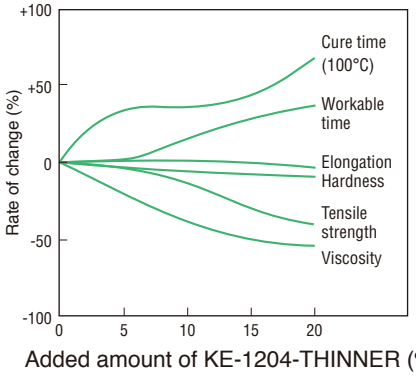
* When used with an addition cure product, a small quantity of RTV-THINNER can greatly reduce viscosity, but with a degradation of physical properties. If possible, KE-1204-THINNER should be used with addition reaction products.

■ Relationship of quantity of added diluent and various physical properties

Condensation cure type



Addition cure type



3. Barrier coat

BARRIER-COAT NO.6 is a low viscosity liquid, and can thus be brushed on or applied as a spray. Applying it to the base form can prevent curing inhibition and the mutual adhesion of liquid silicone rubbers. Please note that BARRIER-COAT NO.6 does not have adhesive properties and therefore cannot be used as an adhesion primer.

Appearance	Specific gravity 25°C	Viscosity 25°C Pa·s	Solvent
Colorless transparent liquid	0.82	0.5	Toluene

4. Curing inhibitors of addition cure type liquid silicone rubber

Curing inhibitors include such substances as sulfur, phosphorus, nitrogen compounds, water, and organometallic salts. In addition, condensation cure type liquid silicone rubber may act as a curing inhibitor.

[Specific examples of curing inhibitors]
●Organic rubbers (natural rubber, and synthetic rubbers such as chloroprene rubber, nitrile rubber, and EPDM) ●Soft PVC resins ●Amine-cured epoxy resins ●Rubber clay and oil clay ●Isocyanates of urethane resins ●Condensation cure type liquid silicone rubber ●Some vinyl tape adhesives, glues, paints (polyester-based paints, etc.), waxes, soldering flux, and pine gum

■Primers

Primers are pre-treatment agents. The application of a primer on some substrates will ensure better adhesion.

■Primer selection standards

Substrates \ Grade		KE-41	KE-42	KE-44	KE-45	KE-347	KE-348
Glass	Glass	○	○	○	○	○	○
	Sun cut glass					C	C
	Ceramics					○	—
	Enamel						○
	Tile						
Stone	Marble	—	—	MT	MT	MT	MT
	Slate						
	Mortar						
	Concrete						
Metal	Aluminum	○	○	○	○	○	○
	Stainless steel	—	—			×	×
	Iron					C	C
	Copper					○	○
	Tin						
	Chrome	○	C				
	Nickel	—	—	C	C		
	Galvanized steel			○	○		
	Tinplate						
Painted panel	Baked acryl	—	—	C	C	○	○
	Melamine paint			○	○		
Rubber	Silicone rubber	○	○	C	○	C	○
Plastic	Hard PVC	—	—	×	○	—	○
	Acrylic	T	T	T	T		—
	Polycarbonate	D-2	D-2	D-2	D-2	D-2	D-2
	Nylon 66	—	—	C	○	C	○
	PBT	×	×	×	×	×	×
	ABS	○	○	U, T	U, T	○	○
	Epoxy			○	○		
	Polyester						
	Phenol						
	Urethane	C	C	C	C	C	C
	Teflon	×	×	×	×	×	×
	Polyethylene						
	Polypropylene						

○: Adheres without primer ×: Won't adhere even with primer MT, C, D-2, U, T: name of optimal primer (e.g. U = Primer U)

[Method of application]
1. Eliminate moisture, oil, and dirt from the area to be treated.
2. Apply to the adherend with a brush or soft cloth.
3. Air-dry, and allow primer to dry completely before continuing with the next process.

[Precautions]
● Be sure to adequately prepare the substrate surface prior to application. Inadequate preparation may lead to poor adhesion.

● Adhesive strength will vary depending on the materials and surface condition of the adherend. We recommend testing a small sample before full application.

● Always provide adequate ventilation when working.

●Primers fall under the category of UN Hazardous Materials. (See p. 26 for details.)
They should never be used near open flame or in high temperature conditions. Primers should be stored in a sealed container in a cool, dark place away from flame.

One-component liquid silicone rubber

Primary application and characteristics	Grade	Cure type (by-product gas)	Brief description	Intended use				Page
				Sealing	Coating	Potting	Thermally conductive	
General electrical purpose	**KE-3423**	Condensation cure (acetone)	Very low viscosity, reduced low-molecular-weight (LMW) siloxane		○			24
	KE-347	Condensation cure (acetone)	Medium viscosity	○	○			18
	KE-3475	Condensation cure (acetone)	Low viscosity	○	○			24
	KE-3479	Condensation cure (acetone)	High viscosity	○				18
	KE-348	Condensation cure (acetone)	Paste	○				18
	KE-3495	Condensation cure (acetone)	Low viscosity, reduced LMW siloxane	○	○			20, 24
	KE-4895	Condensation cure (alcohol)	Low viscosity, reduced LMW siloxane	○	○			20, 24
	KE-4896	Condensation cure (alcohol)	Medium viscosity, reduced LMW siloxane	○	○			20
	KE-4897	Condensation cure (alcohol)	High viscosity, reduced LMW siloxane	○				20
	KE-4898	Condensation cure (alcohol)	Paste, reduced LMW siloxane	○				20
	KE-1056	Addition cure	Transparent gel, excellent low-temperature resistance			○		23
	KE-1151	Addition cure	Thixotropic gel, excellent low-temperature resistance			○		23
	KE-1820	Addition cure	High strength	○				19
	KE-1825	Addition cure	Paste	○				19
	KE-1830	Addition cure	High viscosity	○	○			19
	KE-1831	Addition cure	Non-flammable (UL certified product*1)	○				19
	KE-1833	Addition cure	Excellent adhesion to PPS, heat resistant	○				19
	KE-1842	Addition cure	Low viscosity, low hardness		○	○		19, 24
	KE-1884	Addition cure	Low-temperature curing, medium viscosity, reduced LMW siloxane	○	○			21
	KE-1885	Addition cure	Low-temperature curing, high viscosity, reduced LMW siloxane	○				21
	KE-1886	Addition cure	Low-temperature curing, low viscosity, reduced LMW siloxane	○	○	○		21, 24
	KE-3424-G	Condensation cure (acetone)	Low viscosity, reduced ultra-LMW siloxane	○	○			21, 24
Non-flammable (UL certified product *1)	**KE-3490**	Condensation cure (acetone)	Paste, reduced LMW siloxane	○				20
	KE-3494	Condensation cure (acetone)	Medium viscosity, reduced LMW siloxane	○	○			20
	KE-40RTV	Condensation cure (Oxime)	Paste	○				18
	KE-4890	Addition cure (alcohol)	Paste, reduced LMW siloxane	○				20
MIL standard *2	**KE-3497**	Condensation cure (acetone)	Medium viscosity, reduced LMW siloxane	○	○			20
	KE-3498	Condensation cure (acetone)	Paste, reduced LMW siloxane	○				20
Thermal conductivity	**KE-3493**	Condensation cure (acetone)	Thermal conductivity (1.6 W/m·K), reduced LMW siloxane	○			○	24
	KE-3466	Condensation cure (acetone)	Thermal conductivity (1.9W/m·K), reduced LMW siloxane, Non-flammable (UL certified product*1)	○			○	24
	KE-3467	Condensation cure (acetone)	Thermal conductivity (2.4W/m·K), reduced LMW siloxane, Non-flammable (UL certified product*1)	○			○	24
	KE-1862	Addition cure	Thermal conductivity (0.83 W/m·K)	○		○	○	24
	KE-1867	Addition cure	Thermal conductivity (2.2W/m·K), reduced LMW siloxane, Non-flammable (UL certified product*1)	○		○	○	24
	KE-1891	Addition cure	Non-flammable, high thermal conductivity	○		○	○	24
Conductivity	**KE-3491**	Condensation cure (acetone)	Conductive (resistance: 2Ω·m), reduced LMW siloxane	○				21
	KE-3492	Condensation cure (acetone)	High conductivity (resistance: 0.002 Ω·m), reduced LMW siloxane	○				21
Super heat resistance	**KE-3417***3	Condensation cure (acetone)	Medium viscosity, cannot be used as an insulator, reduced LMW siloxane	○				21
	KE-3418*3	Condensation cure (acetone)	Paste, cannot be used as an insulator, reduced LMW siloxane	○				21
Oil- and solvent-resistance	**FE-123**	Condensation cure (acetic acid)	Oil- and solvent-resistant	○				25
	FE-2000	Condensation cure (alcohol)	Oil- and solvent-resistant	○				25
	FE-57	Addition cure	Gel, oil- and solvent-resistant	○				23, 25
	FE-61	Addition cure	Oil- and solvent-resistant	○		○		25
	X-32-1619	Addition cure	Oil- and solvent-resistant, low viscosity					25

