

# POTTING AND ENCAPSULATING EPOXY

PROTECT AGAINST SUBMERSION,  
TECHNOLOGY, IMPACT AND CHEMICALS

Thermally Conductive • High Temperature  
Flame Retardant (UL Recognized)



[mgchemicals.com](http://mgchemicals.com)



*Serving you since 1955*

# WHO IS MG CHEMICALS

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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, and copper clad boards.

We specialize in the formulation and production of protective coatings for electronics: Conformal Coatings, Epoxy Potting & Encapsulating Compounds, and EMI/RFI Shielding Paints.



# MG SERVICE

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MG Chemicals recognizes that setting up production comes with various challenges. Our service team offers a wide variety of experience in material production, equipment, and technical issues you may encounter during planning, pilot studies, and production runs. To overcome these challenges, we offer professional services.

## **As a service, 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 epoxy 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 focus on getting you the quality product and support you deserve.



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# COMPARISON CHART - SOLVENT FREE EPOXY SYSTEMS

	Standards	832B	832C	832TC	832HT	8322	834FRB	834ATH
<b>Uncured Working Properties</b>								
Mix Ratio (by volume)		2:1	2:1	1:1	1.7:1	4:1	2:1	2:1
Viscosity Mixture (cP)	ASTM D2983	3,300	3,300	18,000	40,000	–	2,600	5,900
	ASTM D2983	2,200	2,200	38,000	46,000	2,500	1,600	4,600
	ASTM D2983	5,800	5,800	15,000	5,800	20	3,600	12,900
Working Time (h)		1	1	2	1	2	1	2
Curing Schedule (h):								
	at room temp.	24	24	96	24	–	24	24
at 65°C		1	1	2	1	4	1	1 @ 80°C
<b>Cured Properties</b>								
Color		Black	Translucent	Black	Black	Optically clear	Black	Black
Hardness	Shore D	80 D	85 D	82 D	87 D	86 D	83 D	85 D
Flamme Retardant	UL 94V-0	N/A	N/A	N/A	N/A	N/A	UL 94V-0	UL 94V-0
<b>Mechanical Properties</b>								
Tensile Strength (PSI)	ASTM D638	8,250	8,100	2,700	7,900	–	6,400	4,100
Elongation Percentage (%)	ASTM D638	3.3	6.4	1.9	3.4	–	–	6.2
Compressive Strength (lb/in <sup>2</sup> )	ASTM D695	22,400	26,500	4,100	11,900	–	–	14,500
Flexural Strength in (lb/in <sup>2</sup> )	ASTM D790	16,500	5,500	5,300	14,600	–	9,500	7,400
Lap Shear Strength in (lb/in <sup>2</sup> )	ASTM D1002	606	640	3,200	1,790	–	–	2,200
<b>Electrical Properties</b>								
Volume Resistivity (ohms·cm)	ASTM D257	5.3 x 10 <sup>12</sup>	1.2 x 10 <sup>16</sup>	2.6 x 10 <sup>15</sup>	9.3 x 10 <sup>15</sup>	–	1.4 x 10 <sup>15</sup>	7.0 x 10 <sup>14</sup>
Dielectric Strength for 1/8" (V/mil)	ASTM D149	442	406	370	454	TBD	344	380
Breakdown Voltage for 1/8" (V)	ASTM D149	55,300	50,700	46,200	56,800	–	43,000	47,000
Dielectric Constant (@1 MHz)	ASTM D150	2.77	2.99	4.41	2.83	–	3.18*	–
Dielectric Dissipation (@1 MHz)	ASTM D150	0.017	–	0.011	0.014	–	0.014*	–
Comparative Tracking Index (V)	ASTM D3628	N/E	N/E	N/E	N/E	N/E	>600	>500
<b>Thermal Properties</b>								
Tg, Glass Transition Temp. (°C)	ASTM D 3638	–	–	25	68	109	56*	51
CTE before Tg (ppm°C)	ASTM E 257	104	72	66	76	–	–	84
CTE after Tg (ppm°C)	ASTM E 257	–	–	167	154	–	–	178
Thermal Conductivity W/(m·K)	ASTM E 1530	–	–	0.682	0.218	N/E	0.24	0.37
Constant Service Temp. (°C)		-30 to	-30 to	-30 to	-30 to	*-40 to	-40 to	-30 to
		+140	+140	+140	+200	+200	+175	+175
Max Withstanding Temp. (°C)		+145	+145	+225	+250	100	+225	+200
Heat Deflection Temp. (°C)	ASTM D648	47	44	35.4	53.9	–	–	53.7

. Values based on chemically equivalent product measurements

\* Yellows @ 80°C

# EPOXY POTTING APPLICATION INSTRUCTIONS

## How to hand mix the MG epoxies potting compound

The procedure outlined here is for manual processing of MG epoxies. For product specific details, see the technical data sheets or product specific instruction guides. We have based our procedure on our experience and industry best practices.

