WACKER

CREATING TOMORROW'S SOLUTIONS

ELASTOSIL®

SEMICOSIL®

WACKER SilGel®

MOBILITY

e-NOVATION FOR POWER CONVERSION
POWERED BY SILICONES

THE BRAIN OF e-MOBILITY

Highly-efficient power conversion is a vital process for e-Mobility. The direct current supplied and stored by the battery must be inverted for compatibility with the e-drive, which consumes and generates alternating current. Similarly, the system voltage must be transformed to the levels required by the various components. All this high-powered action takes place in a compact, enclosed environment. Hence, effective heat management is also essential. With our extensive expertise in automotive, semiconductor and power electronics applications, we meet these challenges with outstanding silicone products. Discover innovative ideas for e-power conversion in this brochure or develop new solutions together with us.

e-Novation is Our Business
With a strong focus on R&D, WACKER provides innovative momentum to products and applications in automotive and power electronics. At our state-of-the-art technical centers, we develop new products for you or optimize those of your existing applications. Rely on first-class service, provided by a vigorous, worldwide partner.

Let's power up the future.
Let's put the wheels on e-Mobility.

SILICONES IN CHARGE

Our silicones meet the power-conversion industry demands by providing efficient heat management and high temperature resistance. Our latest adhesives developments offer quick adhesion build-up with minimum energy input (< 10 min at 60–80 °C) and special grades even enable oven-free processing.

They help to:
- Dissipate heat (thermal management) by providing a durable coupling between the heat source (electronic device) and the heat sink (active or passive cooling system)
- Protect against moisture, oxidation, chemicals and vibration
- Extend life and performance

Silicone Applications for xEV Power Conversion

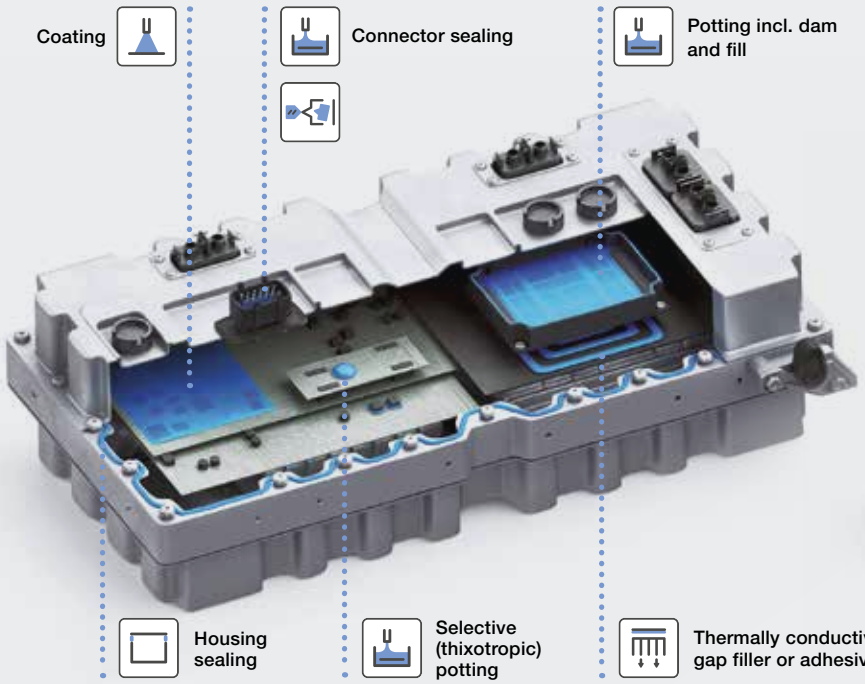
Used in converters, inverters, on-board chargers, boosters and for inductive charging.
- Thermal management with heat-conductive adhesives, encapsulants, gap fillers and pastes
- Assembly:
  - Potting of sensitive electronics: dam and fill or selective potting (power module / insulated-gate bipolar transistor (IGBT) protection)
  - Sealing of components, housing and lid
  - Conformal coating (PCB protection)

Silicones as Insulating Materials

- Dielectric strength typically > 20 kV/mm
- Volume resistivity (IEC 60093) > 10 Ω·cm

Silicone Application Fields

High-Voltage Conversion Unit



Low-Voltage Conversion Unit

DRIVING FORCE OF e-NOVATION

As electric vehicles (EVs) and hybrid electric vehicles (HEVs) both require two different electrical power sources, a high-voltage 400 V battery and a low-voltage 12 V (EV) or 48 V (HEV) battery, electrical currents need to be converted and voltages transformed. Different devices are used for this power conversion.

