

ONE COMPANY... MANY SOLUTIONS

# EPOXY POTTING & ENCAPSULATING COMPOUNDS

AUTOMOTIVE

AEROSPACE

TRANSPORT

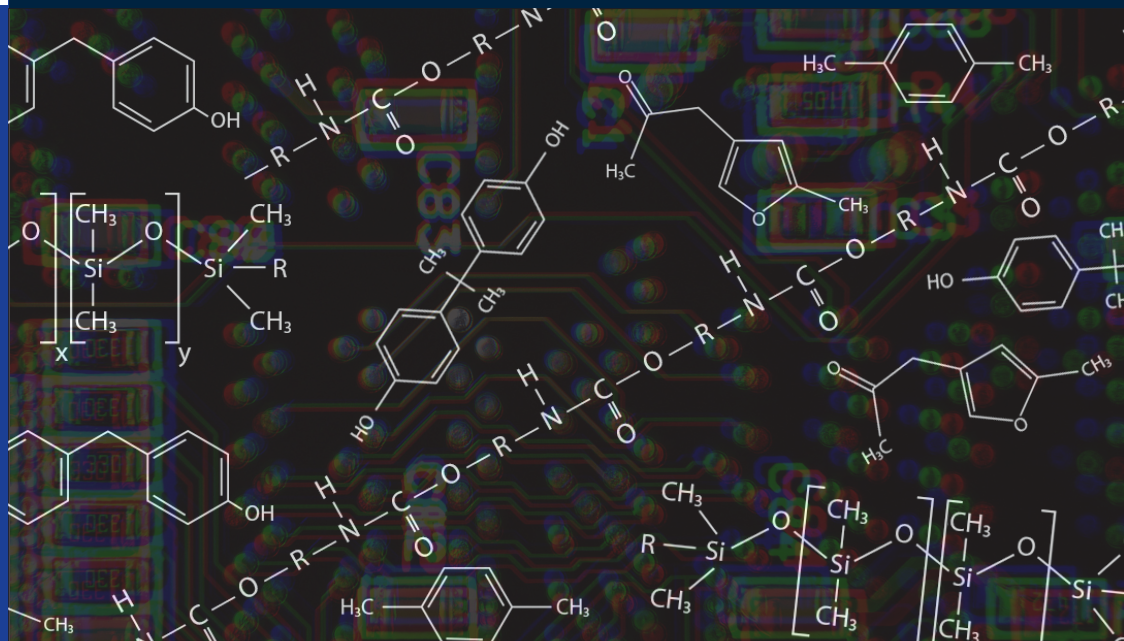
MARINE

MEDICAL

TELECOMMUNICATIONS

CONSUMER ELECTRONICS

UTILITIES







## WHAT IS MG CHEMICALS?

MG Chemicals is a manufacturer and wholesaler of chemical products for the electronics industry. Our chemical products include dusters and circuit coolers, electronic cleaners, flux removers, contact cleaners, protective coatings, epoxies, adhesives, RTV silicones, lubricants, EMI/RFI shielding coatings, thermal management products, prototyping supplies, solders and more. We also distribute related non-chemical products such as wipes, swabs, brushes, desoldering braids, copper-clad boards and 3D printing filaments.

## MG SERVICE

MG Chemicals understands that setting up production involves multiple challenges. Our service team has years of experience in production and equipment use, and understands the various technical issues you may encounter during planning, pilot studies and production runs. To overcome these challenges, we offer the following professional services.

MG Chemicals can

- Provide advice on equipment and materials
- Assist with setup and troubleshooting
- Review your proposed application processes
- Suggest ways of optimizing and customizing processes to best meet your needs
- Offer training on the proper use of our products

Quality Assurance

Since 1955, MG Chemicals has provided the North American electronics industry with a full line of high performance chemicals and accessories. The MG Chemicals manufacturing facility operates under the ISO 9001 Quality System Standard. All products undergo MG Chemicals' design process, including the testing and analysis of each product to maximize performance, user safety, environmental safeguards and market desirability.

Customer Care

Customer care is what separates MG Chemicals from the rest. Our commitment to all of these principles focuses on getting you the quality product and support you deserve.