*1 See p. 27 for details about UL certified products. *2 MIL standard: certified to MIL-A-46146A. *3 Cannot be used as an insulator. LMW: low-molecular-weight

Primary application and characteristics	Grade	Cure type (by-product gas)	Brief description	Intended use				Page
				Sealing	Coating	Potting	Thermally conductive	
Plastic adhesion	**KE-3427**	Condensation cure (acetone)	Adheres to plastics	○				21
	KE-3428	Condensation cure (acetone)	Adheres to plastics	○				21
General industrial purpose	**KE-41**	Condensation cure (acetic acid)	High viscosity	○				18
	KE-42	Condensation cure (acetic acid)	Paste	○				18
	KE-44	Condensation cure (oxime)	High viscosity	○				18
	KE-441	Condensation cure (oxime)	Low viscosity	○	○			18
	KE-445	Condensation cure (oxime)	Low viscosity	○	○			18
	KE-45	Condensation cure (oxime)	Paste	○				18
	KE-45-S	Condensation cure (oxime)	Solvent/diluent type	○	○			18

Two-component (three-component) liquid silicone rubber

General electrical purpose	**KE-103**	Addition cure	Transparent rubber, will cure at room temperature		○			22
	KE-108	Condensation cure (alcohol)	Transparent rubber, will cure at room temperature		○			22
	KE-119	Condensation cure (alcohol)	Potting, high hardness		○			22
	KE-66	Condensation cure (alcohol)	Potting, self-bonding	○	○	○		19, 22
	KE-200	Condensation cure (acetone)	Rapid-cure potting, self-bonding, reduced LMW siloxane	○		○		22
	KE-1800T-A/B	Addition cure	Translucent rubber, adhesive	○				19
	KE-1031-A/B	Addition cure	Transparent rubber, adhesive	○	○	○		22
	KE-1051J-A/B	Addition cure	Transparent gel, high viscosity, will cure at room temperature			○		23
	KE-1012-A/B	Addition cure	Transparent gel, will cure at room temperature			○		23
	KE-106	Addition cure	Transparent rubber, high hardness			○		22
	KE-109E-A/B	Addition cure	Transparent rubber, adhesive		○	○		22
	KE-118	Condensation cure (alcohol)	Self-bonding	○		○		19
Non-flammable (UL certified product*1)	**KE1204A/B**	Addition cure	Reduced LMW siloxane			○		22
	KE1204AL/BL	Addition cure	Low viscosity, reduced LMW siloxane			○		22
	KE-1292-A/B	Addition cure	Non-flammable, multi-purpose	○		○		22
	KE1800A/B/C	Addition cure	Adhesive, high hardness	○				19
	KE-1801-A/B/C	Addition cure	Adhesive, high hardness	○				19
	KE1802A/B/C	Addition cure	Adhesive, high hardness	○				19
Foaming	**KE-513-A/B**	Condensation cure (hydrogen)	Filling, foaming, triple-volume foam	○				25
	KE-521-A/B	Addition cure (hydrogen)	Filling, foaming, triple-volume foam	○				25
Thermal conductivity	**KE-1861-A/B**	Addition cure	Adhesive, Thermal conductivity (0.83 W/m·K)	○		○	○	24

LMW: low-molecular-weight

■ Sealing – General industrial purpose

Grade		One-component room-temperature cure				
		KE-45	**KE-44**	**KE-441**	**KE-445**	**KE-45S**
Cure type (by-product gas)		Condensation (oxime)	Condensation (oxime)	Condensation (oxime)	Condensation (oxime)	Condensation (oxime)
Brief description		Paste	High viscosity	Low viscosity	Low viscosity	Solvent/diluent type
Appearance	Consistency	Paste	Viscous liquid	Liquid	Liquid	Toluene solution
	Color	See p. 28	See p. 28	See p. 28	See p. 28	See p. 28
Viscosity	Pa·s	—	70	15	5	0.6
Density 23°C	g/cm^3	1.05	1.04	1.04	1.05	1.05
Hardness Durometer A		30	25	20	25	20
Tensile strength	MPa	2.0	2.0	1.7	2.0	2.0
Elongation at break	%	350	300	280	200	350
Volume resistivity	TΩ·m	5	5	5	5	5
Dielectric breakdown strength*	kV	23	20	20	25	21
Dielectric constant 50 Hz		3.0	2.8	2.8	2.8	3.0
Dissipation factor 50 Hz		5×10^{-3}	5×10^{-3}	5×10^{-3}	5×10^{-3}	5×10^{-3}
Thermal conductivity	W/m·K	0.21	0.21	0.21	0.21	0.21
Tack-free time	min	6	40	60	20	60
Lap shear strength	MPa	1.0 (aluminum)	1.2 (aluminum)	1.0 (aluminum)	0.3 (aluminum)	—

Data: Relationship between cure speed and temperature and humidity (KE-44, 45, 441, 42) ··· p. 6 *Measured by 1 mm (Not specified values)
Outdoor exposure testing (KE-45) ··· p. 11
Chemical resistance (KE-42-AL) ··· p. 12

■ Sealing – General electrical purpose (one-component)

Grade		One-component room-temperature cure		
		KE-40RTV	**KE-42**	**KE-41**
Cure type (by-product gas)		Condensation (oxime)	Condensation (acetic acid)	Condensation (acetic acid)
Brief description		UL certified product	Paste	High viscosity
Appearance	Consistency	Paste	Paste	Viscous liquid
	Color	See p. 28	See p. 28	See p. 28
Viscosity	Pa·s	—	—	100
Density 23°C	g/cm^3	1.58	1.05	1.04
Hardness Durometer A		60	28	30
Tensile strength	MPa	2.9	2.0	2.5
Elongation at break	%	200	400	250
Volume resistivity	TΩ·m	1	1	1
Dielectric breakdown strength*	kV	25	22	20
Dielectric constant 50 Hz		3.9	3.0	2.9
Dissipation factor 50 Hz		1×10^{-2}	5×10^{-3}	5×10^{-3}
Thermal conductivity	W/m·K	0.42	0.21	0.21
Tack-free time	min	12	5	6
Lap shear strength	MPa	1.0 (aluminum)	1.0 (aluminum)	1.0 (aluminum)

*Measured by 1 mm (Not specified values)

One-component room-temperature cure		
KE-348	**KE-3479**	**KE-347**
Condensation (acetone)	Condensation (acetone)	Condensation (acetone)
Paste	High viscosity	Medium viscosity
Paste	High viscosity	Medium viscosity
See p. 28	See p. 28	See p. 28
—	75	55
1.05	1.06	1.04
30	30	30
2.0	2.5	2.5
400	350	300
1	2	3
23	20	25
3.0	2.9	2.9
4×10^{-3}	3×10^{-3}	3×10^{-3}
0.21	0.21	0.21
1	2	4
1.2 (aluminum)	1.5 (aluminum)	1.0 (aluminum)

(Not specified values)

Data:
Relationship between cure speed and temperature and humidity (KE-348) ··· p. 6
Change in adhesive strength over time (KE-3475, 347, 348) ··· p. 8
Adhesion after outdoor submersion in water (KE-348) ··· p. 11
*Measured by 1 mm

■ Sealing – General electrical purpose (one-component)