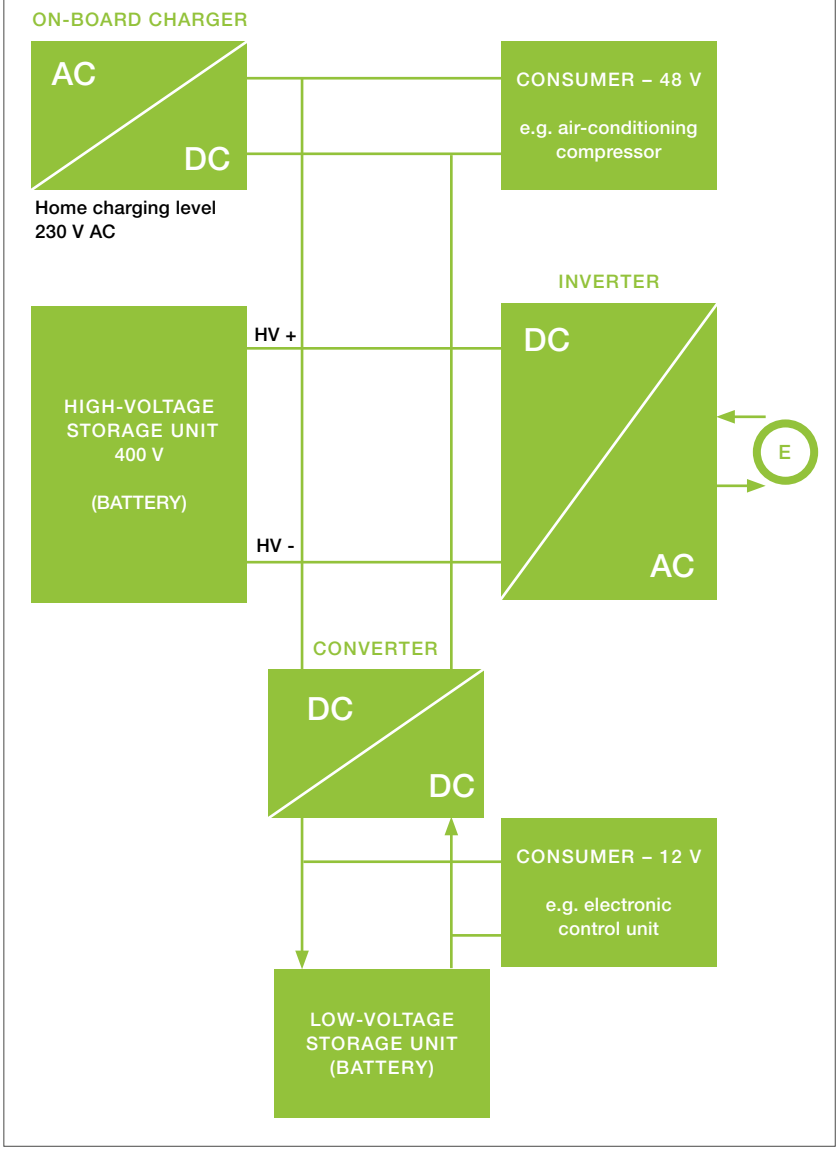
High-Voltage Conversion Units

The on-board charger inverts the power grid's alternating current (AC) into direct current stored in the battery. In addition to this it creates the necessary voltage level for the battery. The inverter converts the DC of the battery into the AC used by the motor and vice versa in case of recuperation. The more efficient this is, the further the electric range of the car.

