

# BERGQUIST GAP FILLER TGF 4500CVO

November 2020



# AGENDA

**01** Industry Challenge

**02** Roadmap

**03** Product Description

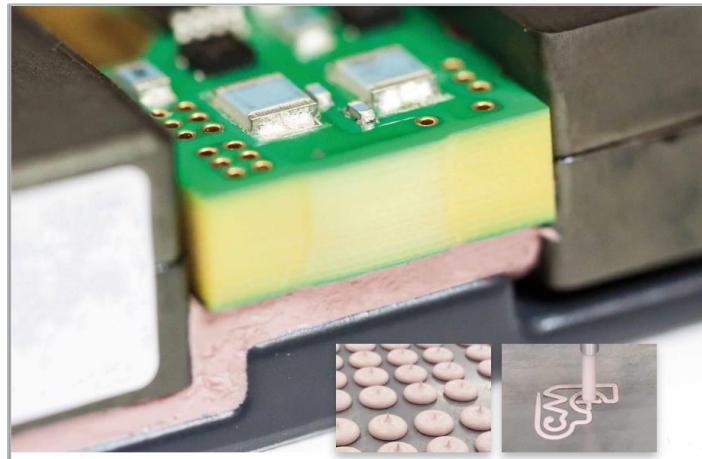
**04** Markets

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# ► INDUSTRY CHALLENGES & SOLUTIONS

## WHY WE DEVELOP THIS PRODUCT

- Most high-performance gap filling materials are difficult to process due to their high viscosities. Some suppliers solve this by adding low molecular weight binders or plasticizers, but these can become mobile in application either volatizing out to condense onto mechanical contacts, optical components, or in sensitive environments like semiconductor packaging equipment or bleeding out onto the surrounding components.
- **BERGQUIST Gap Filler TGF 4500CVO** is a 2 component Gap Filler that provides excellent thermal performance with a high dispense rate for easy, robust processing and controlled volatility so that it can be used in virtually any environment or application without fear of contamination.
- **BERGQUIST Gap Filler TGF 4500CVO** provides the performance and reliability the industry has come to expect from the global leader in thermal gap filling solutions while making processing and automation easier than ever.



# ► WHERE THIS PRODUCT FITS INTO OUR CURRENT PORTFOLIO

## GAP FILLER (2K)

Properties				
Material	TGF 3500LVO	TGF 3600	TGF 4000	TGF 4500CVO
Thermal Conductivity (W/m-K)	3.5	3.6	4.0	4.5
Capillary Viscosity (Pa-sec at 1500 sec <sup>-1</sup> )	45	45	50	20
Dielectric Strength (V/mil)	275	275	450	250
ASTM E595 – Total Mass Loss (TML) %	0.06	0.84	0.27	0.10
ASTM E595 – Collected Volatile Condensable Material (CVCM) %	0.02	0.05	0.07	0.08
Volatile Silicone Outgassing D4 to D10 (cyclic siloxanes) ppm	40	3700	990	300
Maximum dispense rate with Scheugenpflug cartridge dispensing (cc/s)	0.6	0.6	0.4	1.5

# ► GAP FILLER TGF 4500CVO VALUE PROPOSITION VALUE

Reduced stress for applications

Minimal volatile silicones for sensitive applications ( < 300 ppm)

High performance and efficient processability

High Thermal Performance (4.5 W/m-K)

Long Term Reliability: Minimal thermal changes at temperature up to 200° C

Room temperature storage

Available in cartridges and Pail kits

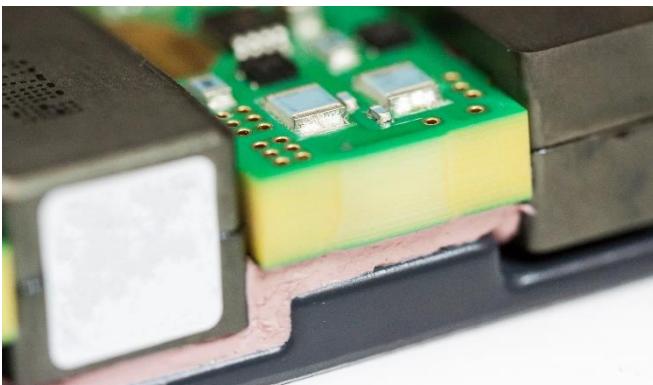
► This product is additional to the existing portfolio and no cannibalization is expected