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# INTRODUCTION TO EPOXY POTTING AND ENCAPSULATING COMPOUNDS

## Epoxy Potting and Encapsulating Compounds

Potting compounds are designed to provide a high level of protection to printed circuit boards and electronic devices by embedding them in a thick, durable polymer. Epoxies are used when extreme operating conditions require optimum protection. They offer different physical and chemical properties from other alternatives, and these properties are listed below.

**Physical Protection** – These compounds hold components firmly in place, preventing damage from vibration, mechanical shocks, abrasion, bending, tension, compression and torsion.

**Environmental Protection** - They are non-porous, providing complete protection from humidity and water, allowing for direct submersion in salt water, and granting complete protection from dust, soil, corrosion and fungus. They also are extremely chemically resistant and can resist most fuels, oils, alcohols, mild solvents, and strong acids.

**Electrical Protection** - Epoxies have inherent insulative properties that result in a high volume resistivity and dielectric strength. These features allow epoxies to provide protection from static discharge, electrical shocks and arcing, and also allow tighter spacing between components.

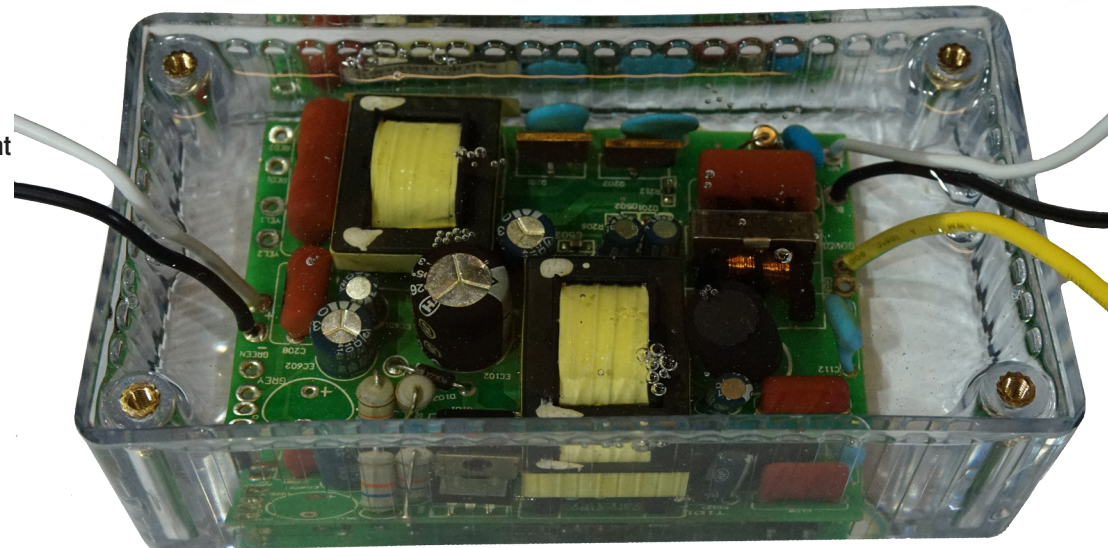
**Thermal Protection** – They provide a high level of resistance to thermal cycling and thermal shock, which is an important requirement for many customers who are looking to protect their electronics from temperature swings.

**Technology Protection** – Black systems block visual inspection and are very difficult to remove without destroying the underlying device, making it more difficult for competitors to reverse engineer.

The three main chemistries in thermosetting, potting and encapsulation compounds are epoxies, silicones and polyurethanes. Epoxies provide a set of benefits not seen with the other chemistries, some of which are listed below:

### BENEFITS & FEATURES

- Cost effective
- Easy to use
- Extended shelf life
- Room temperature shipping and storage
- Room temperature cures are the norm
- Curing can usually be accelerated with heat
- Low VOC's
- Isocyanate-free
- Chemical resistance
- Primerless adhesion to many substrates
- More rigid
- Excellent moisture resistance
- Excellent durability
- Excellent bond strength
- Multifunctional protection



All of our epoxy compounds share certain characteristics; however, the characteristics of each of our products vary to meet the specific needs of the different applications they are intended to serve. Here are some of the ways the characteristics of our compounds vary:

**UL Ratings** – In the epoxy potting compound line, this comprises the UL 94 flammability rating and the UL 746A certification for electrical and mechanical properties. Some industries, such as aerospace and defense, require UL listings to even consider using a product. All compounds in our 834 series are either in the process of being certified or are already UL certified to UL 94V-0.

