Technical Data Sheet

DOWSIL™ Space-Grade Silicone Sealants

One- and two-part silicone elastomers for aerospace applications

Features & Benefits

- Supplied in flowable and thixotropic grades
- Cure to flexible rubber elastomers
- Meet NASA requirements for low thermal vacuum outgassing
- Good physical and electrical stability over a wide temperature range

Composition

- One- and two-part silicone elastomers

Typical Properties

Specification Writers: These values are not intended for use in preparing specifications.

Property	Unit	DOWSIL™ 6-1104 Controlled Volatility Sealant	DOWSIL™ 6-1125 Controlled Volatility Sealant	DOWSIL™ 93-500 Space Grade Encapsulant	DOWSIL™ 93-500 Thixotropic Space Grade Encapsulant
		Result			
As Supplied					
Color		Translucent	White	Transparent	Translucent
Specific gravity	g/cm^3	1.10	1.10	1.03	1.08
Extrusion Rate, 1/8" nozzle at 90 psi	g/min	165	95		1065
Viscosity	Poise	Non-slump	Non-slump	80	Non-slump
Pot life	hours			2.5	0.9
Tack-free time	hours	0.9	0.8	< 16	< 16
Full cure, 1/8" thickness	days	5–7	5–7	1	1
Physical Properties as Cured - 7 days at 25°C (77°F) and 50% RH					
Refractive Index		1.41		1.41	1.44
Durometer, Shore A	points	40	45	40	60
Tensile strength	psi	925	1025	975	1225
Elongation	percent	600	650	170	125
Tear Strength, Die B	ppi	180	190	15	30
Lap Shear, primed aluminium	psi	500	400	475	475
180° Peel, primed aluminum	ppiw	100	85		

Typical Properties (Cont.)

Property	Unit	DOWSIL™ 6-1104 Controlled Volatility Sealant	DOWSIL™ 6-1125 Controlled Volatility Sealant	DOWSIL™ 93-500 Space Grade Encapsulant	DOWSIL™ 93-500 Thixotropic Space Grade Encapsulant
		Result			
Physical Properties as Cured - 7 days at 25°C (77°F) and 50% RH					
Thermal Vacuum Weight Loss[1]	percent	0.20	0.20	0.20	0.20
Volatile Condensible Materials[2]	percent	0.03	0.01	0.01	0.01
Linear Coefficient of Thermal Expansion	micron/m °C	350	350	300	295
Thermal Conductivity	W/m °C	0.23	0.23	0.20	0.20
Electrical Properties as Cured - 7 days at 25°C (77°F) and 50% RH					
Dielectric Strength,	volts/mil	540	550	480	460
Volume Resistivity	ohm-cm	1.0×10^{15}	1.0×10^{15}	1.0×10^{15}	6.2×10^{14}
Dielectric Constant at 100 Hz		2.6	2.6	2.6	2.8
Dielectric Constant at 100 kHz		2.6	2.6	2.6	2.8
Dissipation Factor at 100 Hz		0.0004	0.0016	0.0011	0.0011
Dissipation Factor at 100 kHz		0.0002	0.0002	0.0002	0.0002

1. 24 hours at 125°C (257°F) and < 1×10^{-6} torr.
2. Percent collected at 25°C (77°F) during vacuum weight loss test.

How to Use

Surface Preparation

All surfaces should be thoroughly cleaned and/or degreased with Dow OS Fluids, naphtha, mineral spirits, methyl ethyl ketone (MEK) or other suitable solvent[1]. 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. In most cases, substantially stronger and more uniform adhesion is obtained by preparing the surface to be treated with DOWSIL™ 1200 Prime Coat or DOWSIL™ P5200 Adhesion Promoter, which should be applied by dipping, brushing or spraying. Best results are often obtained by wiping the primer on with a clean cloth and then immediately wiping off any excess with a fresh, clean cloth. Typically, a very thin coating of primer will provide the best adhesion. If cracks appear in the chalked film, too much primer was applied. Under typical room temperature and humidity conditions, the primer should be allowed to air-dry for 1 to 2 hours. Because the prime coat is moisture sensitive, low humidity will necessitate a longer drying time.

[1]Follow solvent manufacturer's recommended safe handling instructions and applicable federal, state and local regulations.

Product Information

	DOWSIL™ 6-1104 Controlled Volatility Sealant	DOWSIL™ 6-1125 Controlled Volatility Sealant	DOWSIL™ 93-500 Space Grade Encapsulant	DOWSIL™ 93-500 Thixotropic Space Grade Encapsulant
Space-Grade Silicone Sealants				
Description	One-part RTV silicone Sealant; translucent	One-part RTV silicone sealant; white	Two-part silicone elastomer	
Features	Extrudable, non-slump materials cure at room temperature; no corrosive cure byproducts; meet NASA requirements for low outgassing; wide operating temperature range; easy repairability; good physical and electrical stability over a range of frequencies, temperatures and humidities; ensure protection of components from temperature extremes, high humidity, radiation, thermal shock, atomic oxygen and mechanical vibration		Exceed requirements of NASA SP-R-0022A for thermal vacuum low outgassing; wide operating temperature range from -115 to 200°C (-149 to 392°F)	

How to Use (Cont.)

Adhesion

Good adhesion cannot be expected on nonreactive metal substrates or nonreactive plastic surfaces such as Teflon, 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. 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, a 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.

