

Information About *Dow Corning*[®] brand Dielectric Gels

Silicones and Electronics

Long-term, reliable protection of sensitive circuits and components is becoming more 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.

Gels are very soft and cure in place to form a cushioning, self-healing, resilient gelled material. Cured gels retain much of the stress relief and self-healing qualities of a liquid while developing the dimensional stability of an elastomer.

Dow Corning offers a line of standard gels, a line of gels for applications requiring low temperature performance and a line of toughened gels for use where chemical adhesion and dimensional stability is required. Dow Corning also has a line of specialty gels including UV-curable and solvent/fuel resistant fluorosilicone gels.

Standard Gels
<p>Type Two-part; variety of cure speeds</p> <p>Physical Form 1:1 mix ratio; various viscosities</p> <p>Special Properties Heat accelerable; operating temperature -45 to 150°C (-49 to 302°F)</p> <p>Potential Uses Seal, protect, preserve electrical characteristics of micro- and macro-electronic devices</p>
Low Temperature Gels
<p>Type One and two part</p> <p>Physical Form 1:1 mix ratio; various viscosities</p> <p>Special Properties Operating temperature -80 to 200°C (-112 to 392°F)</p> <p>Potential Uses Seal, protect, preserve electrical characteristics of micro- and macro-electronic devices requiring low temperature performance</p>
Toughened Gels
<p>Type Two part; fast room-temperature cure</p> <p>Physical Form 1:1 mix ratio; low viscosity</p> <p>Special Properties Chemical adhesion; elastomeric gels; operating temperature -45 to 150°C (-49 to 302°F)</p> <p>Potential Uses Seal, protect, preserve electrical characteristics of micro- and macro-electronic devices requiring stronger adhesion or dimensional stability</p>

Dow Corning® brand Product	Description	Features
Standard Gels		
527 Dielectric Gel	Two-part heat cure material; low viscosity; transparent	Extremely soft, gel-like material; provides thermal/mechanical shock and vibration damping; excellent electrical properties; flexible cure schedule; reversion resistant; thick section cure; physical and electrical stability over wide temperature range -45 to 150°C (-49 to 302°F)
3-4150 Dielectric Gel	Two-part fast RT cure material; low viscosity	
3-4154 Dielectric Gel	Two-part RT cure material; low viscosity; transparent	
3-6636 Dielectric Gel	Two-part RT cure material; high viscosity; transparent	
Low Temperature Gels		
3-4155HV Dielectric Gel	Two-part very fast RT cure material; it has a lower operating temperature of -80°C(-112°F); high viscosity	Extremely soft, gel-like material; provides thermal/mechanical shock and vibration damping; excellent electrical properties; flexible cure schedule; reversion resistant; low viscosity; thick section cure; physical and electrical stability over widest temperature range -80 to 200°C (-112 to 392°F)
3-6575 Dielectric Gel	Two-part RT cure material; low temperature (-80°C/-112°F) stability; transparent	
3-6635 Dielectric Gel	One-part heat cure material; low temperature (-80°C/-112°F) stability; transparent; high viscosity	
Toughened Gels		
3-4207 "Tough Gel" Dielectric Elastomer	Two-part tough gel; fast RT cure; primerless adhesion; UL 94 V-1 flammability classification	Excellent room temperature adhesion; good dielectric properties; tough elastomeric gel; designed for use with automated dispensing equipment; temperature range -45 to 150°C (-49 to 302°F)
3-4219 "Firm Gel" Dielectric Gel	Two-part firm gel; fast RT cure; primerless adhesion; clear	
3-4220 "Firm Gel" Dielectric Gel	Two-part firm gel; fast RT cure; primerless adhesion; UV indicator	
Specialty Gels		
3-6211 Dielectric Gel	One-part UV cure material	Extremely soft, gel-like material; provides thermal/mechanical shock and vibration damping; excellent electrical properties; flexible cure schedule; reversion resistant; low viscosity; thick section cure; physical and electrical stability over wide temperature range -80 to 150°C (-112 to 302°F)
3-6679 Dielectric Gel	Two-part gel; fuel and solvent resistant	Transparent; primerless encapsulant; cures to a soft, gel-like mass; seals and protects while preserving electrical characteristics; stable over a wide temperature range -70 to 150°C (-94 to 302°F)
4-8022 Dielectric Gel	One-part heat cure material; fuel and solvent resistant	