**Thermal Conductivity** – Certain applications involve a lot of heat generation at the board level, requiring thermal management considerations. As polymers are generally thermally insulative on their own, formulating specifically for thermal conductivity is important. Our thermally conductive compounds address the issue of thermal management by transferring the heat from the electronics through the potting compound, thus increasing life span and reliability as well as reducing the overall temperature of components.

**Hard or Flexible** – We offer epoxy potting compounds that are either hard (70-90 Shore D) or flexible (80-90 Shore A). Certain applications require hard compounds; however, hard compounds can introduce stresses that affect sensitive components in situations where a lot of thermal cycling occurs. Flexible epoxies provide a low-stress option in sensitive applications where traditional hard options cannot be used but the core chemical properties of an epoxy are still desired.

**Optical Clarity** – Most potting compounds are pigmented black to prevent visual inspection and maximize radiative cooling. However, we offer products that are clear to allow visual inspection: 832C, which is translucent amber, and 832WC, which is water-clear for maximum optical transmission.

**Mix Ratios** – MG Chemical formulates epoxies with convenient 1:1 or 2:1 mix ratios for easy processing. In some of our specialty products, we utilize mix ratios that are 4:1 or 5:1 to achieve certain desirable properties.

**Viscosity** – Viscosity is the measurement of a product's resistance to flow, and is usually measured in centipoise (cP). The viscosity is important for an application and should be considered during the design stage. Our products vary from low viscosity (less than 1000 cP, thin) to high viscosity (greater than 18000 cP). Products that contain a lot of filler are usually thick, while some compounds can be extremely thin.

**Working Time** – Our epoxies have various working times, depending on the specific resin and hardener being used. Epoxies cure exothermically, and the reaction is accelerated through heat, meaning that a curing epoxy is self-accelerating. Depending on application needs, a low exotherm epoxy may be desired when working with larger quantities, and higher exotherm options may be desired for throughput when working with small quantities. We measure and list our working times using 100 g batches of epoxy.

**Cure Schedule**– Most epoxies can be cured at room temperature; however, optimal properties are achieved when using an elevated temperature. Generally, we try to provide multiple cure schedules, and the most commonly used cure temperatures are 25 °C, 65 °C, and 80 °C. Typically, increasing temperature will decrease cure time. Each system has a limit as to how high it can be heated without impairing the qualities of the cured product.





**832B - Black, 2:1**

A general epoxy potting and encapsulating compound that is extremely tough and durable.

**BENEFITS & FEATURES**

- 2:1 volume mix ratio
- Very high tensile strength
- Very strong compressive strength
- Strong flexural strength

Cat. Number	Packaging	Net Volume		Net Weight	
832B-375ML	Kit	375 mL	12.6 fl oz	403 g	0.89 lb
832B-3L	Kit	2.55 L	0.68 gal	2.74 kg	6.04 lb
832B-12L	Kit	10.8 L	2.88 gal	11.6 kg	25.6 lb
832B-60L	Kit	60 L	16 gal	64.5 kg	142 lb

**832C - Translucent**

A general epoxy potting and encapsulating compound that is a translucent amber color.

**BENEFITS & FEATURES**

- 2:1 volume mix ratio
- Amber color allows for visual inspection
- Very high tensile strength
- Very strong compressive strength
- Very high electrical resistivity

Cat. Number	Packaging	Net Volume		Net Weight	
832C-375ML	Kit	375 mL	12.7 fl oz	402 g	12.9 oz
832C-450ML	Dual cartridge	450 mL	25.3 fl oz	483 g	15.5 oz
832C-3L	Kit	2.55 L	5.39 pt	2.73 kg	6.0 lb
832C-60L	Kit	60 L	16 gal	64.3 kg	142 lb

**832HD - Black, 1:1**

A general epoxy potting and encapsulating compound with a 1:1 volume mix ratio.