Grade		One-component heat cure					
		KE-1820	**KE-1825**	**KE-1830**	**KE-1831**	**KE-1833**	**KE-1842**
Cure type		Addition	Addition	Addition	Addition	Addition	Addition
Brief description		High viscosity	Paste	High viscosity	Non-flammable UL V-0 certified product	Good adhesion to PPS, heat resistant	Low hardness
Appearance	Consistency	Paste	Paste	High viscosity	Paste	High viscosity liquid	Low viscosity
	Color	Opaque white	Opaque white	Light gray	Black	Reddish brown	White
Viscosity	Pa·s	—	—	110	120	140	4.0
Density 23°C	g/cm^3	1.08	1.06	1.27	1.28	1.34	1.00
Curing conditions, standard cure time		120°C×1 h	120°C×1 h	120°C×1 h	120°C×1 h	120°C×1 h	120°C×1 h
Hardness Durometer A		45	29	40	30	33	10
Tensile strength	MPa	5.4	3.3	4.3	3.9	3.4	0.4
Elongation at break	%	600	600	300	400	330	200
Volume resistivity	TΩ·m	4	2	5	2	2	1
Dielectric breakdown strength	kV	25	22	25	25	25	20
Dielectric constant 50 Hz		3.5	3.5	3.5	3.5	3.5	3.5
Dissipation factor 50 Hz		5×10^{-3}	5×10^{-3}	5×10^{-3}	5×10^{-3}	5×10^{-3}	5×10^{-3}
Thermal conductivity	W/m·K	0.25	0.20	0.27	0.27	—	—
Lap shear strength	MPa	2.0 (aluminum)	1.5 (aluminum)	2.0 (aluminum)	2.3 (aluminum)	1.8 (aluminum)	0.2 (aluminum)

*Measured by 1 mm

(Not specified values)

■ Sealing/General electrical purpose (two-component)

Grade		Two-component room-temperature cure		Two-component heat cure			
		KE-118	**KE-66**	**KE1800A/B/C**	**KE-1801-A/B/C**	**KE1802A/B/C**	**KE-1800T-A/B**
Cure type		Condensation (alcohol)	Condensation (alcohol)	Addition	Addition	Addition	Addition
Brief description		Self-bonding	Self-bonding	UL certified product, adhesive, high strength			Translucent, adhesive, high strength
Appearance	Consistency	Liquid	Liquid	Paste	Paste	Paste	Paste
	Color	Light gray	Light gray	A: white B/C: colorless transparent	A:white B/C: colorless transparent	A:black B/C: colorless transparent	A/B: translucent
Viscosity	Pa·s	2	5	A:350/B:14/C:0.25×10^{-3}	A:350/B:14/C:0.25×10^{-3}	A:300/B:14/C:0.25×10^{-3}	A:350 / B:200
Density 23°C	g/cm^3	1.14	1.25	1.10	1.10	1.10	1.08
Curing conditions, standard cure time		23°C×72 h	23°C×72 h	120°C×1 h	120°C×1 h	120°C×1 h	120°C×1 h
Hardness Durometer A		45	40	28	28	30	26
Tensile strength	MPa	1.5	1.5	5.0	5.0	5.0	5.5
Elongation at break	%	90	140	600	600	600	600
Volume resistivity	TΩ·m	4	4	0.5	0.1	0.1	1
Dielectric breakdown strength*	kV	25	25	25	25	25	23
Dielectric constant 50 Hz		3.3	—	3.1	3.1	3.1	—
Dissipation factor 50 Hz		4×10^{-3}	—	1×10^{-3}	1×10^{-3}	5×10^{-3}	—
Thermal conductivity	W/m·K	0.17	—	0.17	0.17	0.17	0.17
Workable time 23°C	h	0.3	1.5	4.0	4.0	6.0	6.0
Lap shear strength	MPa	—	0.6 (copper) 0.6 (Bakelite)	1.7 (glass) 1.7 (polycarbonate)	1.7 (glass) 1.7 (polycarbonate)	1.7 (glass) 1.7 (polycarbonate)	1.5 (PBT)
Name of curing agent		CAT-118-BL	CAT-RC	KE1800B (KE1800C)	KE1800B (KE1800C)	KE1800B (KE1800C)	—
Blend ratio		100 / 5	100 / 2	100 / 10 / 2	100 / 10 / 2	100 / 10 / 2	100 / 100

*Measured by 1 mm

(Not specified values)

■Testing method: complies with JIS K 6249. [Conversion to old JIS units] Viscosity: 10 P=1 Pa·s; Strength: 10 kgf/cm^2=0.98 MPa; Volume resistivity: 10^{14} Ω·cm=1 TΩ·m

■ Sealing/reduced low-molecular-weight siloxane types

Grade		One-component room-temperature cure				
		KE-4898	**KE-4897**	**KE-4896**	**KE-4895**	**KE-4890**
Cure type (by-product gas)		Condensation (alcohol)	Condensation (alcohol)	Condensation (alcohol)	Condensation (alcohol)	Condensation (alcohol)
Brief description		Paste	High viscosity	Medium viscosity	Low viscosity	UL certified product
Appearance	Consistency	Paste	High viscosity	Medium viscosity	Low viscosity	Paste
	Color	See p. 28	See p. 28	See p. 28	See p. 28	See p. 28
Viscosity Pa·s		—	100	50	5	—
Density 23°C g/cm^3		1.04	1.06	1.04	1.04	1.48
Hardness Durometer A		40	40	38	40	50
Tensile strength MPa		2.2	2.0	1.7	1.5	2.0
Elongation at break %		360	200	170	140	200
Volume resistivity TΩ·m		30	50	50	90	6
Dielectric breakdown strength* kV		25	24	20	20	25
Dielectric constant 50 Hz		2.8	2.8	2.8	2.8	3.4
Dissipation factor 50 Hz		1×10^{-3}	1×10^{-3}	1×10^{-3}	1×10^{-3}	4×10^{-3}
Thermal conductivity W/m·K		—	—	—	—	0.33
Tack-free time min		6	12	12	11	6
Lap shear strength MPa		0.8 (aluminum)	0.8 (aluminum)	0.8 (aluminum)	0.5 (aluminum)	1.3 (aluminum)
LMW content ΣD_3-D_{10} ppm		< 300	< 300	< 300	< 300	< 300

* Measured by 1 mm
LMW: low-molecular-weight

(Not specified values)

Grade		One-component room-temperature cure				
		KE-3490	**KE-3494**	**KE-3498**	**KE-3497**	**KE-3495**
Cure type (by-product gas)		Condensation (acetone)	Condensation (acetone)	Condensation (acetone)	Condensation (acetone)	Condensation (acetone)
Brief description		UL certified product	UL certified product	Paste	Medium viscosity	Low viscosity
Appearance	Consistency	Paste	Medium viscosity	Paste	Medium viscosity	Low viscosity
	Color	Gray	Gray	See p. 28	See p. 28	See p. 28
Viscosity Pa·s		—	50	—	40	5.5
Density 23°C g/cm^3		1.18	1.40	1.07	1.07	1.03
Hardness Durometer A		43	35	45	35	30
Tensile strength MPa		2.5	2.5	3.9	3.0	1.1
Elongation at break %		350	250	480	250	200
Volume resistivity TΩ·m		3	3	1	2	4
Dielectric breakdown strength* kV		28	25	25	24	20
Dielectric constant 50 Hz		3.3	3.5	3.0	3.0	2.8
Dissipation factor 50 Hz		1×10^{-2}	1×10^{-2}	1×10^{-3}	3×10^{-3}	3×10^{-3}
Thermal conductivity W/m·K		0.25	0.42	0.21	0.21	0.21
Tack-free time min		3	8	1	13	11
Lap shear strength MPa		1.5 (aluminum)	1.5 (aluminum)	1.5 (aluminum)	0.7 (aluminum)	0.3 (aluminum)
LMW content ΣD_3~D_{10} ppm		< 300	< 300	< 300	< 300	< 300

* Measured by 1 mm
LMW: low-molecular-weight

(Not specified values)

■ Sealing/reduced low-molecular-weight siloxane types

Grade		One-component room-temperature cure			
		KE-3418[*2]	**KE-3417**[*2]	**KE-3427**	**KE-3428**
Cure type (by-product gas)		Condensation (acetone)	Condensation (acetone)	Condensation cure (acetone)	Condensation cure (acetone)
Brief description		Can not be used as an insulator	Can not be used as an insulator	Adheres to plastics	Adheres to plastics
Appearance	Consistency	Paste	Medium viscosity	Medium viscosity	Paste
	Color	Black	Black	Gray	Gray
Viscosity Pa·s		—	45	55	—
Density 23°C g/cm^3		1.09	1.05	1.01	1.05
Hardness Durometer A		45	35	24	32
Tensile strength MPa		2.0	1.4	0.4	1.5
Elongation at break %		200	200	260	320
Volume resistivity TΩ·m		1×10^{-10}	0.2	40	40
Dielectric breakdown strength[*1] kV		5	5	22	22
Dielectric constant 50 Hz		—	10.5	2.8	2.8
Dissipation factor 50 Hz		—	8×10^{-2}	2×10^{-3}	2×10^{-3}
Thermal conductivity W/m·K		0.33	0.25	—	—
Tack-free time min		5	12	6	3
Lap shear strength MPa		1.4 (aluminum)	0.8 (aluminum)	0.4 (aluminum)	1.3 (aluminum)
LMW content ΣD_3~D_{10} ppm		< 300	< 300	< 300	< 300

*1 Measured by 1 mm
*2 KE-3417 and KE-3418 are not suitable for use as insulators.