Dow Corning® brand Product	Potential Uses
527 Dielectric Gel	Sealing and protecting delicate electronic circuits and hybrid devices; sealing small appliances; impregnating capacitors; extremely low stress encapsulating and potting of electronic circuits and assemblies
3-4150 Dielectric Gel	
3-4154 Dielectric Gel	
3-6636 Dielectric Gel	
3-4155HV Dielectric Gel	Sealing and protecting delicate electronic circuits and hybrid devices; sealing small appliances; impregnating capacitors; extremely low stress encapsulating and potting of electronic circuits and assemblies requiring low temperature performance
3-6575 Dielectric Gel	
3-6635 Dielectric Gel	
3-4207 “Tough Gel” Dielectric Elastomer	Encapsulating, protecting and preserving both macro- and microelectronic devices that require dielectric insulation, moisture resistance, vibration damping or high- and low-temperature resistance
3-4219 “Firm Gel” Dielectric Gel	
3-4220 “Firm Gel” Dielectric Gel	
3-6211 Dielectric Gel	Sealing and protecting delicate electronic circuits and hybrid devices; sealing small appliances; impregnating capacitors; extremely low stress encapsulating and potting of electronic circuits and assemblies
3-6679 Dielectric Gel	Sealing, protecting and preserving electrical characteristics of microelectronics such as hybrid circuits in a fuel or solvent environment
4-8022 Dielectric Gel	

TYPICAL PROPERTIES

These values are not intended for use in preparing specifications.

<i>Dow Corning</i> [®] brand Product	Product Form	Color	Viscosity, centipoise or mPa·s	Penetration, 1/10 of mm	Gel Hardness, g	Specific Gravity, uncured	Working Time, minutes
Standard Gels							
527 Dielectric Gel	Two-part RT/heat cure	Clear	425	45	115	0.97	90
3-4150 Dielectric Gel	Two-part RT/heat cure	Transparent Green	475	50	107	0.97	7
3-4154 Dielectric Gel	Two-part RT/heat cure	Clear	545	45	120	0.97	30
3-6636 Dielectric Gel	Two-part RT/heat cure	Clear	3250	55	100	0.97	30
Low Temperature Gels							
3-4155HV Dielectric Gel	Two-part RT cure	Transparent Green	1930	85	65	1.00	<5
3-6575 Dielectric Gel	Two-part RT/heat cure	Clear	740	80	70	1.02	20
3-6635 Dielectric Gel	One-part heat cure	Clear	715	70	75	1.02	NA
Toughened Gels							
3-4207 "Tough Gel" Dielectric Gel	Two-part RT cure	Translucent Green	425	62 Shore OO ¹	—	0.97	<10
3-4219 "Firm Gel" Dielectric Gel	Two-part RT cure	Clear	350	14 Shore OO ¹	—	0.97	<10
3-4220 "Firm Gel" Dielectric Gel	Two-part RT cure	Translucent Green	350	14 Shore OO ¹	—	0.97	<10
Specialty Gels							
3-6211 Dielectric Gel	One-part UV cure	Clear	930	45	120	—	NA
3-6679 Dielectric Gel	Two-part RT/heat cure	Clear	1150	30	185	1.26	>240
4-8022 Dielectric Gel	One-part heat cure	Translucent	700	110	50	1.22	1 month

¹Measured by durometer rather than penetration.

