

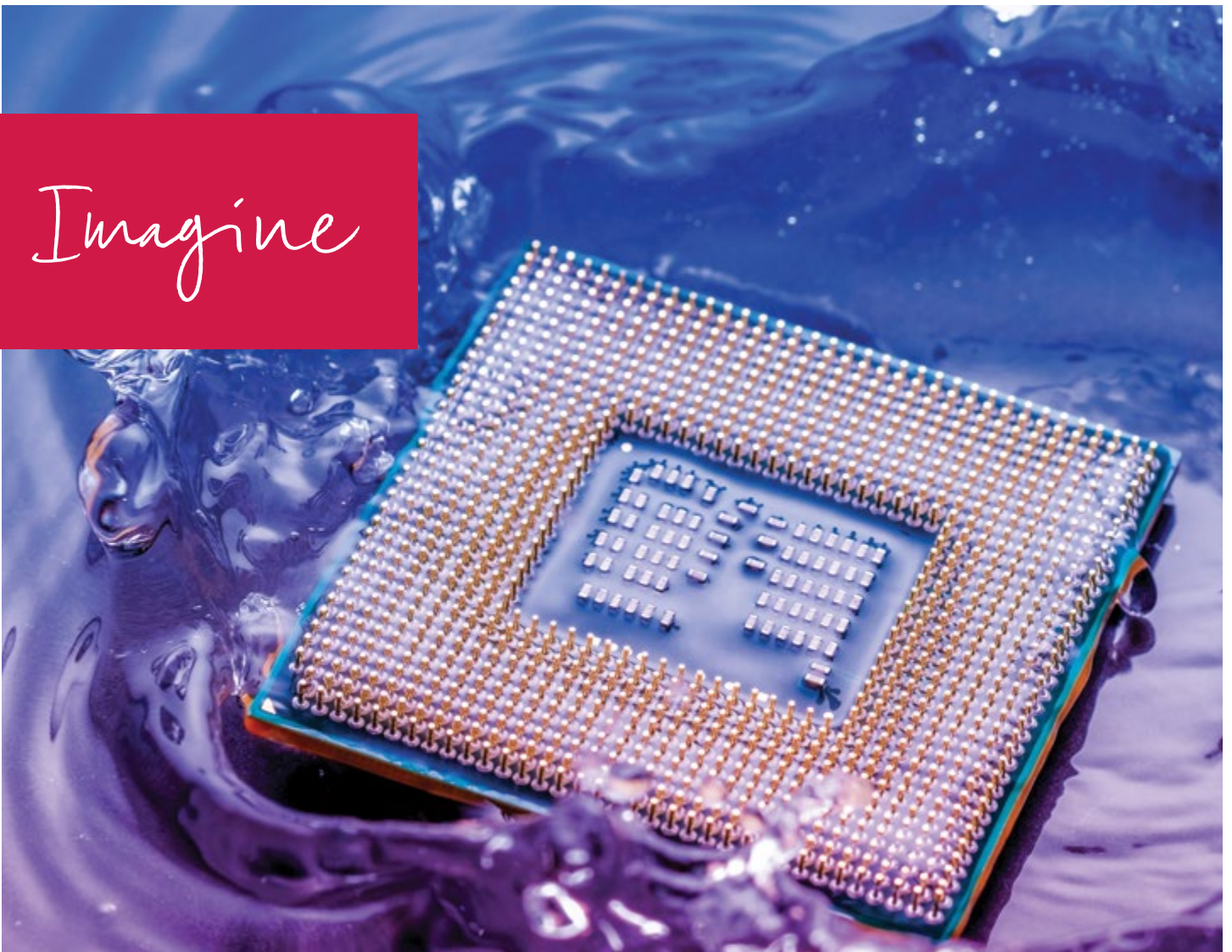


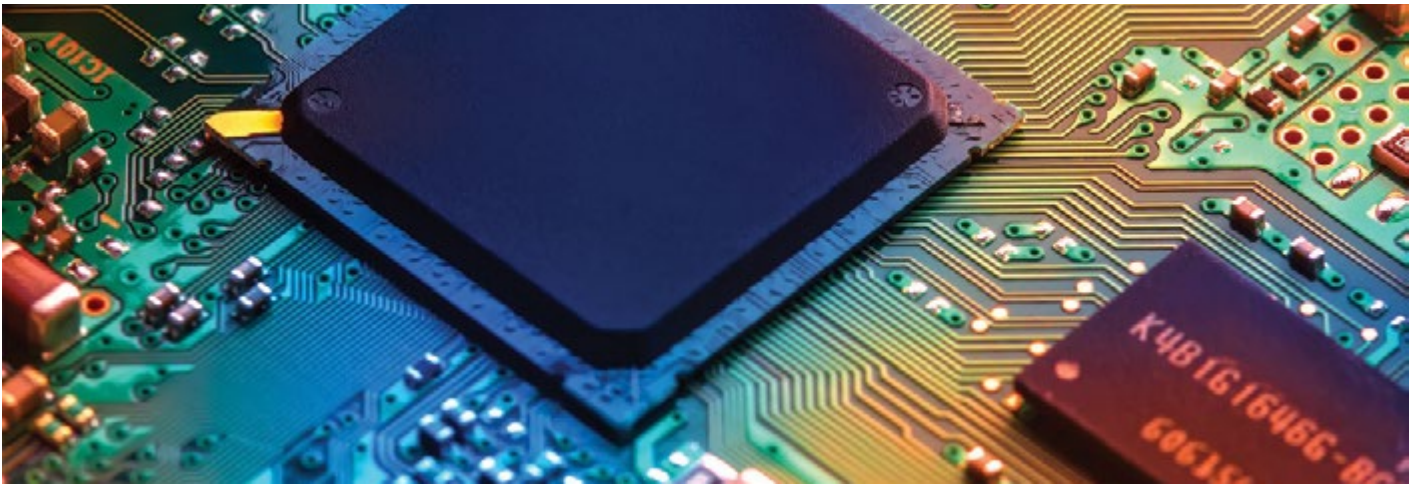
Encapsulants and Gels Selection Guide

# Minimizing Stress to Maximize Reliability with Proven Silicone Encapsulants and Gels

**DOW**SIL™

*Imagine*





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## Why Choose Dow Performance Silicones?