Low-Voltage Conversion Unit

Just like fossil-fuel-powered cars, EVs and HEVs require a low-voltage battery to start and to power features such as electric windows, door locks, lighting and multimedia devices. The converter reduces the voltage so that it can be stored in the low-voltage battery (12 V for electric vehicles EV, 48 V for hybrid electric vehicles HEV). In all conversion units, our silicones ensure protection, long-life performance and heat dissipation.

Overview of the Electric Board Net and Electronic Component Power Supply



LOW-ENERGY CURING SILICONES FOR FASTER PROCESSING

To meet the challenges facing power electronics, WACKER has developed a range of versatile low-energy cure adhesives, ELASTOSIL® RT 720, ELASTOSIL® 722, ELASTOSIL® 725 LV and SEMICOSIL® 811.

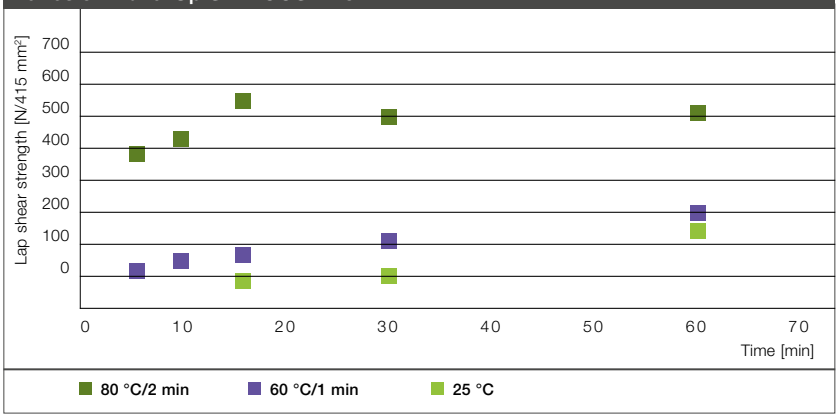
These adhesives enhance your production process by saving time and energy:

- Fast adhesion build-up at room temperature or with moderate energy input (< 10 min at 60 – 80 °C)
- Reduced cycle times (faster processing)
- In-line QC process possible (SEMICOSIL® 811 + ELASTOSIL® RT 725 LV with UV tracer allowing for automated optical inspection control, blue fluorescence under black light)
- High flexibility, high-temperature resistance
- Low level of volatile siloxanes, D4 – D8 < 350 ppm with our LV products

The Specialist for Oven-Free Processing

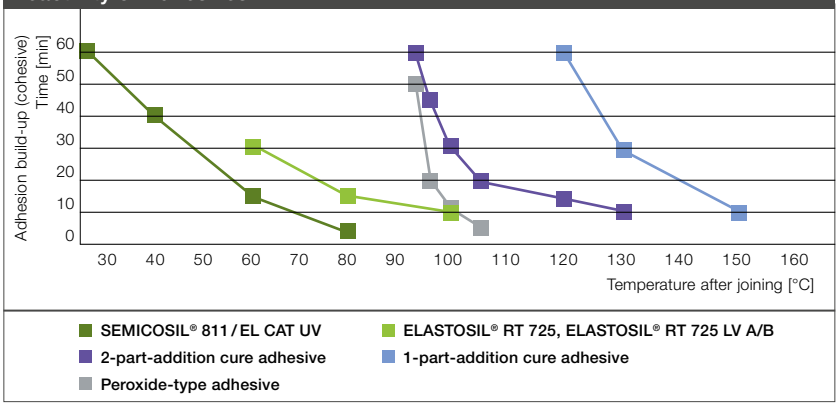
SEMICOSIL® 811 is a highly-specialized non-slump low modulus silicone adhesive sealant. It is designed for oven-free processing, does not require high temperatures for fast adhesion build-up and can be applied to sensitive substrates, such as glass, copper, steel, PBT, FR4 and Al. It is used in a ratio of 10:1 with a catalyst, e.g. ELASTOSIL® CAT PT-F or ELASTOSIL® CAT PT for a regular cure or with ELASTOSIL® CAT UV for a UV-activated cure.