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	Room Temperature Cure Time ²	Heat Cure Time ² , minutes	Dielectric Strength		Dielectric Constant at 100Hz/ 100 kHz	Volume Resistivity, ohm-cm	Dissipation Factor at 100 Hz/ 100 kHz	Shelf Life ³ , months
			volts/ mil	kV/ mm				
Standard Gels								
527 Dielectric Gel	24 hr/>1 week	30/200 @ 100°C 20/75 @ 125°C 10/35 @ 150°C	385	15.1	2.85/2.85	7.0 x 10 ¹⁵	0.002/ <0.001	12
3-4150 Dielectric Gel	45 min/90 min	NA	385	15.1	2.85/2.85	7.0 x 10 ¹⁵	0.002/ <0.001	12
3-4154 Dielectric Gel	4 hr/-	20/180 @ 80°C 10/105 @ 100°C	450	17.7	2.87/2.87	1.05 x 10 ¹⁵	0.003/ <0.001	12
3-6636 Dielectric Gel	3 hr/24 hr	20/180 @ 70°C 10/45 @ 100°C	415	16.3	2.85/2.86	1.1 x 10 ¹⁵	0.0027/ <0.001	12
Low Temperature Gels								
3-4155HV Dielectric Gel	30 min/60 min	NA	400	15.7	2.96/2.96	2.8 x 10 ¹⁴	0.02/<0.001	12
3-6575 Dielectric Gel	5 hr/24 hr	20/40 @ 70°C 10/20 @ 100°C	—	—	—	1.8 x 10 ¹⁵	—	12
3-6635 Dielectric Gel	NA	20/50 @ 125°C	520	20.5	2.83/2.84	4.8 x 10 ¹³	<0.001/ <0.001	6
Toughened Gels								
3-4207 “Tough Gel” Dielectric Gel	15 min/90 min	NA	420	16.5	2.85/2.86	7.1 x 10 ¹³	0.03/<0.001	6
3-4219 “Firm Gel” Dielectric Gel	20 min/60 min	NA	—	—	2.98/2.96	7.1 x 10 ¹³	0.04/<0.001	12
3-4220 “Firm Gel” Dielectric Gel	20 min/60 min	NA	540	21.3	2.90/2.93	5.2 x 10 ¹³	0.004/0.003	12
Specialty Gels								
3-6211 Dielectric Gel	< 5 sec ⁴	NA	—	—	—	—	—	12
3-6679 Dielectric Gel	24 hr/>1 week	20/120 @ 100°C	—	—	7.16/7.12	1.95 x 10 ¹²	0.0093/ 0.004	12
4-8022 Dielectric Gel	NA	-/60 @ 125°C ⁵ -/30 @ 150°C	375	14.8	7.09/7.1	1.2 x 10 ¹²	0.055/0.003	9 @ <4°C

²Time to initial non-flow state/time to 90 percent of final value; 80 gram sample.

³Shelf life from date of manufacture at room temperature.

⁴25 gram sample cured at 3,000 mjoules/cm².

⁵5 gram sample size.

HOW TO USE

Mixing Two-Part Gels

Dow Corning silicone gels are supplied in two parts that are typically lot-matched. They are mixed in a 1:1 ratio by weight or volume, which simplifies the proportioning process.

Due to the fast-curing characteristic of some gels, automated mix and dispense equipment should be used. In some applications, deairing of the material with >28 inches Hg vacuum may be necessary to get bubble-free encapsulation.

Working Time

The cure reaction begins when Part A and Part B are mixed. Cure is evidenced by an increase in viscosity followed by formation of a soft gel. Working time (or pot life) is the time for the initial mixed viscosity to double.

Curing

Thoroughly mixed *Dow Corning* silicone gel may be poured or dispensed directly into the unit in which it will be cured. Care should be taken to minimize air entrapment, especially with fast room-temperature curing gels. To optimize bubble-free encapsulation, vacuum processing may be used.

Silicone gels may be either room-temperature or heat cured. Room-temperature cure gels may also be heat accelerated for faster cure. Cure conditions for each product are shown in the Typical Properties table.

USEFUL TEMPERATURE RANGES

For most uses, silicone gels should be operational over a temperature range of -45 to 150°C (-49 to 302°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. There are specialized products that can perform at -65°C (-85°F) and below.

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.

REPAIRABILITY

In the manufacture of electronic devices it is often desirable to salvage or reclaim damaged or defective units. Removal of *Dow Corning* dielectric gels to allow necessary repairs can be assisted using *Dow Corning*[®] brand OS Fluids. Additional information regarding these products is available from Dow Corning. Digestive stripping agents such as AMTEX-CCR can also be used.

In addition, if only one circuit component is to be replaced, a soldering iron may be applied directly through the gel to remove the component.

After work has been completed, the repaired area should be cleaned with forced air or by brush, then dried and re-gelled with additional product.

COMPATIBILITY

Certain materials, chemicals, curing agents and plasticizers can inhibit the cure of *Dow Corning* dielectric gels. 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, a small scale compatibility test should 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.

STORAGE AND SHELF LIFE

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

LIMITATIONS

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

PACKAGING

In general, *Dow Corning* dielectric gels are available in kits containing both Part A and Part B components. Complete packages are generally supplied in nominal 0.45-, 3.6-, 18- and 200-kg (1-, 8-, 40- and 440-lb) containers, net weight. Not all gels may be available in all packages and some additional packages and package sizes may be available.

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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