

# Information About *Dow Corning*<sup>®</sup> brand Adhesive/Sealants

## Silicones and Electronics

Long-term, reliable protection of sensitive circuits and components is important in many of today's delicate and demanding electronic applications. Silicones function as durable dielectric insulation, as barriers against environmental contaminants and as stress-relieving shock and vibration absorbers over a wide temperature and humidity range.

In addition to sustaining their physical and electrical properties over a broad range of operating conditions, silicones are resistant to ozone and ultraviolet degradation, have good chemical stability and are available in a variety of useful forms as conformal coatings, encapsulants and adhesives. Dow Corning's broad range of general purpose and specialty products offers you a choice of materials for your application needs.

Dow Corning offers a variety of noncorrosive silicone products for electronic sealing, bonding and adhering applications. These adhesives generally fall into three cure types. The first group are moisture cure, generally meant for room-temperature processing. The second type (condensation cure) offers rapid room-temperature and deep-section curing. The third type is heat cure for rapid processing. All convert to durable, relatively low stress elastomers. Most will develop good, primerless adhesion to a variety of common substrates including ceramics, reactive metals and filled plastics.

### One-Part Moisture Cure RTV

**Type**

Noncorrosive, one-part moisture curing RTV silicone elastomers

**Physical Form**

Nonflowing and flowable options; cures to flexible elastomer

**Special Properties**

Room temperature cure; opaque and translucent options; resists humidity and other harsh environments; good dielectric properties; good adhesion to a variety of common substrates; low stress

**Potential Uses**

Sealing modules and housings; gasketing

### Two-Part Room Temperature Condensation Cure

**Type**

Two-part RTV silicone elastomers

**Physical Form**

Nonflowing; cures to flexible elastomer

**Special Properties**

Rapid cure and green strength at room temperature; deep section cure; resists humidity and other harsh environments; good dielectric properties; self-priming adhesion; low stress

**Potential Uses**

Lid and housing seals; gasketing

### Heat Cure

**Type**

One- and two-part silicone elastomers

**Physical Form**

Nonflowing and flowable options; cures to flexible elastomer

**Special Properties**

Fast thermal cure; resists humidity and other harsh environments; good dielectric properties; self-priming adhesion; low stress

**Potential Uses**

Lid and housing seals; gasketing

<b>Dow Corning® brand Product</b>	<b>Description</b>	<b>Features</b>
<b>One-Part Moisture Cure RTV</b>		
838 and 839 Silicone Adhesive/Sealants	Nonflowing; good strength; general purpose; 838 is white; 839 is translucent blue	One-part; noncorrosive silicone; room temperature cure requires moisture
3165 Fast Tack RTV Adhesive/Sealant	Nonflowing; fast tack-free cure with good green strength; good room temperature adhesion to most substrates	One-part; noncorrosive silicone; room temperature cure requires moisture
3145 Silicone Adhesive	Nonflowing; translucent or gray versions; high tensile, elongation, peel and lap shear values; useful for Mil Spec applications; 3145 Clear contains UV indicator for automated inspection; 3145 Gray particularly good for high temperature applications	One-part; noncorrosive silicone; room temperature cure requires moisture
3140 RTV Coating	Flowable; translucent; good cured strength ; contains UV indicator for automated inspection	One-part; noncorrosive silicone; room temperature cure requires moisture
3-1744 Conformal Coating	Flowable; translucent; fast tack over and cure; contains UV indicator for automated inspection	One-part; noncorrosive silicone; room temperature cure requires moisture
<b>Two-Part Room Temperature Condensation Cure</b>		
Q3-6093 Silicone Adhesive	Rapid room temperature and deep section cure; good green strength; nonflow; self-priming adhesion; good room temperature adhesion to most substrates	Two-part; 10:1 mix; noncorrosive
<b>Heat Cure</b>		
577 Primerless Silicone Adhesive	Rapid heat cure; good flow; self-priming adhesion; gray	Two-part; 10:1 mix; noncorrosive
3-6876 Primerless Silicone Adhesive	Rapid heat cure; good flow; self-priming adhesion; gray or black	One-part; noncorrosive
3-6611 Primerless Silicone Adhesive	Rapid heat cure; moderate flow; self-priming adhesion; gray or black	One-part; noncorrosive
3-6265 Primerless Silicone Adhesive	Rapid heat cure; nonflow; self-priming adhesion; black; contains UV indicator for automated inspection	One-part; noncorrosive