**BENEFITS & FEATURES**

- Very high lap shear strength

Cat. Number	Packaging	Net Volume		Net Weight	
832HD-25ML	Dual syringe*	25 mL	0.8 fl oz	26.2 g	0.92 oz
832HD-50ML	Dual cartridge*	50 mL	1.6 fl oz	52.5 g	1.85 oz
832HD-400ML	Dual cartridge	400 mL	13.5 fl oz	420 g	14.8 oz
832HD-7.4L	Kit	7.4 L	1.9 gal	7.77 kg	17.1 lb
832HD-40L	Kit	40 L	10 gal	42 gal	92 lb

**832WC - Water Clear**

An optically clear compound for encapsulating LED's, fiber optics, or any potting or adhesive application requiring optimal clarity

**BENEFITS & FEATURES**

- 2:1 volume mix ratio
- Optically clear
- Minimal yellowing over time

Cat. Number	Packaging	Net Volume		Net Weight	
832WC-375ML	Kit	375 mL	12.6 fl oz	401 g	14.1 oz
832WC-3L	Kit	2.7 L	2.85 qt	2.89 kg	6.37 lb
832WC-12L	Kit	10.8 L	2.88 gal	11.5 kg	25.5 lb
832WC-60L	Kit	60 L	16 gal	64.2 kg	141 lb

**832FX - Flexible**

For use in stress-sensitive or low temperature applications.

**BENEFITS & FEATURES**

- 1:1 volume mix ratio
- Soft, 88 Shore A hardness
- Low mixed viscosity of 700 cP
- Low Tg of 8.8 °C

Cat. Number	Packaging	Net Volume		Net Weight	
832FX-450ML	Kit	450 mL	15.2 fl oz	475 g	1.05 lb
832FX-1.7L	Kit	1.7 L	57 fl oz	1.8 kg	3.9 lb
832FX-7.4L	Kit	7.4 L	1.9 gal	7.82 kg	17.2 lb
832FX-40L	Kit	40 L	10 gal	42.2 kg	93.2 lb

**832TC - Thermally Conductive**

For use when potting heat generating components.

**BENEFITS & FEATURES**

- 1:1 volume mix ratio
- Good thermal conductivity
- Good lap shear strength
- Low exotherm
- Long working time of 2 hours

Cat. Number	Packaging	Net Volume		Net Weight	
832TC-450ML	Kit	450 mL	15.2 fl oz	752 g	1.66 lb
832TC-2L	Kit	1.7 L	0.45 gal	2.84 kg	6.26 lb
832TC-8L	Kit	7.2 L	1.92 gal	12.0 kg	26.5 lb
832TC-40L	Kit	40 L	10.7 gal	66.8 kg	147 lb



**832HT - High Temperature**

For use in high temperature applications, or applications requiring strong chemical resistance or physical strength.

**BENEFITS & FEATURES**

- 2:1 weight mix ratio
- High tensile strength
- Very high dielectric strength
- Strong compressive strength
- Strong flexural strength
- Good lap shear strength
- Excellent chemical resistance
- High Tg of 89 °C

Cat. Number	Packaging	Net Volume		Net Weight	
832HT-375ML	Kit	340 mL	11.5 fl oz	377 g	12.1 oz
832HT-3L	Kit	2.3 L	2.43 qt	2.55 kg	5.62 lb



Uncured Properties	832B	832C	832HD	832TC	832HT	832FX	832WC
Mix Ratio by Vol. (A:B)	2:1	2:1	1:1	1:1	1.7:1	1:1	2:1
Viscosity Mixture	3 300 cP	2 700 cP	4 100 cP	18 000 cP	21 900 cP	700 cP	979 cP
Part A	2 200 cP	1 900 cP	5 900 cP	36 000 cP	46 400 cP	800 cP	2 860 cP
Part B	5 800 cP	5 800 cP	2 300 cP	14 000 cP	6 600 cP	165 cP	340 cP
Working Time @22 °C	1 h	1 h	45 min	2 h	1 h	2.5 h	1 h
Full Cure @22 °C	24 h	24 h	24 h	96 h	24 h	48 h	72 h
Full Cure @65 °C	1 h	1 h	2 h	2 h	1 h	2 h	TBD

Cured Properties	832B	832C	832HD	832TC	832HT	832FX	832WC
Color	Black	Translucent	Black	Black	Black	Black	Optically clear
Density	1.11 g/mL	1.12 g/mL	1.07 g/mL	1.83 g/mL	1.10 g/mL	1.08 g/mL	1.06 g/mL
Hardness	80D	84D	80D	82D	87D	88A	82D