(Not specified values)

Grade		One-component room-temperature cure			One-component heat cure		
		KE-3424-G	**KE-3491**	**KE-3492**	**KE-1884**	**KE-1885**	**KE-1886**
Cure type (by-product gas)		Condensation (acetone)	Condensation (acetone)	Condensation (acetone)	Addition	Addition	Addition
Brief description		Reduced ultra-low -molecular-weight siloxane product, UL certified, electrode coating material	Conductive	Conductive	Low-temperature curing	Low-temperature curing	Low-temperature curing
Appearance	Consistency	Low viscosity	Paste	Paste	Medium viscosity	High viscosity	Low viscosity
	Color	Gray	Black	Black	White	White	Creamy white
Viscosity Pa·s		20	—	—	55	100	12
Density 23°C g/cm^3		1.32	1.09	1.88	1.22	1.14	1.03
Curing conditions, standard cure time		—	—	—	100°C×1 h	100°C×1 h	100°C×1 h
Hardness Durometer A		50	50	85	35	36	29
Tensile strength MPa		4.0	3.0	2.0	3.5	3.5	2.9
Elongation at break %		180	350	30	230	300	160
Volume resistivity TΩ·m		40	2[*2]	0.002[*2]	10	10	10
Dielectric breakdown strength[*1] kV		22	—	—	25	25	25
Dielectric constant 50 Hz		3.6	—	—	3.1	3.1	3.1
Dissipation factor 50 Hz		8.8×10^{-3}	—	—	1×10^{-3}	1×10^{-3}	1×10^{-3}
Thermal conductivity W/m·K		0.4	—	0.84	—	—	—
Tack-free time min		6	5	2	—	—	—
Lap shear strength MPa		0.4 (aluminum)	1.0 (aluminum)	1.0 (aluminum)	1.6 (PBT)	2.0 (aluminum)	0.8 (aluminum)
Blend ratio		—	—	—	—	—	—
LMW content ΣD_3~D_{10} ppm		ΣD_3~D_{20} < 300[*4]	< 300	< 300	< 100	< 100	< 100

*1 Measured by 1 mm *2 KE-3491, KE-3492: unit = Ω·m *3 Workable time (23°C : h) *4 KE-3424-G is a high-grade product, ΣDn (n=3~20) <300 ppm
LMW: low-molecular-weight

(Not specified values)

■Testing method: complies with JIS K 6249. [Conversion to old JIS units] Viscosity: 10 P=1 Pa·s; Strength: 10 kgf/cm^2=0.98 MPa; Volume resistivity: 10^{14} Ω·cm=1 T Ω·m

■ Potting (rubber)

Grade		Two-component room-temperature cure				
		KE-119	**KE-66**	**KE-103**	**KE-108**	**KE-200**
Cure type (by-product gas)		Condensation (alcohol)	Condensation (alcohol)	Addition	Condensation (alcohol)	Condensation (acetone)
Brief description		High hardness	Self-bonding	Transparent, room-temperature cure	Transparent, room-temperature cure	Reduced LMW siloxane, rapid cure
Appearance	Consistency	Low viscosity	Low viscosity	Low viscosity	Liquid	Low viscosity
	Color	Reddish brown	Light gray	Colorless transparent	Colorless transparent	Colorless translucent
Viscosity	Pa·s	17	5	1	0.7	2.8
Density 23°C	g/cm^3	1.47	1.25	0.97	0.98	1.01
Curing conditions, standard cure time		23°C×72 h	23°C×72 h	23°C×72 h	23°C×72 h	23°C×72 h
Hardness Durometer A		68	40	24	31	25
Tensile strength	MPa	5.0	1.5	0.2	—	0.4
Elongation at break	%	100	140	100	—	100
Volume resistivity	TΩ·m	1	4	0.8	0.1	60
Dielectric breakdown strength*1	kV	23	25	20	23	20
Dielectric constant 50 Hz		—	—	3.1	—	2.9
Dissipation factor 50 Hz		—	—	1×10^{-3}	—	3×10^{-3}
Thermal conductivity	W/m·K	0.23	—	0.15	0.15	0.21
Workable time 23°C	h	2.0	1.5	3.0	6.0	0.58
Lap shear strength	MPa	—	0.6 (copper) 0.6 (Bakelite)	—	—	0.4 (aluminum)
Name of curing agent		CAT-RP	CAT-RC	CAT-103	CAT-108	CX-200
Blend ratio		100:10	100:2	100:5	100:5	100:10
LMW content ΣD_3~D_{10}	ppm	—*2	—*2	—*2	—*2	< 300

Data: Adhesion to various materials (KE-200) ··· p. 8 *1 Measured by 1 mm *2 Not a reduced LMW siloxane product (Not specified values)
LMW: low-molecular-weight

Grade		Two-component heat cure					
		KE1204A/B	**KE1204AL/BL**	**KE-1031-A/B**	**KE-106**	**KE-109E-A/B**	**KE-1292-A/B**
Cure type		Addition	Addition	Addition	Addition	Addition	Addition
Brief description		Reduced LMW siloxane		Transparent, adhesive	Transparent, high strength	Transparent, adhesive	Non-flammable, multi-purpose
Appearance	Consistency	Liquid	Liquid	Liquid	Liquid	Liquid	Low viscosity
	Color	A: reddish brown / B: light gray	A: reddish brown / B: light gray	A/B: colorless transparent	Colorless transparent	A/B: colorless transparent	A: black / B: light gray
Viscosity	Pa·s	A: 6 / B: 4	A: 4 / B: 2	A: 1 / B: 0.7	3.5	A: 1 / B: 1	A: 5.0 / B: 2.0
Density 23°C	g/cm^3	1.54	1.52	0.97	1.02	1.00	1.48
Curing conditions, standard cure time		100°C×15 min	100°C×15 min	80°C×2 h	150°C×30 min	100°C×1 h	80°C×2 h
Hardness Durometer A		70	65	20	56	25	37
Tensile strength	MPa	3.5	3.0	0.4	8.0	1.3	1.8
Elongation at break	%	70	80	150	100	140	140
Volume resistivity	TΩ·m	1	2	0.1	3	6	13
Dielectric breakdown strength*1	kV	27	27	20	23	23	30
Dielectric constant 50 Hz		3.2	3.3	3.1	3.1	2.8	3.0
Dissipation factor 50 Hz		1×10^{-3}	5×10^{-3}	1×10^{-3}	5×10^{-3}	6×10^{-4}	8×10^{-3}
Thermal conductivity	W/m·K	0.45	0.29	0.15	0.15	0.15	0.55
Workable time 23°C	h	8.0	8.0	4.0	2.0	4.0	48 h
Lap shear strength	MPa	—	—	0.1 (aluminum)	—	0.2 (aluminum)	0.6 (glass epoxy)
Name of curing agent		—	—	—	CAT-RG	—	—
Blend ratio		100:100	100:100	100:100	100:10	100:100	100:100
LMW content ΣD_3~D_{10}	ppm	< 500	< 500	—*2	—*2	—*2	< 300

Data: Relationship between cure speed and time (KE1204) ··· p. 7
Relationship of quantity of added diluent and various physical properties (KE-1204-THINNER) ··· p. 14
*1 Measured by 1 mm *2 Not a reduced LMW siloxane product (Not specified values)
LMW: low-molecular-weight

■Testing method: complies with JIS K 6249. [Conversion to old JIS units] Viscosity: 10 P=1 Pa·s; Strength: 10 kgf/cm^2=0.98 MPa; Volume resistivity: 10^{14} Ω·cm=1 T Ω·m