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Dow Performance Silicones has been a global leader in silicone-based technology for more than seventy years. Headquartered in Michigan, USA, we maintain manufacturing sites, sales and customer service offices, and research and development labs in every major geographic market worldwide to ensure you receive fast, reliable support for your processing and application development needs.

### Unique product technology

To describe Dow Performance Silicones is to describe the history and evolution of silicone technology, which generated a legacy of innovative and reliable products under the Dow Corning label for more than seven decades. Today that legacy continues under the DOWSIL™ brand name, which encompasses more than 7,000 proven silicone products and services. Few companies offer an encapsulant portfolio with comparable breadth and proven performance, and none match our history in silicone technology.

### Extensive know-how

Dow Performance Silicones multiplies the value of its products with deep in-house expertise and an extended network of industry resources.

### Collaborative culture

Dow Performance Silicones works closely with you to help reduce time and cost at every stage of your new product development.

### Stability

For over seven decades, Dow Performance Silicones has been a global leader who invests in manufacturing and quality to help fuel customer innovation through a consistent supply of proven silicone products.

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## Why Choose a Silicone Encapsulant or Gel versus a Conformal Coating?

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Encapsulants offer better protection and faster, simpler cure options than coatings when:

- PCB features and components are taller than 200 microns
- A PCB presents a more complicated landscape, or thin sensitive wires or solder joints



# Why Choose Silicones versus Organic-Based Encapsulants and Gels?

As a class of materials, silicones generally offer demonstrable benefits over urethane and epoxy solutions, including:

- Maximum protection – especially from silicone gels – against mechanical stress caused by thermal cycling or mismatched coefficient of thermal expansion
- Extraordinary protection against shock and vibration
- Superior thermal stability for more reliable performance at sustained temperatures between -45°C and 200°C
- Greater hydro-stability and stronger resistance to chemicals and UV radiation
- Reduce or eliminate special precautions related to typical safe-handling of organics
- Cure schedule variation of silicones impose a significantly lower impact on end properties
- Simpler processing without the need for oven drying or concerns about exotherms
- Ease of repair when module rework is necessary
- A wide selection range of special features, targeting multiple functions like thermal management, improved processing efficiency and others

# What's Best for Your Application, an Encapsulant or a Gel?

DOWSIL™ encapsulants and gels offer many of the same benefits, including excellent dielectric protection, strong seals against environmental contaminants, and excellent thermal stability and stress relief ranging from good to outstanding. Yet each material class offers distinguishing advantages.

Encapsulants	Gels
Greater resistance to abrasion and damage	Maximum stress relief
Easily repairable for rework	Self healing
Unique options for: <ul style="list-style-type: none"> <li>· Self-priming adhesion</li> <li>· Optical and space grade</li> <li>· Thermal management</li> </ul>	Unique options for: <ul style="list-style-type: none"> <li>· Solvent and fuel resistance</li> <li>· Rapid UV cure</li> </ul>



## Easy Processing

Most encapsulants and gels in our portfolio are two-part addition cure silicones that, as a class of materials, offer several processing advantages over organic materials. Silicones can help to reduce or eliminate special handling precautions required for organics related to their toxicity. Unlike urethanes, they do not require the costly use of ovens to thoroughly dry components before processing. Unlike epoxies, silicones impose no concerns about exotherms.

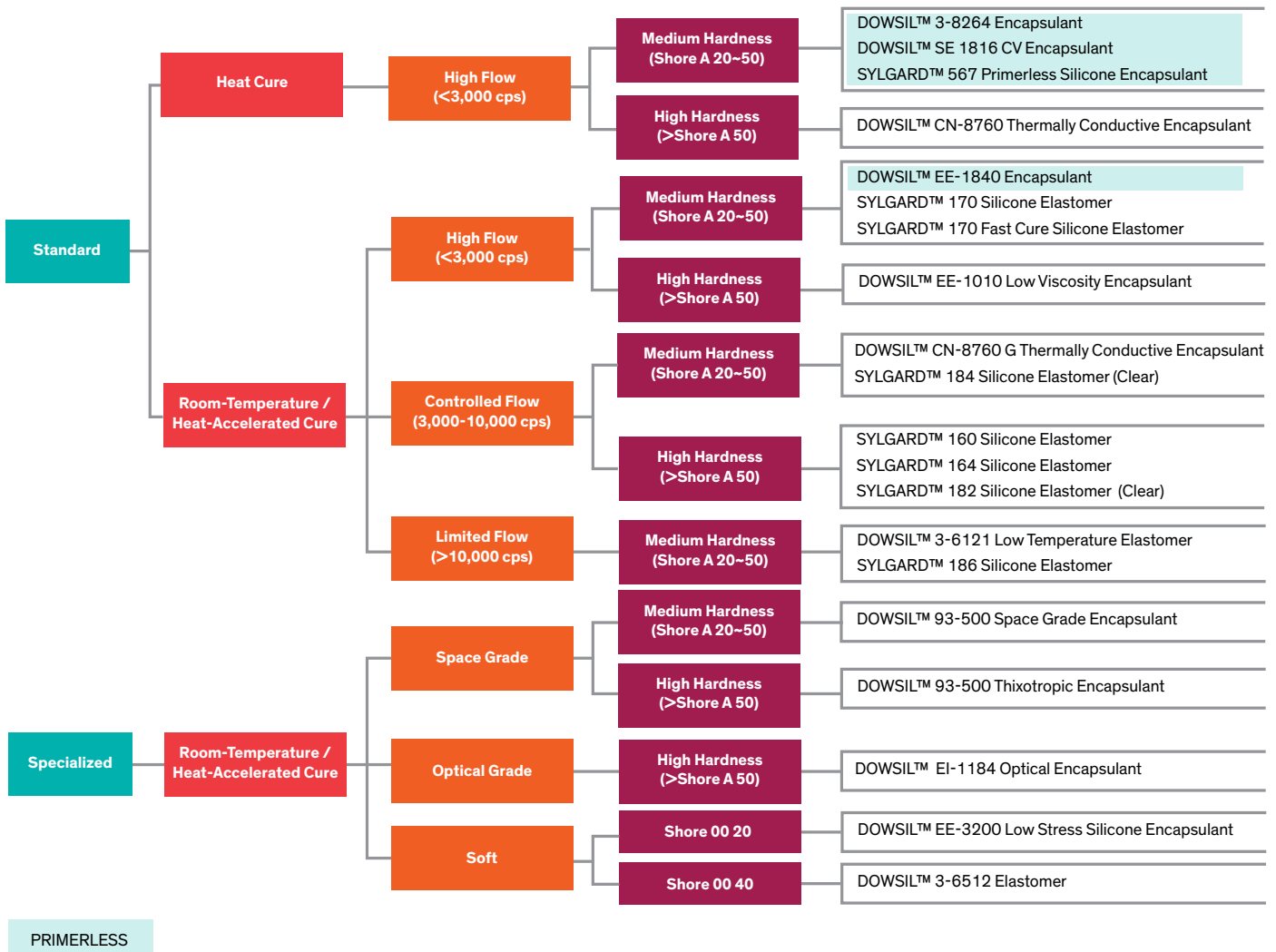
Dow Performance Silicones' portfolio of encapsulants and gels offers a wide variety of viscosities before cure, allowing either shorter cycle times or longer, more controlled flow according to your needs. Our broad selection also offers flexible options for simple, room-temperature cure or accelerated heat curing for enhanced productivity.