<b>Dow Corning® brand Product</b>	<b>Potential Uses</b>	<b>Application Methods</b>
<b>One-Part Moisture Cure RTV</b>		
838 and 839 Silicone Adhesive/Sealants	Sealing openings in modules and housings; adding mechanical stability to individual components; assembly of components on PWBs; sealing in and around wires and electrical leads; yoke assembly	Manual or automated extrusion from cartridge
3165 Fast Tack RTV Adhesive/Sealant		
3145 Silicone Adhesive		
3140 RTV Coating	Sealing lids and housings where grooves or other configurations support a flowable material or where limited flow is desired.	Manual or automated extrusion from cartridge or bulk container
3-1744 Conformal Coating		
<b>Two-Part Room Temperature Condensation Cure</b>		
Q3-6093 Silicone Adhesive	Sealing lids and housings; attaching baseplates; gasketing	Automated, two-part airless mix equipment
<b>Heat Cure</b>		
577 Primerless Silicone Adhesive	Sealing lids and housings; attaching baseplates; gasketing; connector sealing	Automated, two-part airless mix equipment; hand mix and de-air
3-6876 Primerless Silicone Adhesive		Automated dispense through syringe needle from pressure pot reservoir; hand extrusion from cartridge
3-6611 Primerless Silicone Adhesive		
3-6265 Primerless Silicone Adhesive		

## TYPICAL PROPERTIES

These values are not intended for use in preparing specifications.

Dow Corning® brand Product	One or Two Part	Color	Viscosity/Flowability, centipoise or mPas	Extrusion Rate, g/min	Durometer	Tensile Strength			Elongation, percent	Specific Gravity, uncured	Working Time at RT <sup>1</sup>	Tack Free Time at RT, minutes	Cure Time at RT, hours	Unprimed Adhesion, Lap Shear		
						psi	MPa	kgf/cm <sup>2</sup>						psi	MPa	kgf/cm <sup>2</sup>
One-Part Moisture Cure RTV																
838 Silicone Adhesive/Sealant	1	White	Nonflow	220	28 A	230	1.6	16.2	430	1.02	-	45	48	140	1.0	9.8
839 Silicone Adhesive/Sealant	1	Translucent Blue	Nonflow	220	28 A	250	1.7	17.6	350	1.02	-	35	48	140	1.0	9.8
3165 Fast Tack RTV Adhesive/Sealant	1	Gray	Nonflow	200	35 A	170	1.2	11.9	185	1.28	-	4	24	200	1.4	14.1
3145 Silicone Adhesive	1	Gray or translucent	Nonflow	125	50 A	1000	6.9	70.3	660	1.12	-	70	48	-	-	-
3140 RTV Coating	1	Translucent	30,000	NA	32 A	450	3.1	31.6	425	1.03	-	70	72	-	-	-
3-1744 Conformal Coating	1	Translucent	60,000	NA	35 A	-	-	-	-	1.04	-	15	24	175	1.2	12.3
Two-Part Room Temperature Condensation Cure																
Q3-6093 Silicone Adhesive	2	Black	Nonflow	-	45 A	250	1.7	17.6	225	1.37	<20 min.	-	90 min.	230	1.6	16.2
Heat Cure																
577 Primerless Silicone Adhesive	2	Gray	66,000	-	63 A	950	6.5	66.8	200	1.30	>12 hr.	NA	NA	875	6.0	61.5
3-6876 Primerless Silicone Adhesive	1	Gray or black	36,000	-	52 A	800	5.5	56.2	265	1.31	NA	NA	NA	625	4.3	43.9
3-6611 Primerless Silicone Adhesive	1	Gray or black	85,000	-	60 A	850	5.9	59.8	240	1.31	NA	NA	NA	790	5.4	55.5
3-6265 Primerless Silicone Adhesive	1	Black	Nonflow	-	68 A	-	-	-	-	1.34	NA	NA	NA	550	3.8	38.7

<sup>1</sup>Time to double initial mixed viscosity.