Mechanical Properties	832B	832C	832HD	832TC	832HT	832FX	832WC
Tensile Strength	57 N/mm <sup>2</sup>	56 N/mm <sup>2</sup>	32 N/mm <sup>2</sup>	18 N/mm <sup>2</sup>	48 N/mm <sup>2</sup>	9.6 N/mm <sup>2</sup>	10 N/mm <sup>2</sup>
Elongation	3.3%	6.4%	TBD	1.9%	TBD	160%	TBD
Compressive Strength	155 N/mm <sup>2</sup>	182 N/mm <sup>2</sup>	75 N/mm <sup>2</sup>	29 N/mm <sup>2</sup>	130 N/mm <sup>2</sup>	TBD	157 N/mm <sup>2</sup>
Flexural Strength	114 N/mm <sup>2</sup>	38 N/mm <sup>2</sup>	TBD	37 N/mm <sup>2</sup>	101 N/mm <sup>2</sup>	TBD	TBD
Lap Shear Strength, Stainless steel	4.2 N/mm <sup>2</sup>	4.4 N/mm <sup>2</sup>	21 N/mm <sup>2</sup>	13 N/mm <sup>2</sup>	15 N/mm <sup>2</sup>	TBD	3.3 N/mm <sup>2</sup>
Izod Impact	0.93 kJ/m <sup>2</sup>	1.5 kJ/m <sup>2</sup>	TBD	1.7 kJ/m <sup>2</sup>	TBD	TBD	TBD

Electrical Properties	832B	832C	832HD	832TC	832HT	832FX	832WC
Volume Resistivity	5.3 x 10 <sup>12</sup> Ω-cm	1.2 x 10 <sup>16</sup> Ω-cm	1.4 x 10 <sup>13</sup> Ω-cm	2.6 x 10 <sup>15</sup> Ω-cm	1 x 10 <sup>13</sup> Ω-cm	5.8 x 10 <sup>12</sup> Ω-cm	1.6 x 10 <sup>17</sup> Ω-cm
Surface Resistivity	TBD	5.5 x 10 <sup>15</sup> Ω	TBD	3.2 x 10 <sup>15</sup> Ω	TBD	TBD	TBD
Dielectric Strength @1/8"	442 V/mil	406 V/mil	365/mil	370 V/mil	>430 V/mil	343 V/mil	394 V/mil
Breakdown Voltage @1/8"	55.3 kV	50.7 kV	45.7 kV	46.2 kV	>54 kV	42.8 kV	49 kV
Dielectric Constant @1 MHz	2.77	TBD	2.53	4.41	2.83	3.06	3.23
Dielectric Dissipation @1 MHz	0.017	TBD	0.041	0.011	0.014	0.050	0.028

Thermal Properties	832B	832C	832HD	832TC	832HT	832FX	832WC
Thermal Conductivity @25 °C	0.26 W/(m·K)	0.28 W/(m·K)	0.27 W/(m·K)	0.68 W/(m·K)	0.27 W/(m·K)	0.26 W/(m·K)	TBD
Specific Heat Capacity @25 °C	2.2 J/(g·K)	2.1 J/(g·K)	2.0 J/(g·K)	TBD	1.6 J/(g·K)	2.7 J/(g·K)	TBD
Heat Deflection Temp.	47 °C	44 °C	TBD	35 °C	54 °C	TBD	TBD
Glass Transition Temp. (T <sub>g</sub> )	49 °C	35 °C	41 °C	25 °C	89 °C	8.8 °C	33 °C
CTE prior T <sub>g</sub>	79 ppm/°C	77 ppm/°C	73 ppm/°C	66 ppm/°C	86 ppm/°C	114 ppm/°C	80 ppm/°C
CTE after T <sub>g</sub>	196 ppm/°C	195 ppm/°C	207 ppm/°C	167 ppm/°C	152 ppm/°C	218 ppm/°C	192 ppm/°C
Constant Service Temp.	-40 to 140 °C	-40 to 140 °C	-40 to 150 °C	-30 to 175 °C	-40 to 225 °C	-40 to 140 °C	-40 to 140 °C
Maximum Intermittent Temp.	175 °C	175 °C	175 °C	200 °C	250 °C	150 °C	155 °C