Adhesion Build-Up SEMICOSIL® 811



Initial lap shear strength on PBT/Al
AlMgCu not pre-treated / 0.4 mm Silicone (SEMICOSIL® 811/ELASTOSIL® CAT UV) / PBT ULTRADUR® B 4300 G6 GF 30

Reactivity of Adhesives



PRODUCT OVERVIEW

SILICONES FOR e-POWER CONVERSION

Power Conversion Assembly **Potting of Power Module / IGBT Protection**

Soft gels for potting and encapsulation of sensitive electronic devices

Product	Features	Thermal Conductivity [W/mK]	Curing Type	Curing Initiated by	Product Type	Viscosity D = 0.5 1/s [mPa·s]	Hardness	Tensile Strength [MPa]	Elongation at Break [%]	Density [g/cm³]	Curing
WACKER SilGel® 612	Very soft, clear, low bleed, general purpose, UL-94 HB	0.2	Addition	RT or heat	2-part ,1:1, long potlife	1,000	Pen 70 mm / 10	-	-	0.97	8 h / 25 °C, 15 min / 100 °C
WACKER SilGel® 612 EH	Soft, fast cure, low bleed, inhibition robust	0.2	Addition	RT or heat	2-part, 1:1, short potlife	1,000	Pen 35 mm / 10	-	-	0.97	90 min / 25 °C, 10 min / 70 °C
WACKER SilGel® 613	Very soft, clear, general purpose, low volatile	0.2	Addition	Heat or UV	2-part, 10:1, BKS*	200	Pen 70 mm / 10	-	-	0.97	BKS*, see extra table
SEMICOSIL® 900 LT	Very soft, translucent, low-temperature flexible, specified ion content	0.2	Addition	RT or heat	2-part, 1:1, long potlife	15,000, thixotropic	Pen 70 mm / 10	-	-	1	12 h / 25 °C, 10 min / 120 °C
SEMICOSIL® 911	Very soft, low bleed, specified ion content, low volatile	0.2	Addition	Heat	2 part, 1:1, long potlife	8,500, thixotropic	Pen 60 mm / 10	-	-	0.99	6 h / 25 °C, 5 min / 100 °C
SEMICOSIL® 912	Very soft, for fill application, low bleed	0.2	Addition	Heat or UV	2-part, 10:1, BKS*	1,000	Pen 70 mm / 10	-	-	0.97	BKS*, see extra table
SEMICOSIL® 914	Very soft, clear, for dam application, low bleed	0.2	Addition	Heat or UV	2-part, 10:1, BKS*	55,000, thixotropic	Pen 70 mm / 10	-	-	0.99	BKS*, see extra table
SEMICOSIL® 915 HT	Sh00 hardness, clear yellowish, high temperature resistant up to 210 °C	0.2	Addition	Heat or UV	2-part, 10:1, BKS*	1,000	15 Shore 00	-	-	0.97	BKS*, see extra table
SEMICOSIL® 917	Soft, UV tracer, low bleed	0.2	Addition	Heat or UV	2-part, 10:1, BKS*	11,000, thixotropic	Pen 55 mm / 10	-	-	0.98	BKS*, see extra table
SEMICOSIL® 920 LT	Very soft, clear yellowish, low-temperature flexible, specified ion content	0.2	Addition	Heat	2-part, 1:1, long potlife	450	Pen 70 mm / 10	-	-	0.98	30 min / 110 °C, 10 min / 150 °C
SEMICOSIL® 9242	Soft, low bleed, low volatile, UV tracer, specified ion content	0.2	Addition	Heat	1-part	20,000, thixotropic	Pen 50 mm / 10	-	-	0.98	40 min / 130 °C, 10 min / 150 °C
SEMICOSIL® 944	Extremely fast cure, UV tracer	0.2	Addition	Heat or UV	2-part, 10:1, BKS*	12,000, slightly thixotropic	45 Shore 00	-	-	0.98	BKS*, see extra table
SEMICOSIL® 949 UV	Very low viscosity, UV tracer, primerless bonding	0.2	Addition	Heat or UV	2-part, 10:1, BKS* with 949 UV B or 950 UV B	200	35 Shore 00	-	-	0.97	BKS*, see extra table