■ Potting (gel)

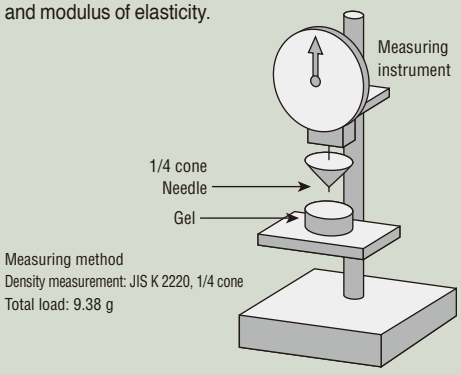
Grade		One-component heat cure			Two-component room-temperature cure	
		KE-1056	**KE-1151**	**FE-57**	**KE-1051J-A/B**	**KE-1012-A/B**
Cure type		Addition	Addition	Addition	Addition	Addition
Brief description		Low-temperature-resistant, transparent gel	Low-temperature-resistant, thixotropic gel	Oil- and solvent-resistant gel	Transparent gel	Transparent gel
Appearance	Consistency	Liquid	Liquid	Liquid	Liquid	Liquid
	Color	Slightly clouded color	Translucent	Light brown	A/B: colorless transparent	A/B: colorless transparent
Viscosity*1 mPa·s		800	2,500	2,000	A: 800 / B: 600	A: 1,000 / B: 800
Specific gravity 25°C		0.98	1.00*4	1.28	0.97	0.97
Curing conditions / Standard cure time		130°C×30 min	130°C×30 min	125°C×2 h	23°C×24 h	110°C×30 min
Hardness Penetration*2		90	90	60	65	50
Tensile strength MPa		—	—	—	—	—
Volume resistivity TΩ·m		8.0	8.0	0.02	10	8.0
Dielectric breakdown strength*3 kV		14	18	—	—	14
Dielectric constant 50 Hz		3.0	3.0	7.0	3.0	3.0
Dissipation factor 50 Hz		5×10^{-4}	5×10^{-4}	1×10^{-2}	5×10^{-4}	5×10^{-4}
Thermal conductivity W/m·K		0.2	0.2	—	0.2	0.2
Workable time 23°C h		—	—	—	1.0	4.0
Blend ratio		—	—	—	100:100	100:100

*1 1,000 mPa·s=1 Pa·s
*2 Hardness (penetration) – see figure below.
*3 Measured by 1 mm
*4 Testing temperature: 23°C

(Not specified values)

Hardness (penetration)

Because the modulus of elasticity of silicone gel is less than 10^5 Nm/m^2, it cannot be measured with common sclerometers.
Hardness (penetration) is usually measured as illustrated in the figure below.
Furthermore, there is a correlation between penetration and modulus of elasticity.



Measuring method
Density measurement: JIS K 2220, 1/4 cone
Total load: 9.38 g

■ Coating

Grade		One-component room-temperature cure					One-component heat cure	
		KE-3423	KE-3475	KE-3495	KE-4895	KE-3424-G	KE-1842	KE-1886
Cure type (by-product gas)		Condensation (acetone)	Condensation (acetone)	Condensation (acetone)	Condensation (alcohol)	Condensation (acetone)	Addition	Addition
Brief description		Reduced LMW siloxane product	Low viscosity	Reduced LMW siloxane product	Reduced LMW siloxane product	Reduced ultra-LMW siloxane, UL certified, electrode coating material	Low viscosity, low hardness	Reduced LMW siloxane, low-temperature curing
Appearance	Consistency	Low viscosity	Low viscosity	Low viscosity	Low viscosity	Low viscosity	Low viscosity	Low viscosity
	Color	Pale yellow cloudy white	See p. 28	See p. 28	See p. 28	Gray	White	Creamy white
Viscosity	Pa·s	0.6	2.5	5.5	5	20	4.0	12
Density 23°C	g/cm^3	0.98	1.04	1.03	1.04	1.32	1.00	1.03
Curing conditions, standard cure time		—	—	—	—	—	120°C×1 h	100°C×1 h
Hardness Durometer A		20	25	30	40	50	13	29
Tensile strength	MPa	0.5	1.0	1.1	1.5	4.0	0.4	2.9
Elongation at break	%	140	200	200	140	180	200	160
Volume resistivity	TΩ·m	60	3	4	90	40	1	10
Dielectric breakdown strength*1	kV	25	22	20	20	22	20	25
Dielectric constant 50 Hz		3.0	3.0	2.8	2.8	3.6	3.5	3.1
Dissipation factor 50 Hz		3×10^{-3}	3×10^{-3}	3×10^{-3}	1×10^{-3}	8.8×10^{-3}	5×10^{-3}	1×10^{-3}
Thermal conductivity	W/m·K	0.17	0.21	0.21	—	0.4	—	—
Tack-free time	min	5	5	11	11	6	—	—
Lap shear strength	MPa	0.3 (aluminum)	0.4 (aluminum)	0.3 (aluminum)	0.5 (aluminum)	0.4 (aluminum)	0.2 (aluminum)	0.8 (aluminum)
LMW content ΣD_3~D_{10}	ppm	< 300	—*2	< 300	< 300	ΣD_3~D_{20} < 300*3	—*2	< 100

*1 Measured by 1 mm *2 Not a reduced LMW siloxane product *3 KE-3424-G is a high-grade product, ΣDn (n=3~20) < 300 ppm LMW: low-molecular-weight (Not specified values)

■ Thermally conductive types

Grade		One-component room-temperature cure			One-component heat cure			Two-component heat cure
		KE-3493	KE-3466	KE-3467	KE-1862	KE-1867	KE-1891	KE-1861-A/B
Cure type (by-product gas)		Condensation (acetone)	Condensation cure (acetone)	Condensation cure (acetone)	Addition	Addition cure	Addition	Addition
Brief description		Reduced LMW siloxane product	Reduced LMW siloxane product, UL certified	Reduced LMW siloxane product, UL certified	Medium viscosity	Reduced LMW siloxane product, UL certified	Non-flammable, high thermal conductivity	Adhesive, thermally conductive
Appearance	Consistency	Paste	Medium viscosity	High viscosity	Medium viscosity	Medium viscosity	Paste	Medium viscosity
	Color	See p. 28	White	White	Gray	Gray	Light gray	A/B: light gray
Viscosity	Pa·s	—	50	100	60	60	—	A: 50 / B: 50
Density 23°C	g/cm^3	1.46	2.80	2.90	2.22	2.92	3.06	2.22
Curing conditions, standard cure time		—	—	—	120°C×1 h	120°C×1 h	120°C× 1 h	120°C×1 h
Hardness Durometer A		73	88	91	83	75	96	75
Tensile strength	MPa	2.0	3.1	3.6	6.0	2.1	5.3	6.4
Elongation at break	%	70	30	30	80	60	10	80
Volume resistivity	TΩ·m	1	2.9	5.9	10	1.2	3.4	10
Dielectric breakdown strength*1	kV	35	24	25	25	23	25	25
Dielectric constant 50 Hz		4.2	5.9	4.6	4.0	6.7	—	4.0
Dissipation factor 50 Hz		2×10^{-3}	4.7×10^{-3}	4.0×10^{-3}	1.6×10^{-3}	4.5×10^{-3}	—	1.6×10^{-3}
Thermal conductivity	W/m·K	1.6	1.9	2.4	0.83	2.2	4.0	0.83
Tack-free time	min	1	7	4	—	—	NA	5.0*2
Lap shear strength	MPa	0.8 (aluminum)	0.5 (aluminum)	0.5 (aluminum)	1.3 (aluminum)	1.0 (aluminum)	0.8	1.0 (aluminum)
Name of curing agent		—	—	—	—	—	—	—
Blend ratio		—	—	—	—	—	—	100:100
LMW content ΣD_3~D_{10}	ppm	< 300	< 300	< 300	—*3	< 300	< 300	—*3

*1 Measured by 1 mm *2 Workable time (23°C : h) *3 Not a reduced LMW siloxane product (Not specified values)
LMW: low-molecular-weight