# Choosing an Encapsulant

Encapsulants from Dow Performance Silicones generally fall into three categories: standard, primerless self-adhering, and specialty grades. Standard encapsulants require a priming step if strong adhesion is needed for extra protection. In contrast, self-priming encapsulants adhere to many common surfaces when heated to temperatures above 100°C during the cure process. With hardness ranging from Shore 00 20 to Shore A 65, encapsulants from either category offer a versatile selection of

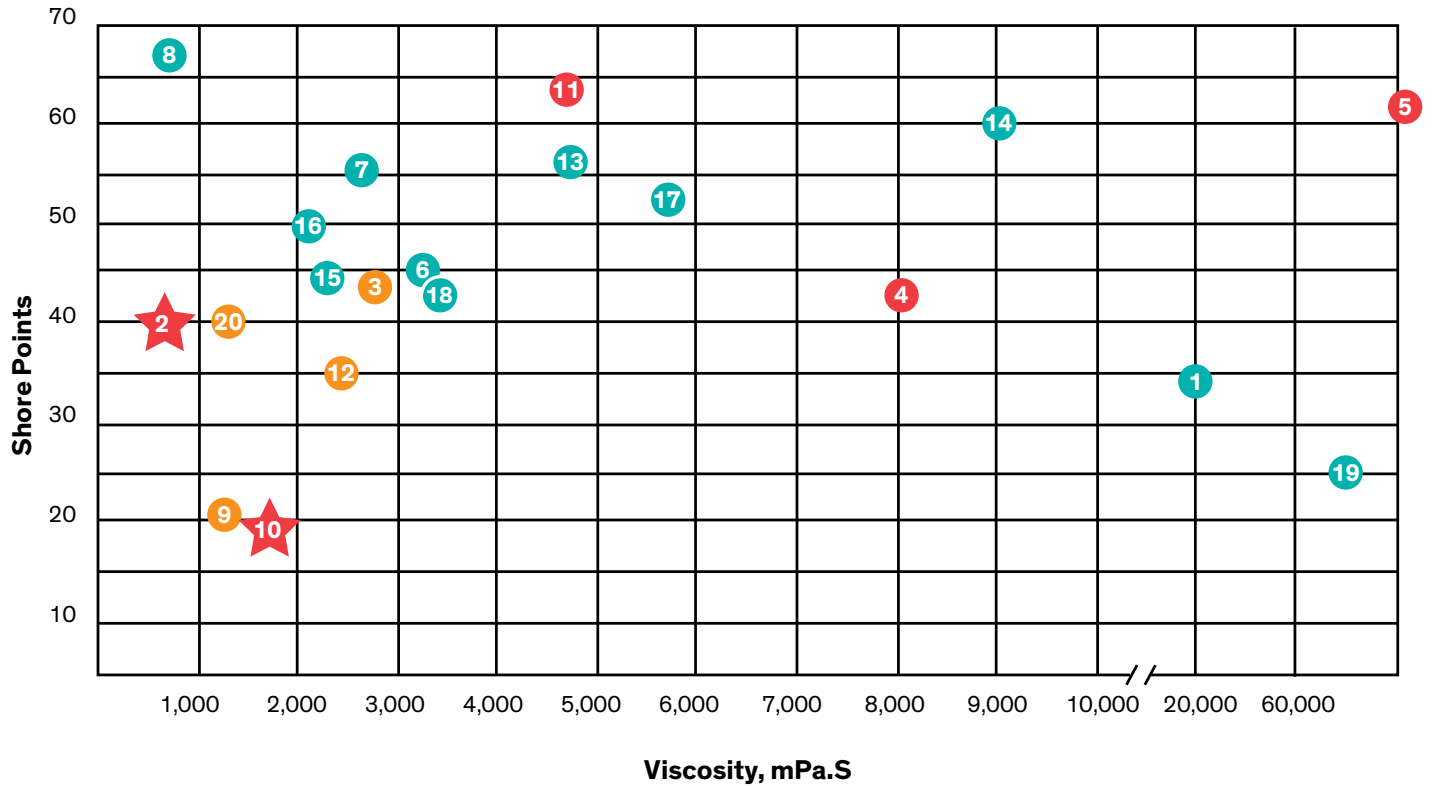
proven solutions for any application. Our specialty grades offer unique properties and benefits, such as thermal conductivity, high transparency, or compliance with military specifications.

This product selection tree will help you quickly narrow your search for an optimal encapsulant for your application. Further details and properties of each product can be found in the product table starting on **page 6**.