**Specification Writers: Please obtain copies of the Dow Corning Sales Specifications for these products and use them as a basis for your specifications. They may be obtained from any Dow Corning Sales Office, or from Dow Corning Customer Service in Midland, MI. Call (517) 496-6000.**

Dow Corning® brand Product	Unprimed Adhesion, Peel Strength			Thermal Conductivity		Linear Coefficient of Thermal Expansion, micron/m °C or ppm	Shelf Life from Date of Manufacture, months	Dielectric Strength		Dielectric Constant at 100 Hz	Dielectric Constant at 100 kHz	Dissipation Factor at 100 Hz	Dissipation Factor at 100 kHz	Volume Resistivity, ohm-cm
	ppi	kN/m	kgf/cm	Watt/meter-K	cal/cm·sec·°C			volts/mil	kV/mm					
One-Part Moisture Cure RTV														
838 Silicone Adhesive/Sealant	30	5.3	5.4	0.18	4.3 x 10 <sup>-4</sup>	380	24 at <32°C	490	19.3	2.64	2.63	<0.001	<0.001	2.2 x 10 <sup>15</sup>
839 Silicone Adhesive/Sealant	30	5.3	5.4	0.18	4.3 x 10 <sup>-4</sup>	300	24 at <32°C	480	18.9	2.51	2.49	<0.001	<0.001	2.5 x 10 <sup>14</sup>
3165 Fast Tack RTV Adhesive/Sealant	-	-	-	-	-	250	12 at <32°C	505	19.9	2.22	2.38	0.003	<0.001	2.4 x 10 <sup>15</sup>
3145 Silicone Adhesive	75	13.2	13.4	0.18	4.3 x 10 <sup>-4</sup>	350	12 at <32°C	510	20.1	2.83	2.83	<0.001	<0.001	4.4 x 10 <sup>14</sup>
3140 RTV Coating	33.5	5.9	6.0	0.18	4.3 x 10 <sup>-4</sup>	315	12 at <32°C	445	17.5	2.52	2.52	0.004	0.001	2.1 x 10 <sup>14</sup>
3-1744 Conformal Coating	-	-	-	0.18	4.3 x 10 <sup>-4</sup>	360	12 at RT	590	23.2	2.32	2.29	0.001	<0.001	2.5 x 10 <sup>15</sup>
Two-Part Room Temperature Condensation Cure														
Q3-6093 Silicone Adhesive	10	1.8	1.8	0.31	7.4 x 10 <sup>-4</sup>	285	12 at RT	510	20.1	3.38	3.28	0.0095	<0.002	7.3 x 10 <sup>14</sup>
Heat Cure														
577 Primerless Silicone Adhesive	-	-	-	-	-	300	12 at <32°C	490	19.3	2.83	2.78	0.0065	<0.001	1.3 x 10 <sup>15</sup>
3-6876 Primerless Silicone Adhesive	-	-	-	0.32	7.6 x 10 <sup>-4</sup>	-	12 at <4°C	530	20.9	2.81	2.78	0.008	<0.001	1.0 x 10 <sup>14</sup>
3-6611 Primerless Silicone Adhesive	-	-	-	0.32	7.6 x 10 <sup>-4</sup>	260	12 at <4°C	350	13.8	3.05	2.98	0.012	0.0038	1.6 x 10 <sup>14</sup>
3-6265 Primerless Silicone Adhesive	-	-	-	0.35	8.4 x 10 <sup>-4</sup>	270	12 at <4°C	535	21.1	2.94	2.89	0.009	<0.001	4.7 x 10 <sup>14</sup>

#### HEAT CURE TIMES

Dow Corning® brand Product	Heat Cure Time	
	at 125°C (257°F), minutes	at 150°C (302°F), minutes
577 Primerless Silicone Adhesive	60	-
3-6876 Primerless Silicone Adhesive	60	30
3-6611 Primerless Silicone Adhesive	60	30
3-6265 Primerless Silicone Adhesive	60	30