# ► GAP FILLER TGF 4500CVO PRODUCT DESCRIPTION

## VALUE

- TGF4500CVO is a 4.5 W/m-K, easily dispensable, controlled volatility Gap Filler from the market leader in gap filling technology

Property	TGP 4500CVO	Units
Thermal Conductivity	4.5	W/m-K
Volatile Silicone	<300	ppm
Dielectric Strength	>10	kV/mm
Low Shear Viscosity	Part A - 522 Part B – 360	Pa-s (1 sec <sup>-1</sup> )
Dispense Rate (EFD Flow Rate @ 90 psi)	300	g/min
Working Time	60 @ 25C 3 @ 85C	minutes
Cured Hardness	70	Shore OO



# ► VALUE PROPOSITION SUMMARY

## BERGQUIST GAP FILLER TGF 4500CVO

Challenge	Solution
<b>Volatility</b>	<ul style="list-style-type: none"><li>▪ &lt;300 ppm volatile silicones for sensitive applications</li><li>▪ Eliminates fouling and contamination concerns; safe and effective for use with optical components, mechanical contacts and sensitive environments such as semiconductor or surface finish operations</li></ul>
<b>Performance and processability</b>	<ul style="list-style-type: none"><li>▪ High throughput – fast dispensing of 300 g/minute (pattern dependent)</li><li>▪ Optimized viscosity for high dispense rate</li><li>▪ Easy and robust mixing ratio</li></ul>
<b>Thermal control</b>	<ul style="list-style-type: none"><li>▪ Thermal conductivity of 4.5 W/m-K</li><li>▪ Improved power output through high thermal conductivity and thorough wet out/gap filling</li></ul>
<b>Long term reliability</b>	<ul style="list-style-type: none"><li>▪ Safe for delicate devices with low assembly stress and low strain on PCBs and solder joints</li><li>▪ Minimal thermal changes at temperature up to 200° C</li><li>▪ Good wet out to various surfaces and topographies</li><li>▪ Stable heat path in thermal cycling conditions</li></ul>
<b>Environmental sustainability</b>	<ul style="list-style-type: none"><li>▪ Room temperature storage and shipping</li><li>▪ Provides benefits through logistics and operations chain</li></ul>
<b>Total Cost of Ownership (TcO)</b>	<ul style="list-style-type: none"><li>▪ Improved supply chain versatility, application adaptability, cost-effectiveness and performance as compared to thermal pads of similar thermal conductivity</li></ul>

# ► PRODUCT BRIEF DESCRIPTION

## GAP FILLER TGF 4500CVO – STORAGE

### STORAGE (Cartridges)

- Check physically if any damage to the box upon receiving.
- Open Box with side up pointing to user.
- Remove Foam packing which are enclosed to protect the cartridges during shipping.
- Cartridges are shipped in "tip up" orientation as shown in the picture
- Part A is white and Part B is pink in color.
- Refer to Application Note for details.



# ► PRODUCT BRIEF DESCRIPTION

## GAP FILLER TGF 4500CVO – PURGING

### PURGING (Cartridges)

- Slight silicone oil might appear on the surface of the container. This is normal. Use a paper napkin (with IPA if needed) to wipe or clean the surface of the cartridges.
- Remove Cartridge from box and open the red cap.



- Put the cartridge in a dispensing tool for purging. (manual dispenser shown)
- Purge about 2% volume of the cartridge to remove any silicone at the top of the tip. The cartridge is ready for usage.
- If the cartridges are loaded unto an automatic dispenser, ensure purging prior to use.



# ► PRODUCT BRIEF DESCRIPTION

## GAP FILLER TGF 4500CVO PRODUCT PROPERTIES

### Typical Properties

		Condition / Test Method	Unit	Typical value
PHYSICAL	Dispense Rate <sup>(1)</sup>		grams/minute <sup>(1)</sup>	300
	Low Shear Viscosity (Part A)	1 / sec , DIN 53019	Pa-s	522
	Low Shear Viscosity (Part B)	1 / sec , DIN 53019	Pa-s	361
	High Shear Viscosity (Part A)	1500 / sec , DIN D50999	Pa-s	20
	High Shear Viscosity (Part B)	1500 / sec , ASTM D5099	Pa-s	11
	Density	ASTM D792	g/cc	3.2
	Heat Capacity	ASTM D2169	J/g-°C	0.8
	Hardness <sup>(2)</sup>	ASTM D2240	Shore OO	70
ELECTRICAL	Dielectric Strength	ASTM D149	kV/mm	10
	Dielectric Constant	ASTM D150 @ 1,000 Hz		8.1
	Volume Resistivity	ASTM D257	Ohm-m	10 <sup>11</sup>
THERMAL	Thermal Conductivity	ASTM D5470	W/m-K	≥4.5
CHEMICAL	UL Flammability Rating (Preliminary)	UL 94		V-0
	RoHS			Pass
	Halogens			Pass
	ASTM E595 NASA Outgassing			Pass
	Siloxane Content (For Info Only)	GC-MS	ppm	<300