PRIMERLESS

# Encapsulants Viscosity/Hardness

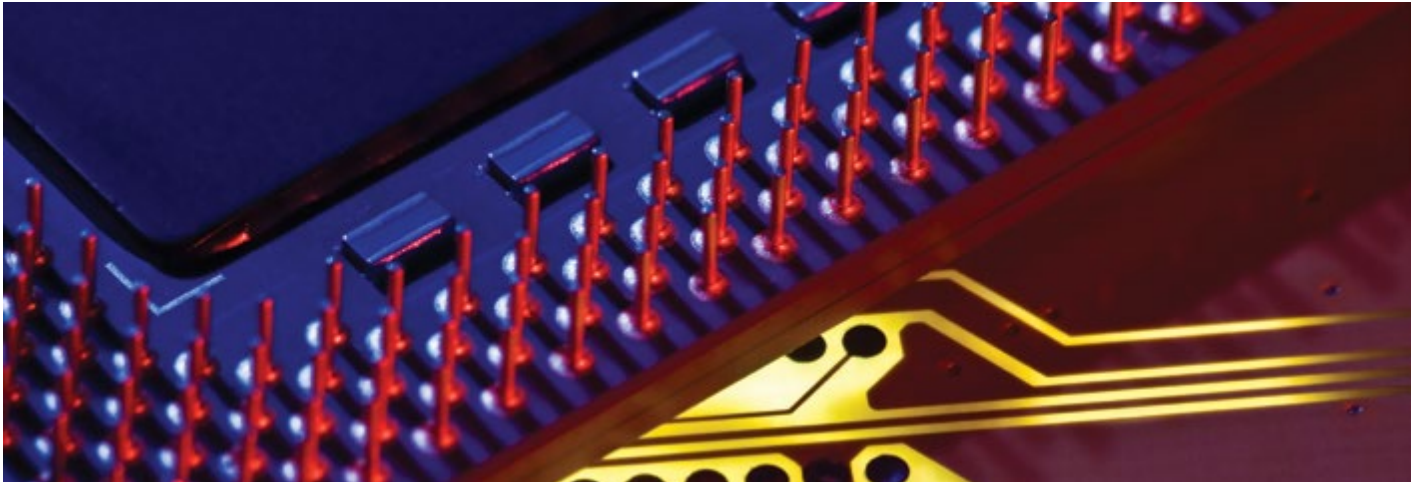


- 1 DOWSIL™ 3-6121 Low Temperature Elastomer
  - 2 DOWSIL™ 3-6512 Elastomer
  - 3 DOWSIL™ 3-8264 Encapsulant
  - 4 DOWSIL™ 93-500 Space Grade Encapsulant
  - 5 DOWSIL™ 93-500 Thixotropic Encapsulant
  - 6 DOWSIL™ CN-8760 G Thermally Conductive Encapsulant
  - 7 DOWSIL™ CN-8760 Thermally Conductive Encapsulant
  - 8 DOWSIL™ EE-1010 Low Viscosity Encapsulant
  - 9 DOWSIL™ EE-1840 Encapsulant
  - 10 DOWSIL™ EE-3200 Low Stress Silicone Encapsulant
  - 11 DOWSIL™ EI-1184 Optical Encapsulant
  - 12 DOWSIL™ SE 1816 CV Encapsulant
  - 13 SYLGARD™ 160 Silicone Elastomer
  - 14 SYLGARD™ 164 Silicone Elastomer
  - 15 SYLGARD™ 170 Fast Cure Silicone Elastomer
  - 16 SYLGARD™ 170 Silicone Elastomer
  - 17 SYLGARD™ 182 Silicone Elastomer
  - 18 SYLGARD™ 184 Silicone Elastomer
  - 19 SYLGARD™ 186 Silicone Elastomer
  - 20 SYLGARD™ 567 Primerless Silicone Encapsulant
- Standard Encapsulants   
 ● Primerless Encapsulants   
 ● Specialty Encapsulants   
 ☆ Shore 00

# Standard Encapsulants

	Product Name	Features & Benefits	Color	Viscosity (mPa·sec)	Cure System (Mixing Ratio)	Working Time (Pot Life)	Room-Temperature Cure	Heat Cure	Specific Gravity	Durometer (Shore A)	Tensile Strength (MPa)	Elongation (%)	Dielectric Strength (kV/mm)	Agency Listing*
Standard Encapsulants	DOWSIL™ 3-6121 Low Temperature Elastomer	Remains a soft elastomer down to -65°C, with a higher refractive index compared to standard silicones	Translucent	19,000	Addition cure; Two-part (10:1)	>2 hrs	48 hrs	20 min @ 100°C 10 min @ 150°C	1.12	35	4.3	275	18	—
	DOWSIL™ CN-8760 G Thermally Conductive Encapsulant	Designed for fast fill rates and reworkability, with moderate thermal conductivity	Gray	3,200	Addition cure; Two-part (1:1)	1 hr 40	24 hrs	30 min @ 60°C	1.58	45	1.8	85	24	UL 94 V-0
	DOWSIL™ CN-8760 Thermally Conductive Encapsulant	Even higher flow version of DOWSIL™ CN-8760 G Encapsulant	Dark gray	2,700	Addition cure; Two-part (1:1)	1 hr 30	—	40 min @ 50°C	1.6	55	2.7	80	33	UL 94 V-0
	DOWSIL™ EE-1010 Low Viscosity Encapsulant	Capable of improved throughput speeds with one of our highest flow rates to rapidly fill around complex board architectures and a fast heat cure	Gray	850	Addition cure; Two-part (1:1)	50 min	24 hrs	3 min @ 100°C 2 min @ 150°C	1.26	65	3.1	40	18	—
	SYLGARD™ 160 Silicone Elastomer	Proven reliability with a higher thermal conductivity and heat stability	Dark gray to black	4,500	Addition cure; Two-part (1:1)	20 min	24 hrs	4 min @ 100°C	1.61	55	4.2	100	19	UL 94 V-0
	SYLGARD™ 164 Silicone Elastomer	Fast, room-temperature cure version of SYLGARD™ 160 Elastomer	Gray	9,100	Addition cure; Two-part (1:1)	—	35 min	Heat accelerable	1.57	60	—	—	19	UL 94 V-0
	SYLGARD™ 170 Silicone Elastomer	An industry standard, with moderate thermal conductivity	Dark gray to black	2,100	Addition cure; Two-part (1:1)	15 min	24 hrs	45 min @ 50°C 25 min @ 70°C 15 min @ 85°C 10 min @ 100°C	1.37	50	2.8	150	19	UL 94 V-0 Mil Spec: MIL-PRF-23586F EN 45545-2 HL3
	SYLGARD™ 170 Fast Cure Silicone Elastomer	Much faster curing version of SYLGARD™ 170 Elastomer	Black	2,300	Addition cure; Two-part (1:1)	<5 min	10 min	Heat accelerable	1.38	45	3.7	125	14	UL 94 V-0
	SYLGARD™ 182 Silicone Elastomer	Well established industry standard that is transparent with a long working time	Clear	5,700	Addition cure; Two-part (10:1)	8 hrs	14 days	75 min @ 100°C 30 min @ 125°C 20 min @ 150°C	1.04	50	7.6	100	18	UL 94 V-1 Mil Spec
	SYLGARD™ 184 Silicone Elastomer	Faster curing version of SYLGARD™ 182 Elastomer	Clear	3,500	Addition cure; Two-part (10:1)	1 hr 30	48 hrs	35 min @ 100°C 20 min @ 125°C 10 min @ 150°C	1.03	45	6.8	125	19	UL 94 V-1 @ 6 mm UL 746C f2 SAE AS81550
SYLGARD™ 186 Silicone Elastomer	One of our toughest encapsulants with proven performance and controlled flowability	Translucent	65,000	Addition cure; Two-part (10:1)	1 hr 40	48 hrs	25 min @ 100°C 15 min @ 150°C	1.12	25	5	425	14	UL 94 V-1	