## CURE CONDITIONS

### One-Part Moisture Cure RTV

The one-part moisture cure adhesives (838, 839, 3165, 3145, 3140 and 3-1744) are generally cured at room temperature and in a range of 30 to 80 percent relative humidity. Greater than 90 percent of their full physical properties should be attained within 24 to 72 hours depending on the product chosen. Materials and parts can be handled in much shorter times of about 10 to 120 minutes depending on the product chosen and the amount of material used per part. These materials are not typically used for highly confined or deep section cures. Materials will generally cure about 0.25 inch per seven days from any exposed surface. Cure progresses from the outer surface and is dependent on the moisture in the air. Working time is generally a few minutes to an hour for these products until a surface skin begins to form. Mild heat acceleration of the cure rate may be possible but temperatures above 60°C (140°F) are not recommended.

### Two-Part Room Temperature Condensation Cure

*Dow Corning*<sup>®</sup> Q3-6093 Silicone Adhesive is the only two-part condensation curing product. Once mixed, cure progresses rapidly at room temperature. Good strength is attained within an hour but full properties are not reached for a number of days. Q3-6093 adhesive contains its own source of moisture and cure progresses evenly throughout the material. Deep section or confined cures are possible however (see “Reversion”). Working time is only a few minutes.

### Heat Cure

The addition curing adhesives (577, 3-6876, 3-6611 and 3-6265) should be cured at 100°C (212°F) or above. The cure rate is rapidly accelerated with heat (see cure schedules

in table). For thicker sections or if voiding is observed, a 30 minutes pre-cure at 70°C (158°F) may reduce voids in the elastomer. Addition-curing materials contain all the ingredients needed for cure with no byproducts from the cure mechanism. Deep section or confined cures are possible. Cure progresses evenly throughout the material. These adhesives generally have long working times.

### **PREPARING SURFACES**

All surfaces should be thoroughly cleaned and/or degreased with *Dow Corning*<sup>®</sup> brand OS Fluids, naphtha, mineral spirits, methyl ethyl ketone (MEK) or other suitable solvent. Solvents such as acetone or isopropyl alcohol (IPA) do not tend to remove oils well, and any oils remaining on the surface may interfere with adhesion. Light surface abrasion is recommended whenever possible, because it promotes good cleaning and increases the surface area for bonding. A final surface wipe with acetone or IPA is also useful. Different cleaning techniques may give better results than others. Users should determine the best techniques for their applications.

### **ADHESION**

*Dow Corning* silicone adhesives are specially formulated to provide unprimed adhesion to many reactive metals, ceramics and glass, as well as to selected laminates, resins and plastics. However, good adhesion cannot be expected on nonreactive metal substrates or non-reactive plastic surfaces such as *Teflon*<sup>®</sup>, polyethylene or polypropylene. Special surface treatments such as chemical etching or plasma treatment can sometimes provide a reactive surface and promote adhesion to these types of substrates. *Dow Corning*<sup>®</sup> brand primers (see “Primer Selection Guide”) can be used to increase the chemical activity on difficult substrates.

## PRIMER SELECTION GUIDE

These values are not intended for use in preparing specifications.

<i>Dow Corning</i> <sup>®</sup> brand Primer or Adhesion Promoter	Flash Point, °C (°F)	Volatile Organic Content (VOC), grams/ liter <sup>4</sup>	Special Properties	For Use On	For Use With	Silicone Product Examples
P5200 Clear <sup>1</sup>	32 (90)	110/705				
1200 Clear	17 (63)	748	Colored for easier identification	Most metals, glass, ceramics and some plastics	Pigmented two-part addition cure	160, 165, 170
1200 Red	17 (63)	774				
P5200 Red <sup>2</sup>	32 (90)	110/705				
1204	15 (59)	774		Most metals, glass and ceramics	All one-part alcohol cure	3140, 3145, 838, 3-1753
P5204 <sup>3</sup>	18 (64)	205/591				
1205	5 (41)	861	Film-forming	Most plastics	All	
3-6060	37 (99)	780	Improves inhibition resistance	Most plastics and metals	All two-part addition cure	182, 184, 186
92-023	-4 (25)	678				
<i>Sylgard</i> <sup>®</sup> Prime Coat	-3 (27)	687				

<sup>1</sup>P5200 Clear is a low-VOC alternative to 1200 Clear.