One-Part Sealants

DOWSIL™ 6-1104 and DOWSIL™ 6-1125 Controlled Volatility Sealants are caulk-like materials and may be applied directly from the collapsible tube. They are generally cured at room temperature in a range of 30 to 80 percent relative humidity. Greater than 90 percent of their full physical properties should be attained within 3 to 5 days. Materials and parts can be handled in much shorter times of about 2 hours depending on 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.

How to Use (Cont.)

Two-Part Sealants

Compatibility

Certain materials, chemicals, curing agents and plasticizers can inhibit the cure of addition-cure silicones such as DOWSIL™ 93-500 Space Grade Encapsulant and DOWSIL™ 93-500 Thixotropic Space Grade Encapsulant. 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

DOWSIL™ 93-500 Space Grade Encapsulant and DOWSIL™ 93-500 Thixotropic Space Grade Encapsulant are supplied as two-part elastomers that require mixing of the base and curing agent to cure. Just prior to use, the two components should be thoroughly blended in a ratio of 10 parts by weight base to one-part curing agent. Avoid entrapment of air during mixing. Vacuum de-airing is recommended to remove all entrapped air to ensure void-free applications. For best results, de-air in containers that are no more than one-third full to avoid foaming material overflowing the container. Continue de-airing for 3 to 5 minutes after the bubbles have collapsed. Variations of up to 10 percent in the concentration of curing agent have little effect upon the working time or on the cured properties. Lowering the curing agent level by more than 10 percent will result in a softer, weaker material, while increasing the level by more than 10 percent will result in a harder, more brittle material. Both conditions can cause higher vacuum weight loss characteristics.

Applying and Curing

When applying the silicone, avoid air entrapment. All four silicone products can be handled after 24 hours or less of room temperature cure, but full mechanical, electrical and weight loss properties are not achieved for seven days. When using DOWSIL™ 93-500 Space Grade Encapsulant and DOWSIL™ 93-500 Thixotropic Space Grade Encapsulants for thin sections (10 mills or less), the silicone surface should be covered with polyethylene during cure or the application should be heat cured to avoid potential surface tackiness that can be caused by airborne contaminants. Curing times can be appreciably decreased with the application of heat. Suggested quick cure cycles are as follows:

- 2 hours at 65°C (150°F)
- 30 minutes at 100°C (212°F)
- 10 minutes at 150°C (300°F)

Relatively massive parts require additional time to bring them up to the required temperature.

Product Information

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Space-Grade Silicone Sealants				
Typical Applications	Sealing and adhering components in space environments; used on space systems, PCB system(s) assemblies and optical applications where low outgassing is essential; bonding, sealant and encapsulating PCB systems components wires and terminals; mounting optics, resistors, connectors and other components on a variety of terrestrial and space systems, PCB system and optical assemblies		Adhering/bonding applications such as solar cells to substrates, cover glasses to solar cells, OSR mirrors to substrates, PCB systems subcomponents and sub-assemblies, optical and other sensors; encapsulating/potting applications such as PCB systems components, circuit boards and assemblies, modules, relays and connectors, thermal extremes, shock and cycling protection, vibration shock dampening; sealing/coating applications such as atomic oxygen protection, fay or fillet seals, formed-in-place gaskets and seals, binders for thermal control paints, seals for optical sensors	

Handling Precautions

PRODUCT SAFETY INFORMATION REQUIRED FOR SAFE USE IS NOT INCLUDED IN THIS DOCUMENT. BEFORE HANDLING, READ PRODUCT AND SAFETY DATA SHEETS AND CONTAINER LABELS FOR SAFE USE, PHYSICAL AND HEALTH HAZARD INFORMATION. THE SAFETY DATA SHEET IS AVAILABLE ON THE DOW WEBSITE AT CONSUMER.DOW.COM, OR FROM YOUR DOW SALES APPLICATION ENGINEER, OR DISTRIBUTOR, OR BY CALLING DOW CUSTOMER SERVICE.

Usable Life and Storage

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

For best results, DOWSIL™ Space-Grade Silicone Sealants should be stored below 32°C (90°F). Containers should be kept tightly closed.

Packaging Information

DOWSIL™ 6-1104 and DOWSIL™ 6-1125 Controlled Volatility Sealants are supplied in 5 oz (142 g) collapsible tubes. DOWSIL™ 93-500 Space Grade Encapsulant and DOWSIL™ 93-500 Thixotropic Space Grade Encapsulants are supplied in packages that contain the base and curing agent in separate containers. Complete packages (base and curing agent) are available as 3.9 oz (110 g) and 1.1 lb (0.5 kg) kits, net weight.

Limitations

This product is neither tested nor represented as suitable for medical or pharmaceutical uses.

Shipping Limitations

None.

Health And Environmental Information

To support customers in their product safety needs, Dow has an extensive Product Stewardship organization and a team of product safety and regulatory compliance specialists available in each area.

For further information, please see our website, consumer.dow.com or consult your local Dow representative.

How Can We Help You Today?

Tell us about your performance, design and manufacturing challenges. Let us put our silicon-based materials expertise, application knowledge and processing experience to work for you.

For more information about our materials and capabilities, visit **consumer.dow.com.**

To discuss how we could work together to meet your specific needs, go to **consumer.dow.com** for a contact close to your location. Dow has customer service teams, science and technology centers, application support teams, sales offices and manufacturing sites around the globe.

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