\*Visit UL.com for specific details



## Primerless and Specialty Encapsulants

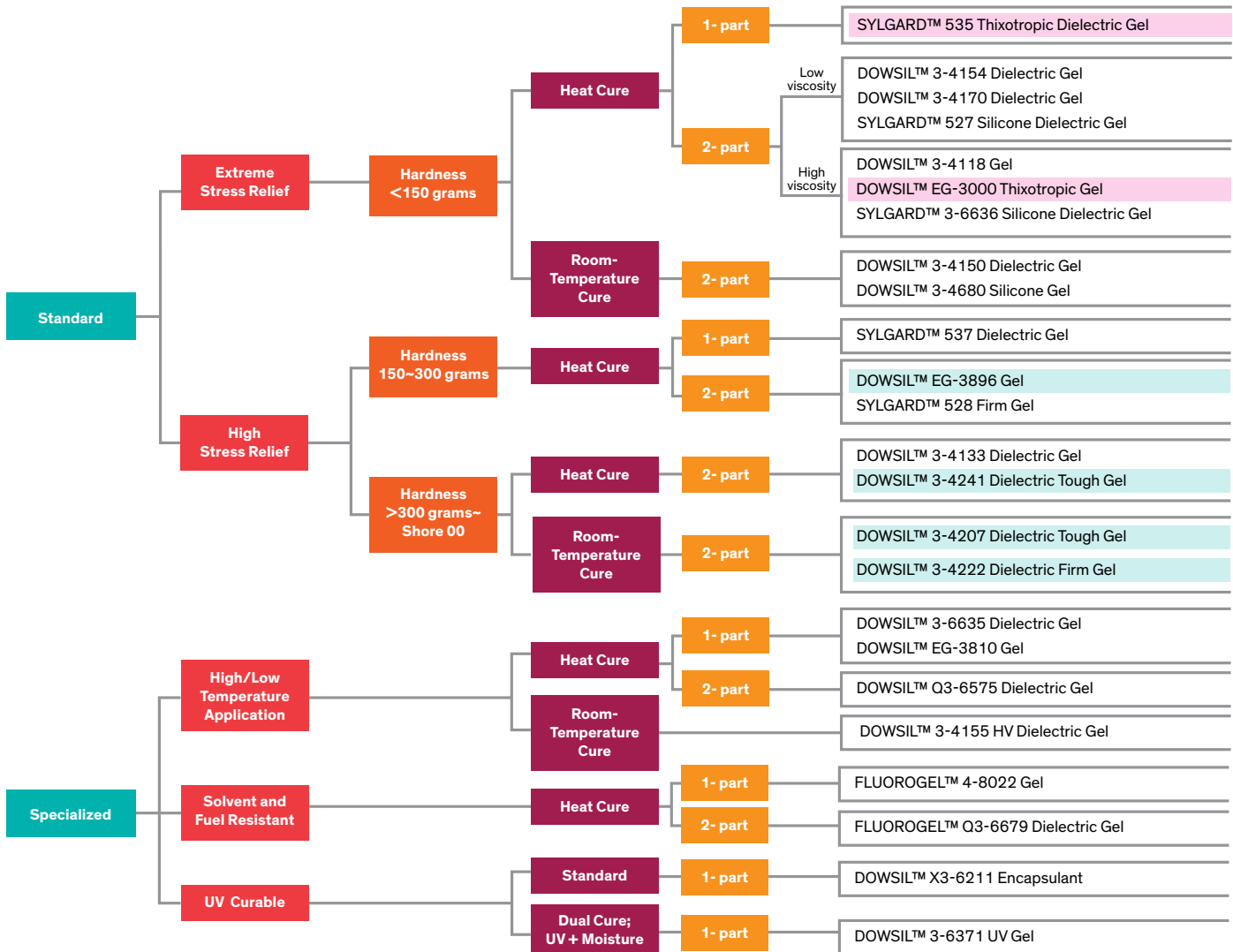
	Product Name	Features & Benefits	Color	Viscosity (mPa·sec)	Cure System (Mixing Ratio)	Working Time (Pot Life)	Room-Temperature Cure	Heat Cure	Specific Gravity	Durometer (Shore A)	Tensile Strength (MPa)	Elongation (%)	Dielectric Strength (kV/mm)	Agency Listing*
Primerless Encapsulants	DOWSIL™ 3-8264 Encapsulant	Self-priming version of SYLGARD™ 170 Elastomer	Black	Part A: 2,700 Part B: 2,600	Addition cure; Two-part (1:1)	5 hrs	NA	2.5 hrs @ 70°C 30 min @ 100°C	1.33	45	3.6	125	17	—
	DOWSIL™ EE-1840 Encapsulant	Fast fill rates and repairable with enhanced stress relief	Black	1,300	Addition cure; Two-part (1:1)	12 min	7 days	Yes	1.01	20	0.55	175	17	UL 94 V-1
	DOWSIL™ SE 1816 CV Encapsulant	Long working time for production flexibility with UL recognition	Black	2,600	Heat cure; Two-part (1:1)	>24 hrs	NA	1 hr @ 100°C	1.35	35	2.9	225	26	UL 94 V-0
	SYLGARD™ 567 Primerless Silicone Encapsulant	One of our fastest fill rates with enhanced high-temperature stability	Black	Part A: 2,100 Part B: 550	Addition cure; Two-part (1:1)	>3 days	NA	3 hrs @ 70°C 2 hrs @ 100°C 85 min @ 115°C 15 min @ 150°C	1.24	40	—	—	21	UL 94 V-0 Mil Spec: MIL-PRF-23586F
Specialty Encapsulants	DOWSIL™ 3-6512 Elastomer	Highly flowable to fill in narrow spaces with enhanced stress relief	Transparent red	900	Addition cure; Two-part (1:1)	24 hrs	—	2 hrs @ 70°C	—	40 Shore 00	—	—	21	—
	DOWSIL™ 93-500 Space Grade Encapsulant	Highly transparent with very low levels of volatile condensable materials – proven for space-grade applications	Clear	8,100	Addition cure; Two-part (10:1)	2 hrs 45	24 hrs	10 min @ 100°C 4 min @ 150°C	1.03	45	6.7	125	19	—
	DOWSIL™ 93-500 Thixotropic Encapsulant	Non-flow version of DOWSIL™ 93-500 Space Grade Encapsulant	Translucent white	Non-flow/thixotropic	Addition cure; Two-part (10:1)	50 min	24 hrs	15 min @ 100°C 10 min @ 125°C 5 min @ 150°C	1.08	60	8.5	125	18	—
	DOWSIL™ EE-3200 Low Stress Silicone Encapsulant	One of our most stress relieving encapsulants with fast processing, moderate thermal conductivity and proven reliability in outdoor applications	Dark gray	1,700	Addition cure; Two-part (1:1)	30 min	2 hrs 45	20 min @ 50°C	1.48	20 Shore 00	0.2	350	14	UL 94 V-0 EN 45545-2 HL3
	DOWSIL™ EI-1184 Optical Encapsulant	Highly transparent with reduced yellowing for optical application reliability – in a convenient 1:1 mix ratio	Clear	4,600	Addition cure; Two-part (1:1)	10 min	4 hrs	15 min @ 100°C	1.04	65	8.3	75	18	UL 94 V-1 UL 746C f1

