# 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

**Type**
Two-part; variety of cure speeds

**Physical Form**
1:1 mix ratio; various viscosities

**Special Properties**
Heat accelerable; operating temperature -45 to 150°C (-49 to 302°F)

**Potential Uses**
Seal, protect, preserve electrical characteristics of micro- and macro-electronic devices

### Low Temperature Gels

**Type**
One and two part

**Physical Form**
1:1 mix ratio; various viscosities

**Special Properties**
Operating temperature -80 to 200°C (-112 to 392°F)

**Potential Uses**
Seal, protect, preserve electrical characteristics of micro- and macro-electronic devices requiring low temperature performance

### Toughened Gels

**Type**
Two part; fast room-temperature cure

**Physical Form**
1:1 mix ratio; low viscosity

**Special Properties**
Chemical adhesion; elastomeric gels; operating temperature -45 to 150°C (-49 to 302°F)

**Potential Uses**
Seal, protect, preserve electrical characteristics of micro- and macro-electronic devices requiring stronger adhesion or dimensional stability

| *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 temperture 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) stabiltiy; 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) |
| 3-4220 "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 | Encapsualting, protecting and preserving both macro- and microelectronic devices that require dielectric insulation, moisture resistance, vibration damping or high- and low-temperature resistance |
| 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.**

| *Dow Corning*® 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 |
| 3-4220 "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 |

[1]Measured 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<br>20/75 @ 125°C<br>10/35 @ 150°C | 385 | 15.1 | 2.85/2.85 | $7.0 \times 10^{15}$ | 0.002/ <0.001 | 12 |
| 3-4150 Dielectric Gel | 45 min/90 min | NA | 385 | 15.1 | 2.85/2.85 | $7.0 \times 10^{15}$ | 0.002/ <0.001 | 12 |
| 3-4154 Dielectric Gel | 4 hr/– | 20/180 @ 80°C<br>10/105 @ 100°C | 450 | 17.7 | 2.87/2.87 | $1.05 \times 10^{15}$ | 0.003/ <0.001 | 12 |
| 3-6636 Dielectric Gel | 3 hr/24 hr | 20/180 @ 70°C<br>10/45 @ 100°C | 415 | 16.3 | 2.85/2.86 | $1.1 \times 10^{15}$ | 0.0027/ <0.001 | 12 |
| Low Temperature Gels | | | | | | | | |
| 3-4155HV Dielectric Gel | 30 min/60 min | NA | 400 | 15.7 | 2.96/2.96 | $2.8 \times 10^{14}$ | 0.02/<0.001 | 12 |
| 3-6575 Dielectric Gel | 5 hr/24 hr | 20/40 @ 70°C<br>10/20 @ 100°C | — | — | — | $1.8 \times 10^{15}$ | — | 12 |
| 3-6635 Dielectric Gel | NA | 20/50 @ 125°C | 520 | 20.5 | 2.83/2.84 | $4.8 \times 10^{13}$ | <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 | $7.1 \times 10^{13}$ | 0.03/<0.001 | 6 |
| 3-4220 "Firm Gel" Dielectric Gel | 20 min/60 min | NA | 540 | 21.3 | 2.90/2.93 | $5.2 \times 10^{13}$ | 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 | $1.95 \times 10^{12}$ | 0.0093/ 0.004 | 12 |
| 4-8022 Dielectric Gel | NA | –/60 @ 125°C[5]<br>–/30 @ 150°C | 375 | 14.8 | 7.09/7.1 | $1.2 \times 10^{12}$ | 0.055/0.003 | 9 @ <4°C |

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

[3]Shelf life from date of manufacture at room temperature.

[4]25 gram sample cured at 3,000 mjoules/$cm^2$.

[5]5 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 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 sensitiviety 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 temperture 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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