

# DOW CORNING® 93-500 Space-Grade Encapsulant

## FEATURES

- Extremely low weight loss under high vacuum exposure
- Transparent
- Two part room temperature cure
- Wide range of operating temperatures (-65°C to +200°C)
- Easy repairability
- Good physical and electrical stability over a wide range of temperatures, frequencies and humidities
- Good flexibility
- Low transmission of vibration and shock
- Good environmental protection

## Two part, transparent, solventless silicone elastomer

## APPLICATIONS

- Used as an embedding and potting compound to provide resilient environmental protection for modules, power supplies, cable connectors or complete electronic assemblies.
- Used as an encapsulant for electronic components, circuit boards and solar cell adhesive.
- Protection of electronic circuits and components from temperature extremes, high humidity, radiation, thermal shock and mechanical vibration.
- Ideally suited to the harsh environment of space due to its inherent physical and electrical stability, together with extremely low mass loss under high vacuum.

## TYPICAL PROPERTIES

Specification writers: These values are not intended for use in preparing specifications. Please contact your local Dow Corning sales representative prior to writing specifications on this product.

CTM*	ASTM*	Property	Unit	Value
<b>As supplied</b>				
		Colour - base/curing agent		Clear/clear
0050	D1084	Viscosity at 25°C (base)	mPa.s	8,400
0055		Pot life at 25°C with curing agent added	hours	2
0095		Tack-free time at 25°C with curing agent added	hours	16
0022	D792	Relative density at 25°C		1.08
		Mixing ratio by weight (base/curing agent)		10/1
<b>Physical properties, cured 7 days at 77°C and 50% relative humidity</b>				
		Color		Transparent
		Refractive index		1.4124
0099	D2240	Durometer hardness, Shore A		40
0137A	D412	Tensile strength	MPa	7.0
0137A	D412	Elongation at break	%	140
		Shrinkage after 3 days at 25°C	%	Nil
		Total mass loss after 24 hours at 125°C and 10 <sup>a</sup> <sub>1</sub> torr	%	0.16
0496A		Collected volatile condensable materials at 25°C during vacuum weight loss test	%	0.02
		Thermal conductivity	W/(m.K)	0.146
		Volume coefficient of thermal expansion	1/K	9x10 <sup>a</sup> <sub>24</sub>
		Thermal shock resistance from -55°C to +155°C MIL-I-16923C		Pass 10 cycles
		Water absorption 7 day immersion at 25°C	%	<0.10

## TYPICAL PROPERTIES (continued)

CTM*	ASTM*	Property	Unit	Value
		Brittle point	°C	-65
		Radiation resistance, Cobalt 60 source:		
		- exposure to 200 megarads		Usable
		- exposure to 500 megarads		Hard/brittle
<b>Electrical properties</b>				
0114	D149	Dielectric strength <sup>1</sup>		14.8
0112	D150	Permittivity at 100Hz		2.75
0112	D150	Permittivity at 100kHz		2.73
0112	D150	Dissipation factor at 100Hz		0.0011
0112	D150	Dissipation factor at 100kHz		0.0013
0249	D257	Volume resistivity	ohm.cm	6.9x10 <sup>13</sup>

1. Tested on specimen 1.6mm thick using 6mm standard ASTM electrodes; 500 volts per second rate of rise.

\* CTM: Corporate Test Method, copies of CTMs are available on request.

ASTM: American Society for Testing and Materials.

### ENGINEERING DATA

Cured sections of DOW CORNING 93-500 Space-Grade Encapsulant are usable over a wide temperature range of -65 to +200°C.

Short term exposure (less than 2 hours) at temperatures as high as 300°C will not degrade the encapsulant. However, generation of volatile species increases as the temperature is elevated.

When parts are embedded in DOW CORNING 93-500 Space-Grade Encapsulant differences in thermal expansion values between the encapsulant and the embedded parts - and the shape of these parts - may influence temperature limits at which such systems may be used. For this reason thermal operating limits for embedded components should be accurately determined by laboratory tests before large scale use.

DOW CORNING 93-500 Space-Grade Encapsulant is not recommended for use in thin coatings of less than 0.25mm unless confined or covered.

### Compatibility

Materials that have been found to inhibit the cure of DOW CORNING 93-500 Space-Grade Encapsulant are:

- Polyvinylchloride, plasticised
- Epoxy - amine cured
- Tin catalysed silicone RTVs
- Polysulfide MIL-S-8516

- Humiseal® 1B-27 coating
- Mystik® 6207 tape
- Mystik® 6215 tape
- Scotch® cellophane tape
- Scotch® 360 tape
- Permacel® masking tape
- Vinyl electrical tape
- Pliobond® adhesive
- Latex vacuum tubing
- Neoprene rubber
- Buna N rubber
- GRS rubber
- Natural rubber
- Viton® A rubber
- Acid core solder flux
- Rosin core solder flux
- Sulphur compounds, Thiols  
Sulphides  
Sulphates  
Silphites  
Thioureas
- Nitrogen compounds, Amines  
Amides  
Imides  
Azides

Each application should be pre-tested with the product in question.