\*Visit UL.com for specific details

# Choosing a Gel

Offering the ultimate in stress relief, most gels also exhibit a tacky surface that adheres naturally to common surfaces, without the need for primers. Dow Performance Silicones' broad selection of gels are organized into four families: standard, low-temperature, toughened, and specialty. Product specification is typically determined by the application's need for stress relief, viscosity, or cure time versus working time.

This product selection tree will help you quickly narrow your search for an optimal gel for your application. Further details and properties of each product can be found in the product table starting on **page 10**.

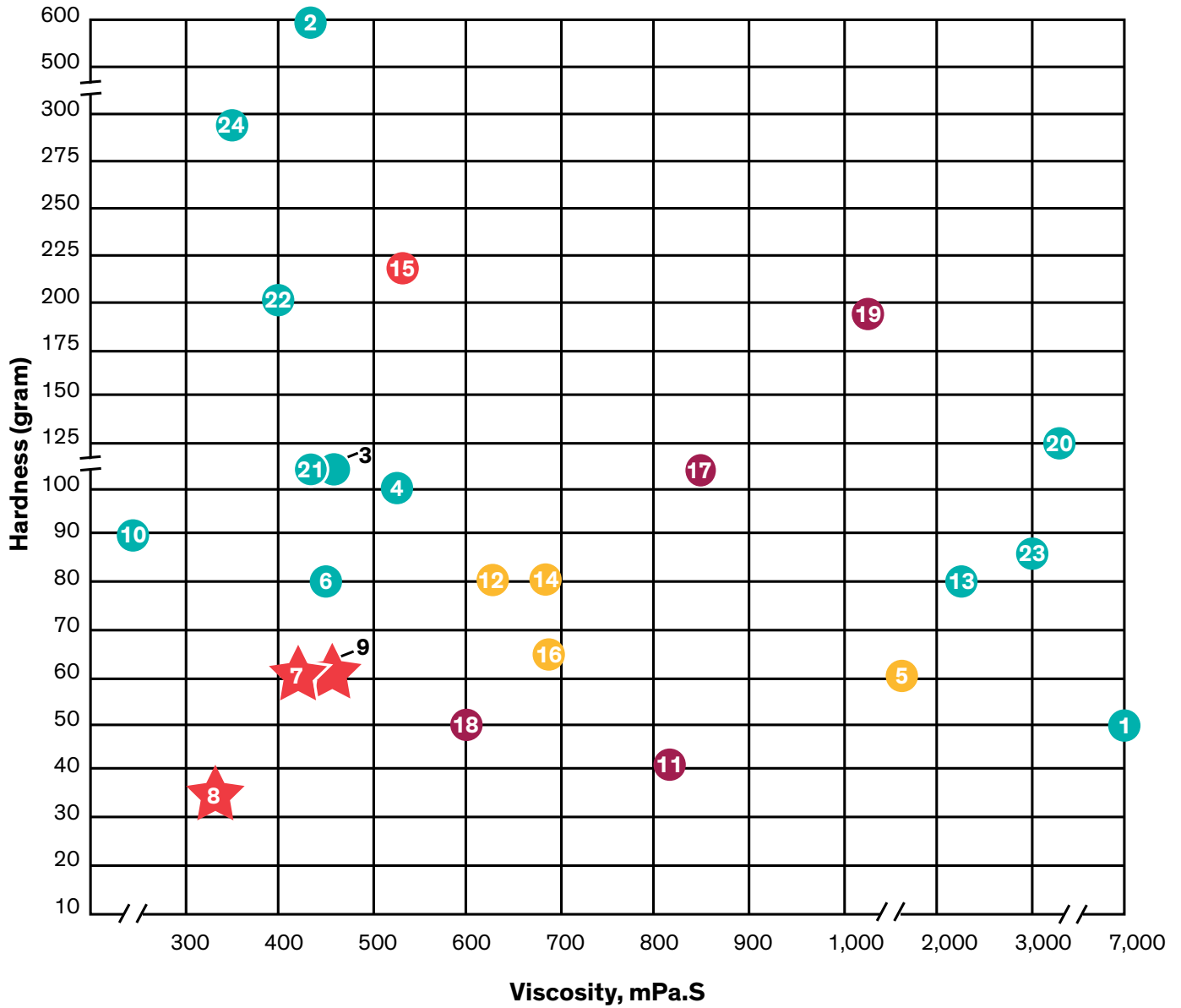


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# Gels Viscosity/Hardness



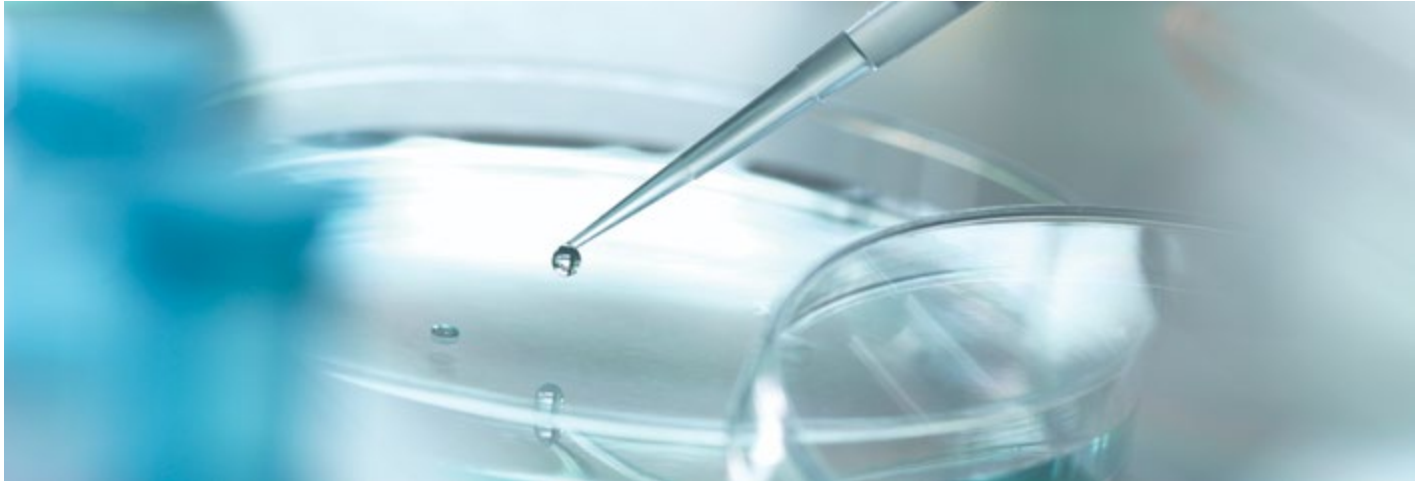
- 1 DOWSIL™ 3-4118 Gel
- 2 DOWSIL™ 3-4133 Dielectric Gel
- 3 DOWSIL™ 3-4150 Dielectric Gel
- 4 DOWSIL™ 3-4154 Dielectric Gel
- 5 DOWSIL™ 3-4155 HV Dielectric Gel
- 6 DOWSIL™ 3-4170 Dielectric Gel
- 7 DOWSIL™ 3-4207 Dielectric Tough Gel
- 8 DOWSIL™ 3-4222 Dielectric Firm Gel
- 9 DOWSIL™ 3-4241 Dielectric Tough Gel
- 10 DOWSIL™ 3-4680 Silicone Gel
- 11 DOWSIL™ 3-6371 UV Gel
- 12 DOWSIL™ 3-6635 Dielectric Gel
- 13 DOWSIL™ EG-3000 Thixotropic Gel
- 14 DOWSIL™ EG-3810 Gel
- 15 DOWSIL™ EG-3896 Gel
- 16 DOWSIL™ Q3-6575 Dielectric Gel
- 17 DOWSIL™ X3-6211 Encapsulant
- 18 FLUOROGEL™ 4-8022 Gel
- 19 FLUOROGEL™ Q3-6679 Dielectric Gel
- 20 SYLGARD™ 3-6636 Silicone Dielectric Gel
- 21 SYLGARD™ 527 Silicone Dielectric Gel
- 22 SYLGARD™ 528 Firm Gel
- 23 SYLGARD™ 535 Thixotropic Dielectric Gel
- 24 SYLGARD™ 537 Silicone Gel

● Standard gels    
 ● High/Low temperature gels    
 ● Tough gels    
 ● Specialty gels    
 ☆ Shore 00

# Standard and High/Low Temperature Gels

	Product Name	Features & Benefits	Color	Viscosity (mPa·sec)	Cure System (Mixing Ratio)	Working Time		Room-Temperature Cure	Heat Cure	Specific Gravity	Hardness			Agency Listing *
						Pot Life	Gel Time (min)				Gel Hardness (g)	Penetration (1/10 mm)	Dielectric Strength (kV/mm)	
Standard Gels	DOWSIL™ 3-4118 Gel	Controlled flowability	Clear	7,000	Addition cure; Two-part (1:1)	30 min	–	Possible	1 hr @ 125°C	0.97	50	110	18	–
	DOWSIL™ 3-4133 Dielectric Gel	Long working time with fast heat cure	Clear	450	Addition cure; Two-part (1:1)	6 hrs	–	Possible	4 min @ 100°C 2.2 min @ 125°C 1.6 min @ 150°C	0.97	600	10	19	–