Notes: (1) 30cc syringe, 90 psi (621 kPa), 0.100" orifice no attachment; (2) dependent on temperature and humidity when cured



# ► PRODUCT BRIEF DESCRIPTION

## GAP FILLER TGF 4500CVO PRODUCT PROPERTIES

### Typical Properties

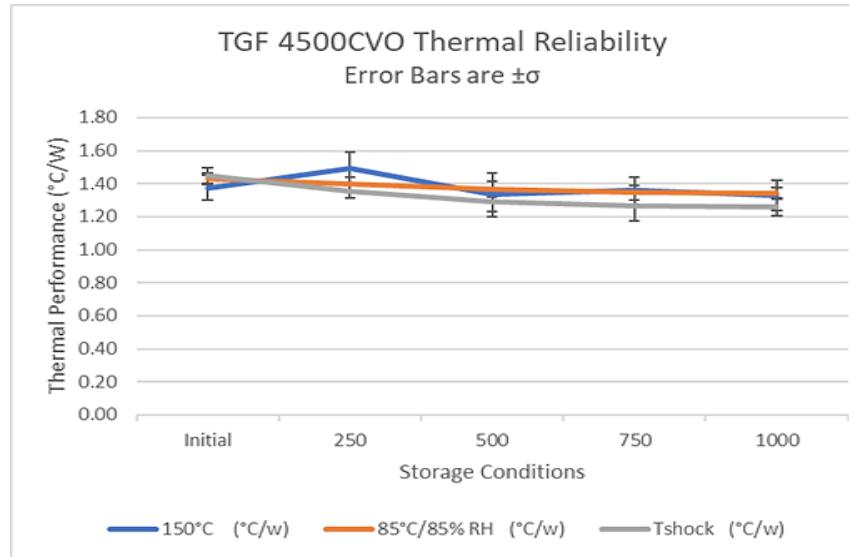
	<i>Condition / Test Method</i>	<i>Unit</i>	<i>Typical value</i>
CHEMICAL	<b>Working Time <sup>(1)</sup></b>	Parallel Plate Rheometer – 2 <sup>nd</sup> derivate peak	
	<b>25 C</b>	Minutes	1260
	<b>50 C</b>	Minutes	60
	<b>85 C</b>	Minutes	3
	<b>Cure Time <sup>(1)</sup></b>	Parallel Plate Rheometer – time to 90% cure (1st derivate)	
	<b>25 C</b>	Minutes	2880
	<b>50 C</b>	Minutes	211
	<b>85 C</b>	Minutes	22

Notes: (1) Parallel Plate rheometer

# ► PRODUCT BRIEF DESCRIPTION

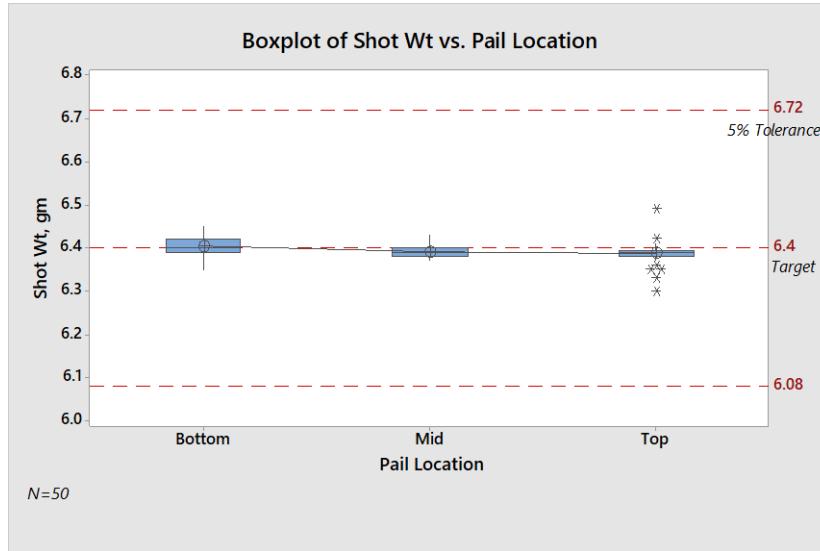
## GAP FILLER TGF 4500CVO PRODUCT RELIABILITY

- Reliability Testing Results
  - Below shows 150 °C, 85RH/85 °C and -50 to 150 °C
  - No significant changes over the 1000 hr period.