TBD=To be determined

## Available Packaging (cartridges)

For kits packaging see pages 10 & 11



25 mL Dual Cartridge



50 mL Dual Cartridge

Dispensing tools  
(Sold separately)



8MT-25 8MT-50



450 mL Dual Cartridge

Dispensing tools  
(Sold separately)

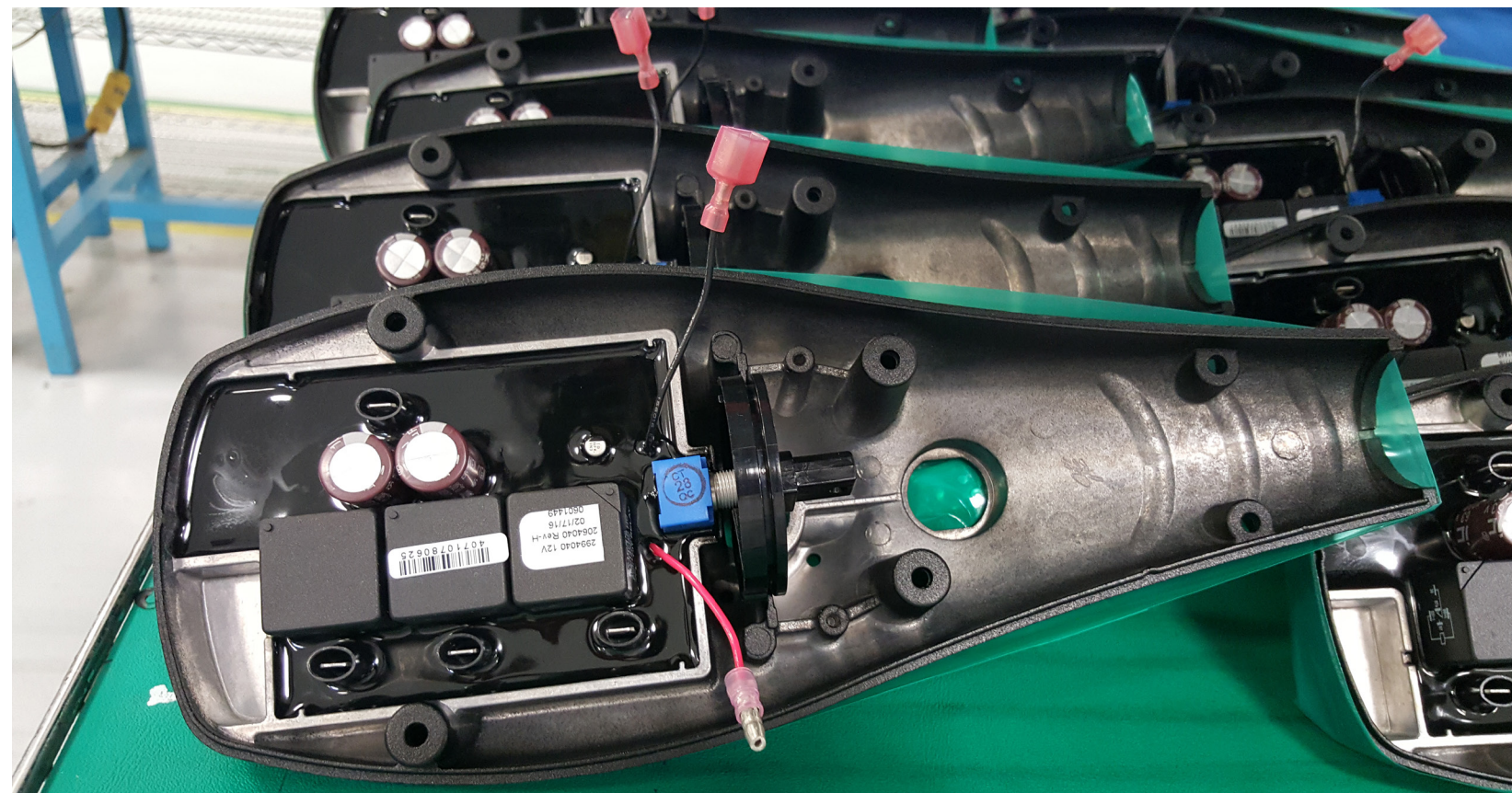


8DG-450-2-1 8MT-450

## 834 Series – Compounds meeting the UL 746A Standard

All compounds in the 834 series are designed to meet the UL746A Standard for polymeric materials.