■ Foams

Grade		Two-component room-temperature cure	
		KE-513-A/B	**KE-521-A/B**
Cure type (by-product gas)		Condensation (hydrogen)	Addition (hydrogen)
Brief description		Triple-volume foaming	Triple-volume foaming
Appearance	Consistency	Low viscosity	Low viscosity
	Color	A: white / B: black	A: black / B: white
Viscosity Pa·s		A: 4 / B: 6	A: 8 / B: 3
Density 23°C g/cm^3		Approx. 0.5	Approx. 0.5
Curing conditions, standard cure time		23°C×24 h	23°C×24 h
Hardness Durometer A		10	14
Tensile strength MPa		0.2	0.2
Elongation at break %		110	120
Volume resistivity TΩ·m		2	4
Dielectric breakdown strength*1 kV		15	15
Dielectric constant 50 Hz		2.6	2.2
Dissipation factor 50 Hz		2×10^{-3}	5×10^{-3}
Thermal conductivity W/m·K		0.22	0.23
Workable time 23°C h		0.2	0.15
Blend ratio		100:10	100:100

*1 Measured by 1 mm

(Not specified values)

■ Oil- and solvent-resistant types (fluorosilicone)

Grade		One-component room-temperature cure		One-component heat cure		
		FE-123	**FE-2000**	**FE-61**	**X-32-1619**	**FE-57**
Cure type (by-product gas)		Condensation (acetic acid)	Condensation (alcohol)	Addition	Addition	Addition
Brief description		Oil- and solvent-resistant	Oil- and solvent-resistant	Oil- and solvent-resistant	Oil- and solvent-resistant	Oil- and solvent-resistant gel
Appearance	Consistency	Paste	Paste	Medium viscosity	Low viscosity	Low viscosity
	Color	See p. 28	Translucent	Light gray	Light gray	Light brown
Viscosity Pa·s		—	—	60	20	2
Density 23°C g/cm^3		1.34	1.35	1.43	1.46	1.28*2
Curing conditions, standard cure time		—	—	120°C×1 h	120°C×1 h	125°C×2 h
Hardness Durometer A		40	40	25	25	60*3
Tensile strength MPa		2.5	1.9	1.7	1.1	—
Elongation at break %		250	140	170	130	—
Volume resistivity GΩ·m		0.1	—	2.0	2.0	20
Dielectric breakdown strength*1 kV		17	—	18	18	—
Dielectric constant 50 Hz		8.0	—	6.5	6.5	7.0
Dissipation factor 50 Hz		3×10^{-2}	—	1×10^{-2}	1×10^{-2}	1×10^{-2}
Thermal conductivity W/m·K		0.17	—	—	—	—
Tack-free time min		5	6	—	—	—
Lap shear strength MPa		1.0 (aluminum)	0.8	0.6 (aluminum)	0.2 (aluminum)	—

*1 Measured by 1 mm *2 25°C *3 Penetration

(Not specified values)

■Testing method: complies with JIS K 6249. [Conversion to old JIS units] Viscosity: 10 P=1 Pa·s; Strength: 10 kgf/cm^2=0.98 MPa; Volume resistivity: 10^{14} Ω·cm=1 T Ω·m

■ Primers

Grade	Liquid silicone rubber type compatibility	Intended substrate	Characteristics	Drying time 23°C (min)	Usage amount (g/m²)	Packaging			UN No.
PRIMER-C	One-component condensation cure type	Glass, enamel, tile, porcelain, metal, plastic	Pale yellow transparent liquid, rubber volatile oil	15	35	100 g (bottle)	250 g (square can)	1 kg (can)	UN-1133
PRIMER-MT	One-component condensation cure type	Stone, mortar, slate, concrete	Colorless transparent liquid, toluene, isopropanol	30	200	100 g (bottle)	250 g (square can)	1 kg (can)	UN-1866
PRIMER-T	One- and two-component condensation cure types	Plastic	Colorless transparent liquid, toluene, isopropanol	15	50	100 g (bottle)	250 g (square can)	1 kg (can)	UN-1866
PRIMER-D-2	One-component condensation cure type	Fluorine paint, PVC, plastic	Colorless transparent liquid, ethanol	30	100	100 g (bottle)	250 g (square can)	—	UN-1133
PRIMER-U	One-component condensation cure type	Plastic, metal	Colorless transparent liquid, volatile oil	15	30	100 g (bottle)	250 g (square can)	1 kg (can)	UN-1133
PRIMER-S	One- and two-component condensation cure types	Metals	Colorless transparent liquid	30	35	100 g (bottle)	500 g (bottle)	1 kg (poly bottle)	UN-1866
PRIMER-NO.4	One- and two-component addition cure types	Plastic, metal	Aliphatic hydrocarbon	40	35	100 g (bottle)	—	1 kg (can)	UN-1133

Data: primer selection standards – p. 15; preparation and usage – p. 30

■ Curing agents

Grade	Compatible base resin	Consistency and appearance	Packaging			UN No.
CAT-103	**KE-103**	Colorless transparent liquid	50 g (bottle)	—	800 g (can)	Not applicable
CAT-RG	**KE-106**	Colorless transparent liquid	—	100 g (bottle)	900 g (can)	Not applicable
CAT-108	**KE-108**	Colorless to pale yellow liquid	50 g (bottle)	—	800 g (can)	UN-1760
CAT-118-BL	**KE-118**	Blue transparent liquid	50 g (bottle)	100 g (bottle)	800 g (can)	UN-1993
CAT-RC	**KE-66**	Colorless transparent liquid	20 g (bottle)	40 g (bottle)	800 g (can)	UN-1760
CAT-RP	**KE-119**	Light blue liquid	—	100 g (bottle)	1 kg (can)	UN-3802
CX-200	**KE-200**	Blue liquid	—	100 g (bottle)	900 g (can)	UN-3267
KE1800B	**KE1800·KE-1801·KE1802**	Colorless transparent	—	100 g (bottle)	1 kg (can)	Not applicable
KE1800C	**KE1800·KE-1801·KE1802**	Colorless transparent	20 g (bottle)	—	400 g (can)	UN-1866

■ Diluents, Additives and Coatings

	Diluent		Additive				Coating
Category	Thinner		Cure accelerator		Cure retardant		Agent to prevent curing inhibition
Grade	**RTV-THINNER**	**KE-1204-THINNER**	**CAT-RS**	**X-93-405**	**WETTER-NO.5**	**SEIGYOZAI-NO.6-10**	**BARRIER-COAT NO.6**
Characteristics	Colorless transparent liquid	Colorless transparent liquid	Pale yellow to pale yellowish brown liquid	Pale yellow liquid	Colorless transparent liquid	Colorless transparent liquid	Colorless transparent liquid
Compatible base resin	Two-component condensation cure type	Two-component addition cure type	Two-component condensation cure type	Two-component addition cure type	Two-component condensation cure type	Two-component addition cure type	Two-component addition cure type
Usage amount	As needed per application (<10%)	1~3%	0.1~0.5%	Up to 1%	1~2%	Up to 1%	As needed
Effect	Can be used to adjust viscosity, but will also change general physical properties.	Can be used to adjust viscosity if used in the proportions shown above.	Greatly reduces cure time. Please note that workable time will also decrease proportionately.	Cure time can be reduced by half, but workable time will also be halved.	Workable time and cure time can be extended by approx. 2 times.	Workable time and cure time can be extended by approx. 2.5 times.	Application to the base form can prevent the incidence of curing inhibition and prevent the mutual bonding of liquid silicone rubbers.
Handling precautions	Excessive amounts will adversely affect physical properties. Be sure to measure KE-1204-THINNER accurately.		Additives for condensation cure products and addition cure products differ, and cannot be used interchangeably. With cure accelerators and retardants, always accurately measure the specified curing agent and add the standard amount.				Cannot be used as an adhesive primer.
Packaging	1 kg (can)	1 kg (can)	100 g (bottle)	100 g (bottle)	100 g (bottle)	100 g (bottle)	100 g (bottle)
			1 kg (can)	1 kg (can)	1 kg (can)	1 kg (can)	1 kg (can)
UN No.	NON	NON	NON	NON	NON	NON	UN-1866

Data: Relationship of quantity of added diluent and various physical properties ··· p. 14 BARRIER-COAT NO.6 ··· p. 15

■ UL listing General liquid silicone rubbers correspond to UL 94HB, but the following products are UL registered.