<sup>2</sup>P5200 Red is a low-VOC alternative to 1200 Red.

<sup>3</sup>P5204 is a low-VOC alternative to 1204.

<sup>4</sup>The lower VOC value is for states and air quality management districts that have recognized volatile methylsiloxanes as VOC exempt.

## LISTINGS AND SPECIFICATIONS

Dow Corning® brand Product	UL Reference		Mil Spec	
	Flammability Classification	Temperature Index, °C Electrical/Mechanical	Specification	Type, Class, Group
One-Part Moisture Cure RTV				
838 Silicone Adhesive/Sealant	94 HB	105/105	–	–
839 Silicone Adhesive/Sealant	–	–	–	–
3165 Fast Tack RTV Adhesive/Sealant	94 V-0	105/105	–	–
3145 Silicone Adhesive	–	180/180 <sup>1</sup> 200/200 <sup>2</sup>	MIL-A-46146 Rev. B, Amend. 3	Type I, Group II, CERT (clear); Group III, CERT (gray)
3140 RTV Coating	94 V-1	180/180	MIL-A-46146 Rev. B, Amend. 3	Type II, Group I, CERT
3-1744 Conformal Coating	94 V-0 <sup>3</sup>	105/105	–	–
Two-Part Room Temperature Condensation Cure				
Q3-6093 Silicone Adhesive	–	–	–	–
Heat Cure				
577 Primerless Silicone Adhesive	94 V-0	105/105	MIL-PRF-23586F (Grade B2)	Type II, Class IV, QPL
3-6876 Primerless Silicone Adhesive	–	–	–	–
3-6611 Primerless Silicone Adhesive	–	–	–	–
3-6265 Primerless Silicone Adhesive	–	–	–	–

<sup>1</sup>Clear only.

<sup>2</sup>Gray only.

<sup>3</sup>UL746C Approved.

Poor adhesion may be experienced on plastic or rubber substrates that are highly plasticized, because the mobile plasticizers act as release agents. Small-scale laboratory evaluation of all substrates is recommended before production trials are made.

In general, increasing the cure temperature and/or cure time will improve the ultimate adhesion.

### SUBSTRATE TESTING

Due to the wide variety of substrate types and differences in substrate surface conditions, general statements on adhesion and bond strength are impossible. To ensure maximum bond strength on a particular substrate, 100 percent cohesive failure of the adhesive in a lap shear or similar adhesive strength test is desired. This ensures compatibility of the adhesive with the substrate being considered. Also, this test can be used to determine minimum cure time or can detect the presence of surface contaminants such as mold release agents, oils, greases and oxide films.

### USEFUL TEMPERATURE RANGES

For most uses, silicone elastomers should be operational over a temperature range of -45 to 200°C (-49 to 392°F) for long periods of time. However, at both the low and high temperature ends of the spectrum, behavior of the materials and performance in particular applications can become more complex and require additional considerations.

For low-temperature performance, thermal cycling to conditions such as -55°C (-67°F) may be possible, but performance should be verified for your parts or assemblies. Factors that may influence performance are configuration and stress sensitivity of components, cooling rates and hold times, and prior temperature history.

At the high-temperature end, the durability of the cured silicone elastomer is time and temperature dependent. As expected, the higher the temperature, the shorter the time the material will remain useable.

### COMPATIBILITY

Certain materials, chemicals, curing agents and plasticizers can inhibit the cure of addition cure adhesives. Most notable of these include:

- Organotin and other organometallic compounds
- Silicone rubber containing organotin catalyst
- Sulfur, polysulfides, polysulfones or other sulfur-containing materials
- Amines, urethanes or amine-containing materials
- Unsaturated hydrocarbon plasticizers
- Some solder flux residues

If a substrate or material is questionable with respect to potentially causing inhibition of cure, it is recommended that a small scale compatibility test be run to ascertain suitability in a given application. The presence of liquid or uncured product at the interface between the questionable substrate and the cured gel indicates incompatibility and inhibition of cure.