The UL 746A Standard provides data regarding the physical, electrical, flammability, thermal, and other properties of the materials, and is intended to furnish guidance to the material manufacturers, molders, end-product manufacturers, safety engineers, and other interested parties.



### 834B - Balanced Formula

A good standard potting compound. Suitable for most applications.

#### BENEFITS & FEATURES

- 2:1 volume mix ratio
- High thermal conductivity
- Halogen free

### 834FRB - Low Viscosity

Flame retardant but not thermally conductive. The lack of thermal fillers allows better flow and physical strength.

#### BENEFITS & FEATURES

- 2:1 volume mix ratio
- Very high lap shear strength
- Very flowable
- Excellent CTI (>600 V, PLC=0)
- Low thermal conductivity

Cat. Number	Packaging	Net Volume	Net Weight
834B-375ML	Kit	375 mL 12.6 fl oz	597 g 1.31 lb
834B-2.7L	Kit	2.7 L 2.85 qt	4.3 kg 9.48 lb
834B-10.8L	Kit	10.8 L 2.85 gal	17.2 kg 37.9 lb
834B-60L	Kit	60 L 15.8 gal	95.6 kg 210 lb

Cat. Number	Packaging	Net Volume	Net Weight
834FRB-375ML	Kit	375 mL 12.6 fl oz	475 g 1.05 lb
834FRB-3L	Kit	3 L 3.17 qt	3.81 kg 8.39 lb
8324FRB-60L	Kit	60 L 16 gal	76.1 kg 167 lb



### 834ATH - Economical

Pigmented with aluminum trihydrate (ATH), providing a cost-effective solution with some thermal conductivity.

#### BENEFITS & FEATURES

- 2:1 volume mix ratio
- Thermally conductive
- Cost Effective
- Good compressive strength
- Good lap shear strength
- Low impact resistance

Cat. Number	Packaging	Net Volume		Net Weight	
834ATH-375ML	Kit	375 mL	12.6 fl oz	516 g	1.13 lb
834ATH-3L	Kit	2.55 L	2.69 qt	3.5 kg	7.73 lb
834ATH-60L	Kit	60 L	16 gal	82.5 kg	182 lb

### 834HTC - High Thermal Conductivity

Use when high thermal conductivity is essential.

#### BENEFITS & FEATURES

- 5:1 volume mix ratio
- High thermal conductivity of 1.0 W/m.K
- Halogen free



Cat. Number	Packaging	Net Volume		Net Weight	
834THC-900ML	Kit	900 mL	1.9 pt	1.53 kg	3.38 lb
834THC-4.25L	Kit	4.25 L	1.13 gal	7.25 kg	15.9 lb

### 834FX - Flexible

For use in stress-sensitive or low temperature applications.

#### BENEFITS & FEATURES

- 1:1 volume mix ratio
- Good thermal conductivity: 0.61 W/m.K
- Soft, 88 Shore A Hardness
- Low Tg of 0.7 °C.
- Halogen free
- Low constant service temperature limit
- Long working time of 2.5 hours
- Low exotherm



Cat. Number	Packaging	Net Volume		Net Weight	
834FX-450ML	Kit	450 mL	15.2 fl oz	728 g	1.6 lb
834FX-1.7L	Kit	1.7 L	1.79 qt	2.75 kg	6.06 lb
834FX-7.4L	Kit	7.4 L	1.92 gal	11.6 kg	25.6 lb
834FX-40L	Kit	40 L	10.6 gal	64.8 kg	142 lb