Approved products [File no. E48923]

	Shin-Etsu grade	Reaction type (by-product gas)	UL list item	
			Registered product name Material Dsg	Level Flame Class {Min. Thk}
One-component room-temperature cure	**KE-3494**	Condensation (acetone)	**KE-3494**	94V-0 {1.5 mm} 94V-1 {0.75 mm}
	KE-3490	Condensation (acetone)	**KE-3490**	94V-0 {3.0 mm} 94V-1 {0.75 mm}
	KE-3467	Condensation (acetone)	**KE-3467**	94V-0 {2.0 - 2.2 mm} 94V-1 {0.8 mm}
	KE-3466	Condensation (acetone)	**KE-3466**	94V-1 {0.8 - 0.9 mm}
	KE-3424-G	Condensation (acetone)	**KE-3424G**	94V-1 {2.0 mm}
	KE-3497-T	Condensation (acetone)	**KE-3497T**	94HB {0.75 mm}
	KE-3497-W	Condensation (acetone)	**KE-3497W**	94HB {0.75 mm}
	KE-347	Condensation (acetone)	**KE-347**	94HB {0.75 mm}
	KE-4890	Condensation (alcohol)	**KE-4890**	94V-0 {0.75 mm}
	KE-40RTV	Condensation (oxime)	**KE-40RTV**	94V-0 {0.75 mm}
	KE-45	Condensation (oxime)	**KE45&**	94HB {1.5 mm}
	KE-441	Condensation (oxime)	**KE-441**	94HB {1.0 mm}
One-component heat cure	**KE-1831**	Addition	**KE-1831**	94V-0 {0.75 mm}
	KE-1867	Addition	**KE-1867**	94V-0 {0.8 mm}
	KE-1891	Addition	**KE-1891**	94V-0 {2.0 mm}
Two-component room-temperature	**KE-200**	Condensation (acetone)	**KE-200**	94HB {1.5 mm} 94V-1 {8.5mm}
Two-component heat cure	**KE1204A/B KE1204AL/BL**	Addition	**KE-1204-LTV**	94V-0 {0.89 mm}
	KE-1292-A/B	Addition	**KE-1292**	94V-0 {0.75 mm}
	KE1800	Addition	**KE-1800**	94V-0 {3.0 mm} 94V-1 {1.5 mm}
	KE1802	Addition	**KE-1802**	94V-0 {3.0 mm} 94V-1 {0.75 mm}

Figures within brackets { } indicate minimum thickness.

UL94 flammability classification criteria

Classification	Criteria
94V-0*	A set of 5 specimens is tested. The flaming combustion time for each specimen does not exceed 10 seconds, and total time for the set does not exceed 50 seconds.
94V-1*	A set of 5 specimens is tested. The flaming combustion time for each specimen does not exceed 30 seconds, and total time for the set does not exceed 250 seconds.
94HB	In the horizontal burn test, burning stops before the 100 mm reference mark.

*A rectangular test strip (width: 13.0 mm, length: 125 mm, thickness: smallest practical) is supported at one end. A 20 mm flame is applied to the free end for 10 seconds, then removed. The time that the strip continues to burn is measured. Once combustion stops, the flame is again applied in the same manner and combustion time is measured again.

Flame resistance testing left: silicone rubber / right: organic rubber

■ One-component liquid silicone rubber (room-temperature cure type)

Grade \ Indicated color	100 g×20 tubes						330 mL×20 cartridges						1 kg×10 cans		UN No.
	W	T	B	G	R	Other	W	T	B	G	R	Other	W	T	
KE-3417			○						○						UN-1993
KE-3418			○						○						UN-3077
KE-3423														○	UN-1133
KE-3424-G				○ *1						○					UN-1993
KE-3427				○						○					UN-3082
KE-3428				○						○					UN-3082
KE-3466	○ *2						○								Not applicable
KE-3467	○ *2						○								Not applicable
KE-347*	○	○	○				○	○	○						UN-1993
KE-3475*	○	○					○	○					○	○	UN-1993
KE-3479*		○						○							UN-1993
KE-348*	○	○					○	○	○						Not applicable
KE-3490				○ *3,4						○					UN-3077
KE-3491			○						○						UN-3077
KE-3492			○ *5												UN-1866
KE-3493	○ *6						○								UN-3077
KE-3494				○ *3						○					UN-1993
KE-3495*	○	○					○	○					○		UN-3082
KE-3497*	○	○					○	○							UN-1993
KE-3498*	○						○								UN-3077
KE-40RTV*	○ *7			○ *7			○			○					Not applicable
KE-41*	○	○					○	○							Not applicable
KE-42*	○	○	○				○	○	○	○		○ AL			Not applicable
KE-44*	○	○	○	○			○	○	○	○					Not applicable
KE-441*	○	○			○		○	○			○				Not applicable
KE-445*	○						○	○	○		○			○	Not applicable
KE-45*	○	○	○		○	○ YW	○	○	○	○	○	○ YW			Not applicable
KE-45-S*													○	○	UN-1866
KE-4890*	○ *8			○ *8			○			○					Not applicable
KE-4895*	○	○					○	○							Not applicable
KE-4896*	○	○					○	○							Not applicable
KE-4897*	○	○					○	○							Not applicable
KE-4898*	○	○					○	○							Not applicable
FE-123*	○ *9	○ *9					○								Not applicable
FE-2000		○ *1						○							Not applicable

*1 120 g×20 tubes *2 250 g×20 tubes *3 110 g laminated tube is available. *4 200 g×20 tubes are available.
*5 160 g×20 tubes *6 130 g×20 tubes *7 150 g×20 tubes *8 140 g×20 tubes *9 120 g×1 tube
Please contact our sales department separately regarding 15~20 kg pails.
W: white, T: transparent, B: black, G: gray, R: reddish brown,
GB: dark gray, YW: ivory, LG: light gray, AL: aluminum

★ When ordering products with this mark,
please specify the product name, color, packaging, and amount.
Example) Tube : KE-45-W, 100 g×20 tubes
Cartridge: KE-45-W, 330 mL×20 cartridges

■ One-component liquid silicone rubber (heat cure type)

Grade	100 g×20 tubes	330 mL×20 cartridges	1 kg×10 cans	UN No.
KE-1056			○: slightly clouded color	Not applicable
KE-1151			○: translucent	Not applicable
KE-1820	○: creamy white	○: creamy white	○: creamy white	Not applicable
KE-1825	○: creamy white	○: creamy white	○: creamy white	Not applicable
KE-1830	○: light gray	○: light gray	○: light gray	Not applicable
KE-1831	○: black			Not applicable
KE-1833		○: reddish brown/black	○: reddish brown	Not applicable
KE-1842	○: white		○: white	Not applicable
KE-1862	○*1: gray		○: gray	Not applicable
KE-1867	○*1: gray		○: gray	Not applicable
FE-57			○: light brown	Not applicable
FE-61	○*2 : light gray		○: light gray	Not applicable
KE-1884	○: white		○: white	Not applicable
KE-1885	○: white		○: white	Not applicable
KE-1886	○: creamy white		○: creamy white	Not applicable
KE-1891	○*3 : light gray		○: light gray	Not applicable
X-32-1619	○*2 : light gray			Not applicable

*1 200 g×20 tubes
*2 130 g×20 tubes
*3 300 g×20 tubes

■ Two-component liquid silicone rubber (room-temperature cure and heat cure types)