All suggestions must be critically reviewed, and if necessary, altered or substituted in accordance to the specification and operating constraints of your printed circuit assembly. The component application and geometry do affect the recommendations. Further, equipment availability, automation capabilities, and production facility requirements also affect recommendations.

## REQUIRED EQUIPMENT

- Wiping cloth or paper towel - for cleaning tools and equipment
- Gloves and personal protective clothing
- 3 x 12" stainless steel stirring spatula for 1L kits —OR—  
2 x 48" paddles for 20 L [5.2 gal] pail kits  
(label paddles A, B, and Mix respectively)
- A volume or mass measurement or dispensing devices
- 1 mixing container - sufficiently large to hold both epoxy parts while leaving room for stirring
- Oven - set at 65 °C [149 °F] (optional)
- Vacuum chamber for de-airing (optional)
- Ethyl lactate solvent (Cat. No. 8328-500ML) for cleaning uncured epoxy spills (optional)

## 1. STIRRING OF INDIVIDUAL EPOXY PARTS

Thorough stirring of individual parts is required prior to jointly mixing each part.

### Additional Requirement

Requires strong upper body strength to stir pail size containers well.

### TO STIR PART A:

1. With a part A paddle, scrape the walls and bottom of a part A pail to lift, break up, and reincorporate all settled material into solution.
2. Stir slowly, in one circular direction only; fold the material from the bottom onto the top.
3. Continue stirring until the solution is homogenous. The material should show uniform color and consistency without color tint variations or visible chunks.
4. If material sits for more than an hour, re-stir back to homogeneity prior to processing.

### TO STIR PART B:

Follow instructions for part A, but substitute part B in text. (Do NOT use the same paddle as for A.)

As long as parts are not cross-contaminated, the shelf-life of each part is generally about  $\leq 5$  years. Between processing, put the pail cover back on unused parts A or B to avoid contamination from dust, humidity, or other foreign materials.

Further, equipment availability, automation capabilities, and production facility requirements also affect recommendations.

## WARNING!

Failure to properly stir individual parts before mixing them together can cause surface defects, degrade the cured properties, or even cause cure failures. Further, improper pre-stirring of parts can create irrecoverable off-ratio conditions that renders the remainder of the stock material unusable.

## CAUTION

Do not cross contaminate. To avoid premature curing, use different stirring tools for parts A & B.

## CAUTION

Quickly reversing mixing direction or using a whipping action can trap air in mixture leading to bubble problems.

## 2. MIXING PARTS A + B OF MG EPOXIES

Estimate the part A and B volumes that will be needed for your potting application prior to mixing. To avoid waste, mix the needed epoxy amounts only when you are ready to encapsulate components. The pot life for the mixed epoxy is about one hour at room temperature.

### Additional Requirement

Requires strong upper body strength to stir pail size containers well.

### TO CREATING POTTING MIXTURE:

1. Measure a volume of pre-stirred A, and pour in the mixing container.
2. By the given ratio, measure the corresponding volume of pre-stirred B, and slowly pour in the mixing container while stirring.
3. With a Mix paddle, scrape the walls and bottom of the mixing container.
4. For 3 minutes, stir slowly in a circular unidirectional motion while folding the material from the bottom onto the top to create a homogeneous mixture.
5. Let sit for 30 minutes to de-air. –OR–  
Put in a vacuum chamber, bring to 25 Hg/in pressure, and wait for 2 minutes to de-air.
6. If bubbles are present at top, use the mixing paddle to break them.

The potting mixture is ready to use. At room temperature, the pot life of the mixture is 1 hour after first initial mixing. Higher temperatures lower viscosity of the mixture and allows for faster de-airing; however, greater than room temperature shortens the pot life. Similarly, lowering the mixture temperature increases pot life but increases viscosity.

### CAUTION

Follow the mix ratio as closely as possible. Deviations of  $\geq 10\%$  are not acceptable.

### CAUTION

Without stirring, mixing  $>500\text{g}$  (0.4 L) of Part B at a time into A can promote flash cure.

### NOTE

Our epoxy products do not require kit matching. You are free to use Part A and Part B with different batch numbers without affecting the cured product properties.

## 3. POTTING COMPONENTS

The printed circuit board (PCB) may now be covered or embedded in epoxy. Ensure the cleanliness and dryness of the assembly and components prior to potting.