### Corrosion

No corrosion has been observed on common metals - notably copper - when used with DOW CORNING 93-500 Space-Grade Encapsulant.

### HOW TO USE

### Surface preparation

DOW CORNING 93-500 Space-Grade Encapsulant will not normally bond to non-porous surfaces. If adhesion is required DOW CORNING® 1200 Primer is recommended for low volatility applications. For best results:

1. Clean the surface with a chlorinated solvent (see Handling Precautions) and a slightly abrasive pad or a coarse lint-free cloth.
2. Rinse cleaned surface with acetone or methyl ethyl ketone.
3. Apply a thin coat of primer by dipping, brushing or spraying.
4. Allow the primer to dry for at least 1 hour, according to relative humidity.
5. Silicone rubber surfaces should not normally be primed, but only roughened slightly with abrasive paper and rinsed with acetone. In thin sections, a primer may be needed.

### Preparing containers and components

Containers, moulds or components which come into contact with DOW CORNING 93-500 Space-Grade Encapsulant should be clean and dry. Containers or moulds which have been used to handle room temperature vulcanising silicone rubber, organic rubber or plastics should not be used as traces of these materials may inhibit the cure or contaminate the encapsulant. Inhibition of cure which results in an incompatible component or substrate

can usually be prevented by one of the following methods:

1. Wash the contaminants off with solvent; ultrasonic cleaning has also been found to be effective.
2. Volatilise the contaminants by heating prior to applying the encapsulant.

### **Mixing**

DOW CORNING 93-500 Space-Grade Encapsulant is supplied with the curing agent. Just prior to use, the two are blended in the ratio of 10 parts encapsulant to 1 part curing agent, by weight. Thoroughly mixing is easy since both encapsulant and curing agent are supplied as low viscosity fluids. During mixing, care should be taken to minimise entrapment of air. Any entrapped air should be removed before the encapsulant is poured.

If the encapsulant is cured in sections less than 25mm deep, all entrapped air should escape before the cure is complete. For thick sections and quick de-airing, the use of a vacuum is required. The vacuum should be applied slowly otherwise, the material may foam and overflow the container. As a rule, containers should be no more than half full. Vacuum should be held for 3 to 5 minutes after all bubbles have collapsed.

The encapsulant and the curing agent present no handling problems in normal industrial practice.

Note: variations of up to 10% in the concentration of curing agent in DOW CORNING 93-500 Space-Grade Encapsulant have little effect upon set-up time or on the properties of the final cured part. Lowering the curing agent concentration by more than 10% will result in a softer, weaker, material which could have higher vacuum weight loss characteristics; increasing the percentage will result in an overhardening of cured encapsulant and will tend to degrade physical and thermal-vacuum properties.

### **How to apply**

When pouring DOW CORNING 93-500 Space-Grade Encapsulant into

the unit in which it is to be cured, care should be taken to minimise air entrapment within the system.

Where practical, it is suggested that pouring be done under vacuum, particularly if the component being cast has many fine voids. When this technique cannot be used the unit should be evacuated after the encapsulant has been poured.

### **Working and curing time**

DOW CORNING 93-500 Space-Grade Encapsulant can be satisfactorily cured either exposed to air or completely sealed, and at temperatures ranging from 25°C to 150°C. However, complete cure will not occur in thin coatings of less than 0.25mm unless confined or covered.

Working time at 25°C of DOW CORNING 93-500 Space-Grade Encapsulant is approximately 1 hour.

After 24 hours at 25°C the material will have cured sufficiently to allow handling. Full mechanical and electrical strength, and optimum weight loss properties however will not be achieved for 7 days. Curing time can be appreciably decreased by heating the compound. Suggested quick curing cycles are as follows:

65°C for 4 hours, or  
100°C for 1 hour, or  
150°C for 15 minutes.

Large parts will require additional time in the oven to bring them up to the required temperature.

### **HANDLING PRECAUTIONS**

PRODUCT SAFETY INFORMATION REQUIRED FOR SAFE USE IS NOT INCLUDED. 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 FROM YOUR LOCAL DOW CORNING SALES REPRESENTATIVE.

### **USABLE LIFE AND STORAGE**

When stored at or below 32°C in the original unopened containers, DOW CORNING 93-500 Space-Grade Encapsulant has a usable life of 24 months from the date of production.

### **PACKAGING**

DOW CORNING 93-500 Space-Grade Encapsulant is supplied in packages that contain the encapsulant and its curing agent in separate containers. Net weight for complete packages - encapsulant and curing agent - 0.5kg.

### **LIMITATIONS**

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

### **HEALTH AND ENVIRONMENTAL INFORMATION**

To support customers in their product safety needs, Dow Corning has an extensive Product Stewardship organization and a team of Health, Environment and Regulatory Affairs specialists available in each area.

For further information, please consult your local Dow Corning representative.

### **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 use shall not be taken as inducements to infringe any patent.