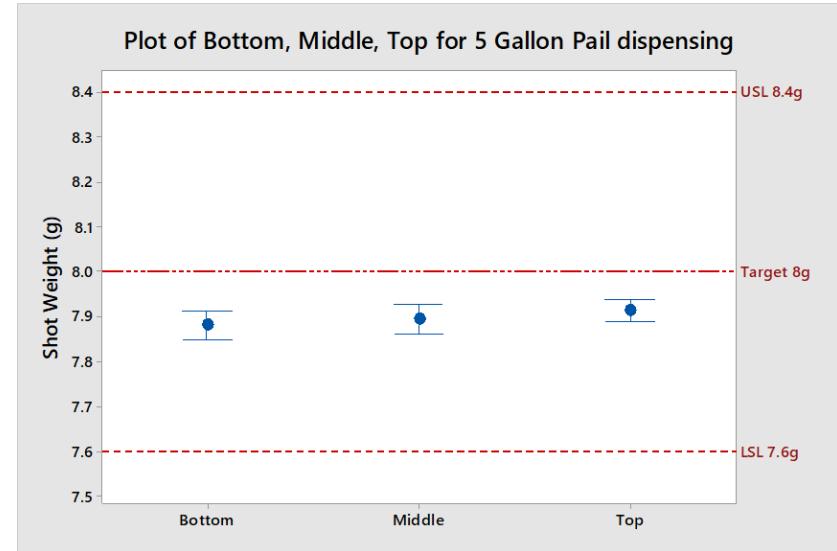


# ► PRODUCT BRIEF DESCRIPTION

## GAP FILLER TGF 4500CVO SHELF LIFE (DISPENSING)



3 Months Shelf Life



6 Months Shelf Life

► Stability in dispensing over shelf life in Pail Kits

# ► PRODUCT BRIEF DESCRIPTION

## GAP FILLER TGF 4500CVO SHELF LIFE (PROPERTIES)

<b>Property</b>	<b>6 Gallon Pail Kit (Month 0)</b>			<b>6 Gallon Pail Kit (Month 3)</b>			<b>6 Gallon Pail Kit (Month 6)</b>		
	Top	Middle	Bottom	Top	Middle	Bottom	Top	Middle	Bottom
Thermal Conductivity (W/m-K)	4.99	5.13	4.9	4.76	4.93	4.68	4.8	4.67	4.45
Hardness (Shore OO)	67	76	78	69	73	82	79	77	80
Part A									
Flow Viscosity (Pa-sec at 1 sec <sup>-1</sup> )	565	493	524	663	593	607	719	714	490
Part B									
Flow Viscosity (Pa-sec at 1 sec <sup>-1</sup> )	341	230	230	368	402	410	270	226	192
Density (g/cc)	3.22	3.22	3.22	3.22	3.21	3.19	3.22	3.22	3.13

Notes: Month 0 is tested at Mfg CF Plant while Month 3 and 6 are tested at TCS Chan Lab.

► Shelf-life properties measured at 6 months are still within spec

# ► PRODUCT INFORMATION

Product	<b>BERGQUIST Gap Filler TGF 4500CVO</b>
Link to product web page	<a href="#">Click here</a>
Link to sell sheet	<a href="#">Click here</a>
Link to TDS	<a href="#">Click here</a>
Link to SDS Search	<a href="#">Click here</a>

# TARGET MARKETS

## Power & Industrial Automation

- Power Inverter
- Surface Mount Power Switching
- EV Charger



## Automotive

- Audio amplification
- Infotainment Systems
- Power Conversion



## Electronics

- Memory
- SOC
- High thermals ICs dissipation required



# ► REGULATORY

## GAP FILLER TGF 4500CVO

- Compliant to UL (94V-0), Halogen, RoHS
  - Check respective internal and UL websites for documents details



# THANK YOU