Power Conversion Assembly **Adhesives / Foam**

Sealing of power control unit components, housings and lids

Product	Features	Thermal Conductivity [W/mK]	Curing Type	Curing Initiated by	Product Type	Viscosity D = 0.5 1/s [mPa·s]	Hardness	Tensile Strength [MPa]	Elongation at Break [%]	Density [g/cm³]	Curing**
ELASTOSIL® E4	CIPG / FIPG	0.2	Acetoxy	RT	1-part, RTV-1	Non-slump	15 Shore A	1.7	900	1.02	120 h / 23 °C
SEMICOSIL® 811	Low-energy cure adhesive, low-temperature cure, oven free, fast adhesion build-up at moderate temperature, FIPG	0.2	Addition	RT, heat or UV	2-part, 10:1, BKS*	260,000, thixotropic	30 Shore A	3.3	330	1.08	BKS*, see extra table
SEMICOSIL® 986/1k	Sealing adhesive, FIPG, thixotropic, specified ion content, UV tracer	0.2	Addition	Heat	1-part	Non-slump	50 Shore A	5	200	1.1	30 min / 130 °C, 10 min / 150 °C
SEMICOSIL® 987 GR	Sealing adhesive, CIPG, FIPG, specified ion content	0.2	Addition	Heat	1-part	Non-slump, thixotropic	55 Shore A	5	200	1.1	60 min / 130 °C, 10 min / 150 °C
SEMICOSIL® 988 / 1k gray / tran	Sealing adhesive, CIPG, FIPG, specified ion content	0.2	Addition	Heat	1-part	Non-slump, thixotropic	35 Shore A	4.5	350	1.1	60 min / 130 °C, 10 min / 150 °C
SEMICOSIL® 9882	Fast curing, designed for large part CIPG and for ovenless IR curing process	0.2	Addition	Heat or IR light	2-part, 1:1	Non-slump	30 Shore A	7	500	1.1	CIPG IR / heat cure 60 – 130 °C: > 30 min / 60 °C; > 10 min / 100 °C
ELASTOSIL® RT 720	Low-energy cure adhesive, CIPG, FIPG, excellent mech. properties, flowable adhesive	0.2	Addition	Heat	2-part, 1:1	35,000	40 Shore A	6	300	1.1	45 min / 90 °C, 15 min / 125 °C
ELASTOSIL® RT 722	Low-energy cure adhesive, low volatile, excellent mech. properties	0.2	Addition	Heat	2-part, 1:1	Non-slump, thixotropic	45 Shore A	6	300	1.1	45 min / 90 °C, 15 min / 125 °C
ELASTOSIL® RT 725 LV	Low-energy cure adhesive, low volatile, UV tracer	0.2	Addition	Heat	2-part, 1:1	Non-slump	50 Shore A	7	250	1.1	10 min / 100 °C, 30 min / 60 °C
ELASTOSIL® SC 870	Silicone foam, CIPG, high LOI	< 0.1	Addition		Silicone foam	40,000, thixotropic	10 Shore A	-	-	0.35	

* BKS = Batch-Kit System: base component to be combined with ELASTOSIL® CAT PT ELASTOSIL® CAT PT-F or ELASTOSIL® CAT UV to allow curing at room temperature, under heat or by UV light (for details, please refer to the respective technical datasheet)

** Speed of adhesion built-up dependend on substrate

PRODUCT OVERVIEW
SILICONES FOR e-POWER CONVERSION

PCB Protection Conformal Coatings

Solvent-free, 100% silicone, UV-initiated products available, fast reaction, shadow cure, no volatile by-products (addition-cure)

Product	Features	Thermal Conductivity [W/mK]	Curing Type	Curing Initiated by	Product Type
SEMICOSIL® 942 UV	Soft gel, sprayable, avoids electromigration, UV tracer	0.2	Addition	UV	2 part 10:1

Product	Viscosity D = 0.5 1/s [mPa·s]	Hardness	Density [g/cm³]	Curing
SEMICOSIL® 942 UV	2,500	Pen 60 mm / 10	0.98	UV active cure (+ shadow cure)