### MIXING AND DE-AIRING

Upon standing, some filler may settle to the bottom of the liquid containers after several weeks. To ensure a uniform product mix, the material in each container should be thoroughly mixed prior to use.

Two-part materials should be mixed in the proper ratio (1:1 or 10:1) either by weight or volume. The presence of light colored streaks or marbling indicates inadequate mixing.

Automated airless dispense equipment can be used to reduce or avoid the need to de-air. If de-airing is required to reduce voids in the cured elastomer, consider a vacuum de-air schedule of >28 inches Hg for 10 minutes or until bubbling subsides.

### REVERSION

When two-part condensation curing materials with organotin catalysts, such as Q3-6093 adhesive, are cured in confinement (especially in deep section) and are later subjected to high heat conditions, can potentially revert back from a cured elastomer to a flowable polymer. Although this condition is unusual, parts using Q3-6093 adhesive should be thoroughly tested in accelerated temperature conditions for this potential limitation.

### SOLVENT EXPOSURE

When liquid or vapor solvent or fuel exposure can occur in an application, the silicone adhesives discussed in this brochure are intended only to survive splash or intermittent exposures. They are not suited for continuous solvent or fuel exposure. Testing should be done to confirm performance of the adhesives under these conditions.

### STORAGE AND SHELF LIFE

Shelf life is indicated by the "Use Before" date found on the product label.

For best results, *Dow Corning* RTV adhesives should be stored at or below 25°C (77°F). Special precautions must be taken to prevent moisture from contacting these materials. Containers should be kept tightly closed and head or air space minimized. Partially filled containers should be purged with dry air or other gases, such as nitrogen.

*Dow Corning* heat-cure adhesives should also be stored at or below 25°C (77°C). Containers should be kept tightly closed and kept in cold storage at all times to extend shelf life.

### LIMITATIONS

These products are neither tested nor represented as suitable for medical or pharmaceutical uses.

### PACKAGING

In general, *Dow Corning* adhesives/sealants are supplied in nominal 0.45-, 3.6-, 18- and 200-kg (1-, 8-, 40- and 440-lb) containers, net weight. Not all products may be available in all packages and some additional packages, such as a bladder packs or tubes, may be available for certain coatings and package sizes.

### SAFE HANDLING INFORMATION

PRODUCT SAFETY INFORMATION REQUIRED FOR SAFE USE IS NOT INCLUDED. BEFORE HANDLING, READ PRODUCT AND MATERIAL SAFETY DATA SHEETS AND CONTAINER LABELS FOR SAFE USE, PHYSICAL AND HEALTH HAZARD INFORMATION. THE MATERIAL SAFETY DATA SHEET IS AVAILABLE FROM YOUR DOW CORNING REPRESENTATIVE, OR DISTRIBUTOR, OR BY WRITING TO DOW CORNING CUSTOMER SERVICE, OR BY CALLING (517) 496-6000.

### WARRANTY INFORMATION – PLEASE READ CAREFULLY

The information contained herein is offered in good faith and is believed to be accurate. However, because conditions and methods of use of our products are beyond our control, this information should not be used in substitution for customer's tests to ensure that Dow Corning's products are safe, effective, and fully satisfactory for the intended end use. Dow Corning's sole warranty is that the product will meet the Dow Corning sales specifications in effect at the time of shipment. Your exclusive remedy for breach of such warranty is limited to refund of purchase price or replacement of any product shown to be other than as warranted. Dow Corning specifically disclaims any other express or implied warranty of fitness for a particular purpose or merchantability. Unless Dow Corning provides you with a specific, duly signed endorsement of fitness for use, Dow Corning disclaims liability for any incidental or consequential damages. Suggestions of uses should not be taken as inducements to infringe any particular patent.

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