## 834 Series Epoxy UL Rated Comparison Chart

Uncured Properties	834B	834FRB	834FX	834HTC	834ATH
Mix Ratio by Vol. (A:B)	2:1	2:1	1:1	5:1	2:1
Viscosity Mixture	16 200 cP	2 600 cP	10 800 cP	10 500 cP	5 900 cP
Part A	27 500 cP	1 900 cP	4 560 cP	55 900 cP	4 600 cP
Part B	2 100 cP	4 800 cP	4 670 cP	24 cP	12 900 cP
Working Time @22 °C	1 h	1 h	2.5 h	1.5 h	2 h
Full Cure @22 °C	48 h	24 h	48 h	24 h	24 h
Full Cure @65 °C	3 h	1 h	3 h	2 h	1 h @80 °C

Cured Properties	834B	834FRB	834FX	834HTC	834ATH
Color	Black	Black	Black	Black	Black
Density	1.59 g/mL	1.39 g/mL	1.64 g/mL	1.69 g/mL	1.40 g/mL
Hardness	85D	83D	88A	91D	85D
UL 94V-0 Certification File #	Meets	E334302	Meets	Meets	E334302
Halogen Free	No	No	Yes	Yes	No

Mechanical Properties	834B	834FRB	834FX	834HTC	834ATH
Tensile Strength	17 N/mm <sup>2</sup>	23 N/mm <sup>2</sup>	5.3 N/mm <sup>2</sup>	22 N/mm <sup>2</sup>	28 N/mm <sup>2</sup>
Compressive Strength	74 N/mm <sup>2</sup>	140 N/mm <sup>2</sup>	14 N/mm <sup>2</sup>	123 N/mm <sup>2</sup>	100 N/mm <sup>2</sup>
Flexural Strength	TBD	65 N/mm <sup>2</sup>	TBD	TBD	51 N/mm <sup>2</sup>
Lap Shear Strength, Stainless steel	8.2 N/mm <sup>2</sup>	24 N/mm <sup>2</sup>	3.7 N/mm <sup>2</sup>	6.7 N/mm <sup>2</sup>	15 N/mm <sup>2</sup> , Al
Izod Impact	TBD	2.39 kJ/m <sup>2</sup>	TBD	N/A	0.02 kJ/m <sup>2</sup>

Electrical Properties	834B	834FRB	834FX	834HTC	834ATH
Volume Resistivity	2.1 x 10 <sup>12</sup> Ω·cm	1.4 x 10 <sup>15</sup> Ω·cm	7.5 x 10 <sup>11</sup> Ω·cm	3.0 x 10 <sup>13</sup> Ω·cm	7 x 10 <sup>14</sup> Ω·cm
Dielectric Strength @1/8"	376 V/mil	344 V/mil	330 V/mil	345 V/mil	380 V/mil
Breakdown Voltage @1/8"	47 kV	43.0 kV	41.4 kV	43.1 kV	47 kV
Dielectric Constant @1 MHz	3.10	2.80	4.50	3.91	3.07
Dielectric Dissipation @1 MHz	0.010	0.011	0.044	0.019	0.016

Thermal Properties	834B	834FRB	834FX	834HTC	834ATH
Thermal Conductivity @25 °C	0.79 W/(m·K)	0.28 W/(m·K)	0.61 W/(m·K)	0.94 W/(m·K)	0.37 W/(m·K)
Specific Heat Capacity @25 °C	1.5 J/(g·K)	TBD	1.4 J/(g·K)	1.3 J/(g·K)	1.2 J/(g·K)
Heat Deflection Temperature	TBD	TBD	TBD	TBD	54 °C
Glass Transition Temperature (T <sub>g</sub> )	56 °C	39 °C	0.7 °C	52 °C	51 °C
CTE prior T <sub>g</sub>	74 ppm/°C	50 ppm/°C	71 ppm/°C	34 ppm/°C	84 ppm/°C
CTE after T <sub>g</sub>	107 ppm/°C	178 ppm/°C	137 ppm/°C	116 ppm/°C	178 ppm/°C
Constant Service Temperature	-40 to 175 °C	-40 to 175 °C	-50 to 150 °C	-50 to 150 °C	-40 to 175 °C
Maximum Intermittent Temperature	200 °C	200 °C	165 °C	165 °C	200 °C

TBD=To be determined

## Available Packaging (kits)



375mL Kit



900mL Kit



1.7L Kit



3L Kit



4.25L Kit



7.4L Kit



10.8L Kit



40L Kit



60L Kit



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## FOR SAFETY DATA SHEETS

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## FOR TECHNICAL SUPPORT

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