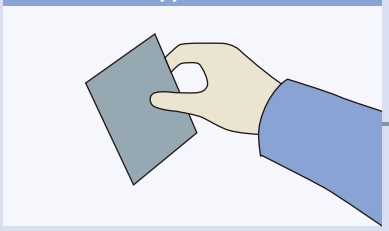
Grade	1 kg×10 cans	16 kg can	20 kg can	UN No.
KE-66*	○: light gray		○: light gray	Not applicable
KE-103*	○: colorless transparent	○: colorless transparent		Not applicable
KE-1031-A/B	○: Agent A/B : colorless transparent	○: Agent A/B : colorless transparent		Not applicable
KE-1051J-A/B	○: Agent A/B : colorless transparent	○: Agent A/B : colorless transparent (18 kg)		Not applicable
KE-1012-A/B	○: Agent A/B : colorless transparent	○: Agent A/B : colorless transparent		Not applicable
KE-106*	○: colorless transparent	○: colorless transparent (18 kg)		Not applicable
KE-108*	○: colorless transparent	○: colorless transparent		Not applicable
KE-109E-A/B	○: Agent A/B : colorless transparent	○: Agent A/B : colorless transparent		Not applicable
KE-118*	○: light gray		○: light gray	Not applicable
KE-119*	○: reddish brown		○: reddish brown	Not applicable
KE1204A/B	○: Agent A: reddish brown/Agent B: light gray		○: Agent A: reddish brown/Agent B: light gray	Not applicable
KE1204AL/BL	○ : Agent A: reddish brown/Agent B: white		○: Agent A: reddish brown/Agent B: white	Not applicable
KE-1292-A/B	○: Agent A: black/Agent B: light gray		○: Agent A: black/Agent B: light gray	Not applicable
KE1800A* KE1800B/C*	○: Agent A: white Agent B/C: colorless transparent		○: Agent A: white Agent B/C: colorless transparent	Agent A/B: Not applicable Agent C: UN-1866
KE-1801-A* KE1800B/C	○: Agent A: white Agent B/C: colorless transparent		○: Agent A: white Agent B/C: colorless transparent	Agent A/B: Not applicable Agent C: UN-1866
KE1802A* KE1800B/C	○: Agent A: black Agent B/C: colorless transparent		○: Agent A: black Agent B/C: colorless transparent	Agent A/B: Not applicable Agent C: UN-1866
KE-1800T-A/B	○: Agent A/B : translucent		○: Agent A/B : translucent	Not applicable
KE-1861-A/B	○: Agent A: white/Agent B: light gray			Not applicable
KE-200*	○: colorless translucent	○: colorless translucent (18 kg)		UN-3082
KE-513-A/B	○: Agent A: white/Agent B: black		○: Agent A: white/Agent B: black	Agent A: Not applicable/Agent B: UN-1866
KE-521-A/B	○: Agent A: black/Agent B: white		○: Agent A: black/Agent B: white	Not applicable

* For information regarding curing agents, please refer to p. 26.

Directions for Usage

■ Usage instructions for one-component liquid silicone rubbers

Clean the application surface



Clean the surface of all rust, oil, dirt, grime and other substances that may interfere with adhesion using sandpaper or a solvent (toluene, xylene, other). When cleaning plastics with solvents, use caution as some solvents may damage plastics.

To save for later use

Tubes

Remove the nozzle and seal tightly. Clean residue out of the nozzle using a solvent.

Cartridges

Product should be used all at once if possible. If product remains, seal tightly before storage. If tightly sealed, the product can be kept for several days.

Tubes

Open the tube and load it into the dispenser cartridge.

Cartridges

Cut the nozzle tip and load the cartridge into the dispenser cartridge.

Application can be done by machine or by hand

Photo provided by Musashi Engineering Inc.

■ Usage instructions for two-component liquid silicone rubbers

Before use

Check the mix ratio carefully when using two-component liquid silicone rubber products.
All ratios are given in parts by weight. Put the base polymer (A) into a container, followed by the curing agent (B). Mix thoroughly until evenly mixed throughout.
Be sure to deaerate the product after mixing. When using a planetary-centrifugal type mixer/deaerator, friction within the product can cause a sharp rise in temperature. Also be aware that with certain low viscosity products, there may be some settling of the fillers during storage. Before use, first agitate well to disperse the fillers and then proceed to mixing the two components.

To store

Be sure to seal the product tightly before storage. Use a solvent or other cleaning agent to clean stirrers, containers and other tools used in the mixing process after use.

Stir before use

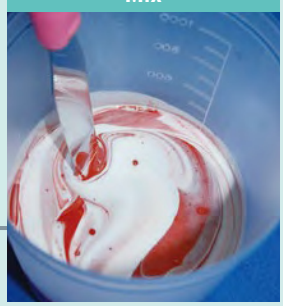
Fillers may settle to the bottom of the container, so be sure to stir thoroughly with a suitable implement prior to use.

Weigh

Weigh out both the base polymer and curing agent.

Combine

Mix



Combine the base polymer and curing agent, and mix until color is uniform and consistent.

Deaerate

Use

After mixing and deaeration, immediately pour into place.

Handling Precautions

Handling precautions

1. One-component condensation cure type liquid silicone rubber reacts with moisture in the air and begins to cure at the surface. Consequently, the cure speed will vary according to the temperature and humidity of the use environment, but these rubbers do not exhibit good deep-curing and are therefore not suitable for wide-area surface bonding. In addition, please note that if humidity exceeds 100% and water droplets form on the curing rubber, a hydrolytic reaction will precede the crosslinking cure reaction, which will reduce the strength of the post-cured rubber and remain surface tackiness. (See p. 6)

2. Some of the one-component condensation cure type liquid silicone rubbers, such as the acetic acid and oxime types, may corrode metal. The acetic acid type may cause rust, and under sealed conditions the oxime type may corrode copper metals. Conduct a test using a small sample to determine whether the product is suitable for the intended application.

3. The electrical insulative properties will temporarily decline during the curing process. But in nearly all cases, the rubber will exhibit its inherent electrical insulative properties once completely cured.

4. Please note that in some cases, the rubber may not cure if it comes in contact with flux or certain other materials.

5. Do not use condensation cure type liquid silicone rubbers in a completely enclosed space.

6. One-component condensation cure type liquid silicone rubber may yellow over time, but this does not negatively affect the characteristic properties.

7. If addition cure type liquid silicone rubbers become mixed with or come into contact with curing inhibitors (e.g. sulfur, phosphorus, nitrogen compounds, water, organometallic salts, etc.), a defective cure may result, so please use caution. For information about curing inhibitors, see p. 15.

8. Addition cure type liquid silicone rubbers should not be used in humid conditions, as this may cause defective curing and poor adhesion.

9. With addition cure type liquid silicone rubbers, please note that minute quantities of hydrogen gas are released during the curing process.

Usage

1. Completely remove water, oil, dirt, and contaminants from the surface of the adherend.

2. For certain substrates, use a primer as needed.
(For information about primer types, see p. 15.)

3. For products that will become tack-free in a short time, surface treatment should be finished as quickly as possible using a spatula or similar tool.

4. When using two-component liquid silicone rubber products, be sure to agitate, blend, and deaerate thoroughly. Failure to do so may degrade the characteristics of the rubber.

5. When using an air gun, be sure to set the pressure at a safe and proper level. Pressure should generally not exceed 0.2-0.3 MPa.

Safety and hygiene

1. Be sure to provide adequate ventilation when using condensation cure type liquid silicone rubber. During curing, the following gases are generated, depending on the cure type: acetic acid type – acetic acid; alcohol type – methanol; oxime type – methyl ethyl ketone oxime (MEKO); acetone type – acetone. If you experience any unpleasant symptoms please move to an area with fresh air.

2. Uncured liquid silicone rubber may irritate skin and mucous membranes, so avoid eye contact and prolonged skin contact. In case of accidental eye contact, flush with water for at least 15 minutes and see a physician. In case of skin contact, immediately wipe off with a dry cloth and wash with soapy water. Contact lens wearers should exercise adequate caution; if uncured liquid silicone rubber enters the eye, the contact lens may become bonded to the eye.

3. When using, be careful not to rub the eyes with the hands. Please take appropriate precautions such as wearing safety glasses.

4. When exposed to high-temperature conditions exceeding 150°C, FE-123, FE-2000, FE-61, FE-57, and X-32-1619 break down and release trace amounts of a poisonous gas, trifluoropropionaldehyde. When using in high-temperature conditions, be sure to provide adequate ventilation.

5. Primers and some liquid silicone rubbers and curing agents are classified as hazardous materials under the laws of certain countries. In such cases, the laws must be followed regarding storage, labeling, and handling.

6. Keep out of reach of children.

7. Please read the Safety Data Sheet (SDS) before use. SDS can be obtained from our Sales Department.

Storage precautions

1. Store between 1°C~30°C, out of direct sunlight. Some products must be stored between 1°C~25°C. Products with “refrigeration required” on the label must be stored below 10°C.

2. With cartridges, as a general rule it is best to completely use up the product once the cartridge has been opened. If any remains, be sure to seal completely.

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Gunma Complex	ISO 9001 (JCQA-0004)	ISO 14001 (JCQA-E-0002)
Naoetsu Plant	ISO 9001 (JCQA-0018)	ISO 14001 (JCQA-E-0064)
Takefu Plant	ISO 9001 (JQA-0479)	ISO 14001 (JQA-EM0298)

https://www.shinetsusilicone-global.com/

This is an edited version of the product data released on Aug. 2020.