	DOWSIL™ 3-4150 Dielectric Gel	Blue + yellow that turns to green when mixed, fast cure version of SYLGARD™ 527 Dielectric Gel	Transparent green	470	Addition cure; Two-part (1:1)	6 min	30	90 min	–	0.97	110	50	15	–
	DOWSIL™ 3-4154 Dielectric Gel	Longer processing time version of DOWSIL™ 3-4150 Dielectric Gel	Clear	550	Addition cure; Two-part (1:1)	30 min	–	NA	3 hrs @ 80°C 1.75 hrs @ 100°C	0.97	100	50	18	–
	DOWSIL™ 3-4170 Dielectric Gel	Fast heat cure with UL recognition	Clear	460	Addition cure; Two-part (1:1)	>24 hrs	–	NA	9 min @ 100°C 5 min @ 125°C 3 min @ 150°C	0.97	80	65	20	UL 94 HB
	DOWSIL™ 3-4680 Silicone Gel	One of our highest flow rates for fast filling and processing	Transparent blue	260	Addition cure; Two-part (1:1)	–	10	30 min	1 min @ 125°C	0.97	90	60	16	–
	DOWSIL™ EG-3000 Thixotropic Gel	Thixotropic to allow selective and cost-effective protection	Slightly hazy/clear	2,300	Addition cure; Two-part (1:1)	6 hrs	8	NA	1 hr @ 150°C	0.99	80	60	22	–
	SYLGARD™ 3-6636 Silicone Dielectric Gel	Tougher with a controlled flow	Clear	3,300	Addition cure; Two-part (1:1)	<10 min	6	24 hrs	3 hrs @ 70°C 45 min @ 100°C	0.99	125	55	16	–
	SYLGARD™ 527 Silicone Dielectric Gel	Proven industry standard with a long working time for greater processing flexibility	Clear	460	Addition cure; Two-part (1:1)	2 hrs	–	>1 wk	3.5 hrs @ 100°C 1.25 hrs @ 125°C 35 min @ 150°C	0.95	115	–	17	UL 94 HB
	SYLGARD™ 528 Firm Gel	Intermediate modulus with a long working time	Clear	400	Addition cure; Two-part (1:1)	6 hrs	–	Possible	Possible	0.97	200	–	–	–
	High/Low Temperature Gels	SYLGARD™ 535 Thixotropic Dielectric Gel	One-part version of DOWSIL™ EG-3000 Thixotropic Gel	Translucent	3,000	Addition cure; One-part	–	–	–	1 hr @ 150°C	0.97	85	60	11
SYLGARD™ 537 Dielectric Gel		One-part, harder version of SYLGARD™ 528 Firm Gel	Clear	360	Addition cure; One-part	–	–	–	1 hr @ 120°C	0.98	290	20	22	–
DOWSIL™ 3-4155 HV Dielectric Gel		Proven automotive grade with blue + yellow that turns to green when mixed, and designed for use down to -80°C	Transparent green	1,850	Addition cure; Two-part (1:1)	–	8	60 min	–	1	60	90	16	–
DOWSIL™ 3-6635 Dielectric Gel		Fast filling automotive grade, designed for use down to -80°C	Clear	650	Addition cure; One-part	–	11	NA	2 hrs @ 100°C	1	80	85	20	UL 94 HB
DOWSIL™ EG-3810 Gel	Enhanced use temperature range from -60 to +200°C	Clear	690	Addition cure; One-part	–	–	NA	15 min @ 125°C 10 min @ 150°C	0.97 Uncured	80	80	21	–	
DOWSIL™ Q3-6575 Dielectric Gel	Extended shelf life, two-part version of DOWSIL™ 3-6635 Dielectric Gel	Clear	670	Addition cure; Two-part (1:1)	20 min	6	24 hrs	40 min @ 70°C 20 min @ 100°C	1.02	65	80	10	–	