Potlife and Cure Times for BKS* Grades (10:1 Mix)

Product	Potlife [min] 10:1 with ELASTOSIL® CAT			Curing Time [min] 10:1 with ELASTOSIL® CAT		
	CAT PT [min] 25 °C	CAT PT-F [min] 25 °C	CAT UV [h] 25 °C	CAT PT [min] 100 °C	CAT PT-F [min] 100 °C	CAT UV** 100 °C
WACKER SilGel® 613	120	5	> 72	10	2	< 2 min
SEMICOSIL® 811	45	30	> 48	–	–	< 10 min***
SEMICOSIL® 912	120	5	> 72	15	5	< 2 min
SEMICOSIL® 914	120	5	> 72	15	5	< 2 min
SEMICOSIL® 915 HT	180	15	> 72	30	10	< 3 min
SEMICOSIL® 917	120	5	> 72	10	2	< 2 min
SEMICOSIL® 944	n.a.	n.a.	> 72	–	–	< 2 min
SEMICOSIL® 949	120	–	> 72	15	–	< 2 min****

* BKS = Batch-Kit System: base component to be combined with ELASTOSIL® CAT PT, ELASTOSIL® CAT PT-F or ELASTOSIL® CAT UV to allow curing at room temperature, under heat or by UV light (for details, please refer to the respective technical datasheet)

** Curing time under UV irradiation depending on substrate, layer thickness, UV intensity and dose. Ozone-free Fe-discharge lamp (emission > 250 nm) is recommended

*** Typically 40-60 sec open time (time to bond), cure at 25 °C after 30 min. Adhesion: 25 °C (PBT/Al): > 45 min; Adhesion: 80 °C (PBT /Al): < 5 min

**** As encapsulant an intensity between 100 and 400 mW/cm² can be chosen. At high intensity, material is cured almost immediately after irradiation (10 sec)

PRODUCT OVERVIEW

SILICONES FOR e-POWER CONVERSION

Power Conversion Thermal Management **Thermally Conductive Silicone Encapsulants**

Tough encapsulation materials with good resistance to mechanical and environmental stress

Product	Features	Thermal Conductivity [W/mK]	Curing Type	Curing Initiated by	Product Type	Viscosity D = 0.5 1/s [mPa·s]	Hardness	Tensile Strength [MPa]	Elongation at Break [%]	Density [g/cm³]	Lap Shear Strength [N/mm²]	Curing
ELASTOSIL® RT 607	General purpose potting	0.5	Addition	Heat	2-part, 9:1	10,000	55 Shore A	3.5	100	1.4	-	20 min/70 °C
ELASTOSIL® RT 743 LV-K	General purpose potting, low viscosity	0.5	Addition	Heat	2-part, 1:1	1,100	20 Shore A	3	150	1.5	-	60 min/120 °C
ELASTOSIL® RT 736 TC*	Self-leveling, good adhesion properties, UL 94 V-0	0.6	Addition	Heat	2-part, 1:1	3,000	63 Shore A	4.6	150	1.5	1.2	60 min/120 °C
ELASTOSIL® RT 744 TC	General purpose potting, low viscosity, medium TC	1.0	Addition	50 °C or higher	2-part, 10:1**	9,500 (D = 1 1/s)	70 Shore A	3.1	70	2.2	-	15 min/80 °C
ELASTOSIL® RT 738 TC*	Self-leveling, good flow and adhesion properties	1.1	Addition	Heat	2-part, 1:1	5,500 (D = 1 1/s)	20 Shore A	0.5	90	1.9	0.4	60 min/120 °C
ELASTOSIL® RT 747 TC	Self-leveling, good flow and adhesion properties	1.4	Addition	Heat	1-part	45,000	70 Shore A	4	90	2.3	0.8	30 min/130 °C
ELASTOSIL® RT 739 TC*	Self-leveling, good flow and adhesion properties	2.2	Addition	Heat	2-part, 1:1	17,000 (D = 1 1/s)	50 Shore A	1.3	60	2.8	0.6	60 min/120 °C