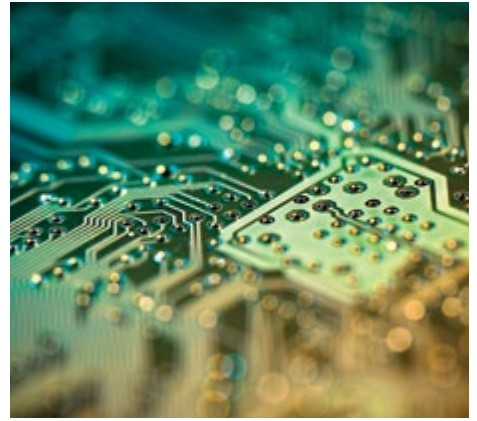
\*Visit UL.com for specific details



## Tough and Specialty Gels

	Product Name	Features & Benefits	Color	Viscosity (mPa·sec)	Cure System (Mixing Ratio)	Working Time		Room-Temperature Cure	Heat Cure	Specific Gravity	Hardness			Agency Listing *
						Pot Life	Gel Time (min)				Gel Hardness (g)	Penetration (1/10 mm)	Dielectric Strength (kV/mm)	
Tough Gels	DOWSIL™ 3-4207 Dielectric Tough Gel	Designed as a toughened gel for additional strength, with blue + yellow that turns to green when mixed, conditional primerless adhesion at room temperature, and a UV indicator	Translucent green	410	Addition cure; Two-part (1:1)	—	7	90 min	10 min @ 50°C 3 min @ 100°C 3 min @ 150°C	0.98	60 Shore 00	NA	17	UL 94 V-1 f2
	DOWSIL™ 3-4222 Dielectric Firm Gel	Enhanced stress relief version of DOWSIL™ 3-4207 Dielectric Tough Gel	Translucent green	340	Addition cure; Two-part (1:1)	3 min	13	30 min	2 min @ 100°C 1 min @ 125°C	0.97	35 Shore 00	NA	14	—
	DOWSIL™ 3-4241 Dielectric Tough Gel	Enhanced working life version of DOWSIL™ 3-4207 Dielectric Tough Gel	Translucent green	410	Addition cure; Two-part (1:1)	>1h	—	11 hrs	2 min @ 125°C	0.98	60 Shore 00	NA	17	UL 94 V-1
	DOWSIL™ EG-3896 Gel	Designed as a toughened gel for improved crack resistance at operating temperatures as high as 185°C	Slightly hazy/clear	520	Addition cure; Two-part (1:1)	>4 hrs	—	—	30 min @ 70°C 10 min @ 100°C 5 min @ 150°C	0.98	220	30	22	UL 94 V-1
Specialty Gels	DOWSIL™ 3-6371 UV Gel	UV cure with a secondary moisture cure for shadowed areas	Translucent amber	820	UV + Moisture secondary cure; One-part	7 days	—	25 sec @ 4000 mJ/cm <sup>2</sup> (15 mm thick)	NA	0.98	40	140	12	—
	DOWSIL™ X3-6211 Encapsulant	Extremely fast line-of-sight UV cure	Clear	850	UV cure; One-part	—	—	5 sec @ >3000 mJ/cm <sup>2</sup> (12 mm thick)	NA	0.99	105	50	17	—
	FLUOROGEL™ 4-8022 Gel	Automotive grade with solvent and fuels resistance, in a one-part formulation	Translucent	600	Addition cure; One-part	30 days	—	NA	1 hr @ 125°C 30 min @ 150°C	1.23	50	105	—	—
	FLUOROGEL™ Q3-6679 Dielectric Gel	Two-part, enhanced processing, flexibility version of FLUOROGEL™ 4-8022 Gel	Clear	1,100	Addition cure; Two-part (1:1)	>4 hrs	7	>1 week	2 hrs @ 100°C	1.26	180	30	—	—

\*Visit UL.com for specific details



## Learn More

We bring more than just an industry-leading portfolio of advanced silicone-based materials. As your dedicated innovation leader, we bring proven process and application expertise, a network of technical experts, a reliable global supply base, and world-class customer service.

To find out how we can support your applications, visit [consumer.dow.com/pcb](https://consumer.dow.com/pcb).

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### LIMITED 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 our products are safe, effective and fully satisfactory for the intended end use. Suggestions of use shall not be taken as inducements to infringe any patent.

Dow's sole warranty is that our products will meet the 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.

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