Power Conversion Thermal Management

Thermally Conductive Dispensable Silicone Gap Fillers and Pastes

Soft, flexible gap filling between uneven surfaces across broad temperature range; non-curing, low stress paste solutions

Product	Features	Thermal Conductivity [W/mK]	Curing Type	Curing Initiated by	Product Type	Viscosity D = 0.5 1/s [mPa·s]	Hardness	Tensile Strength [MPa]	Elongation at Break [%]	Density [g/cm³]	Lap Shear Strength [N/mm²]	Curing
WACKER Silicone Paste P12	Standard thermal heat sink paste	0.8	-	-	1-part, ready-to-use	Non-slump	Paste-like	n.d.	n.d.	2.3	-	-
ELASTOSIL® Paste 30 TC*	Thermal heat sink paste	3.0	-	-	1-part, ready-to-use	Non-slump	Paste-like	n.a.	n.a.	3.2	-	-
SEMICOSIL® Paste 40 TC	High performance paste, screen printable	4.0	-	-	1-part, ready-to-use	Non-slump	Paste-like	n.d.	n.d.	3.3	-	-
SEMICOSIL® 961 TC	High dosing rate, UL 94 V-0, low volatile	2.3	Addition	RT or fast cure at elevated temp	2-part, 1:1	Non-slump	25 Shore A	n.d.	n.d.	2.9	-	4–6 h/23 °C
SEMICOSIL® 962 TC	High dosing rate, soft tacky gel, UL 94 V-0, low volatile	3.0	Addition	RT or fast cure at elevated temp	2-part, 1:1	Non-slump	25 Shore A	n.d.	n.d.	3.1	-	4–6 h/23 °C
SEMICOSIL® 963 TC	High dosing rate, UL 94 V-0, low volatile	3.0	Addition	RT or fast cure at elevated temp	2-part, 1:1	Non-slump	Pen 20 mm/10	n.d.	n.d.	3.1	-	4–6 h/23 °C

Power Conversion Thermal Management **Thermally Conductive Silicone Adhesives**

Silicone adhesives to couple components to heat sink element/to active cooling, also for application in PTC heaters

Product	Features	Thermal Conductivity [W/mK]	Curing Type	Curing Initiated by	Product Type	Viscosity D = 0.5 1/s [mPa·s]	Hardness	Tensile Strength [MPa]	Elongation at Break [%]	Density [g/cm³]	Lap Shear Strength [N/mm²]	Curing
ELASTOSIL® RT 709 CN	Flowable, excellent thermal stability	0.4	Addition	Heat	1-part	180,000	49 Shore A	4	200	1.2	> 2.2	10 min/140 °C, 2 min/200 °C
SEMICOSIL® 970 TC	Universal self-adhesive thermally conductive silicone	0.8	Addition	Heat	2-part, 1:1	95,000	65 Shore A	4	90	2.3	> 3	30 min/130 °C
ELASTOSIL® TC 9800	General purpose potting, self-bonding	0.85	Condensation	RT	1-part, RTV-1	120,000	73 Shore A	3	85	1.6	> 1	Skin forming: 5 min/23 °C
SEMICOSIL® 971 TC	Stir cartridges	2.0	Addition	Heat	1-part	Non-slump	75 Shore A	5	70	2.7	> 2.5	30 min/125 °C
SEMICOSIL® 9712 TC	General purpose adhesive, high heat resistance	2.5	Addition	Heat	2-part	Non-slump	85 Shore A	5	60	2.9	> 3	15 min/85 °C
SEMICOSIL® 973 TC	Primerless adhesion to many substrates, stir cartridges	3.0	Addition	Heat	1-part	Non-slump	90 Shore A	3	45	3.0	> 2.5	30 min/125 °C
SEMICOSIL® 975 TC	High thermally conductive 1-part adhesive	4.3	Addition	Heat	1-part	Non-slump	98 Shore A	3	45	3.3	> 2.5	30 min/130 °C

* Under development

** Base component to be combined with ELASTOSIL® CAT PT or ELASTOSIL® CAT PT-F to allow curing at room temperature or under heat (For details, please see product's technical data sheet.)

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7537E e/04.18 replaces 7537E e/10.17