### TO POT ASSEMBLY:

1. Slowly pour de-aired epoxy mix in the PCB-component box or enclosure.
2. Let the product level before inserting additional components within enclosure. This avoids trapping air.
3. If geometry contributes to air entrapment, use injection, vacuum, or suitable method to help displace any air pockets.

### NOTE

Spills of uncured epoxy mix can be wiped with a dry cloth or a paper towel. For better cleaning, moisten the cloth or paper towel with ethyl lactate. Ethyl lactate is an excellent solvent for removing uncured epoxies. All cleaning should be done before the epoxy is cured.

## 4. CURING MG EPOXIES

Heat accelerated cures not only shorten cures from days to minutes or hours, but typically give better properties.

### To room temperature cure the MG epoxies

Let stand for 24 hours.

### To heat cure the MG epoxies

Put in oven at  $65\text{ }^\circ\text{C}$  [ $149\text{ }^\circ\text{F}$ ] for 60 minutes. –OR–  
Put in oven at  $80\text{ }^\circ\text{C}$  [ $176\text{ }^\circ\text{F}$ ] for 45 minutes. –OR–  
Put in oven at  $100\text{ }^\circ\text{C}$  [ $212\text{ }^\circ\text{F}$ ] for 35 minutes.

After the initial curing, the epoxy properties should continue to improve with time until it reaches its optimum properties.

### ATTENTION!

Due to exothermic reaction, heat cure temperatures should be at least 25% below the maximum temperature tolerated by the most fragile PCB component.

For larger potting blocks, reduce heat cure temperature by greater margins.

# B

# BLACK EPOXY

Protects sensitive electronic components from impact, shock, vibration, heat, conductivity, moisture, chemicals, and visual inspection.

- Non-porous, water and chemical resistant (allows for total immersion)
- Extremely impact resistant (contains a form of nylon)
- Extreme acid resistant
- Colored black, to prevent visual inspection
- Affords high security, once cured, extremely difficult to remove
- Non-conductive, an electrical insulator
- Low toxicity
- Easy and simple to mix
- Long pot life
- Can be cured in one hour at 65°C (150°F)
- This product is RoHS compliant

Catalog Number	Sizes Available	Description
832B-375ML	375 mL (12 oz)	Liquid
832B-3L	2.55 L	Liquid
832B-12L	10.2 L	Liquid
832B-60L	60 L	Liquid



## CURING & WORK SCHEDULE

	Test Method	Result
Working Life		60 minutes
Shelf Life		≥ 3 years
Full Cure	at 20 °C [68 °F]	24 hours
	at 65 °C [149 °F]	60 minutes
	at 80 °C [176 °F]	45 minutes
	at 100 °C [212 °F]	35 minutes
Storage Temperature of Unmixed Parts		16 to 27 °C [60 to 80 °F]
Constant Service Temp.		-30 °C to 140 °C [-22 to 284 °F]
Service Temperature		≤ 30 to +145 °C [≤ 22 to +294 °F]

## CURED PROPERTIES: THERMAL

	Test Method	Result
Coefficient of Thermal Expansion (CTE)	ASTM E 831	104 ppm/°C
Glass Transition Temperature (Tg)	ASTM D 3418	Not established
Heat Deflection Temperature (HDT)	ASTM D 648	46.638 °C [115.95 °F]

## CURED PROPERTIES: PHYSICAL

	Test Method	Result
Color	Visual	Black
Density (at 26 °C)	ASTM D 792	1.12 g/cm <sup>3</sup>
Hardness (Shore D durometer)		80D to 82D
Tensile Strength	ASTM D 638	56.9 N/mm <sup>2</sup> [8,250 lb/in <sup>2</sup> ]
Elongation	ASTM D 638	3.3%
Lap Shear Strength	ASTM D 1002	4.2 N/mm <sup>2</sup> [606 lb/in <sup>2</sup> ]
Izod Impact	ASTM D 256	0.932 kJ/m <sup>2</sup> [0.443 ft-lb/in <sup>2</sup> ]
Compression Strength	ASTM D 695	155 N/mm <sup>2</sup> [22,400 lb/in <sup>2</sup> ]
Modulus	ASTM D 695	2,590 N/mm <sup>2</sup> [375,000 lb/in <sup>2</sup> ]
Flexural Strength	ASTM D 790	113.76 N/mm <sup>2</sup> [16,500 lb/in <sup>2</sup> ]
Modulus	ASTM D 790	2,940 N/mm <sup>2</sup> [427,000 lb/in <sup>2</sup> ]

## CURED PROPERTIES: ELECTRICAL

	Test Method	Result
Breakdown Voltage	ASTM D 149	55.3 kV @ avg. of 2.79 mm
Dielectric Strength	ASTM D 149	442 V/mil [18.6 kV/mm]
Volume Resistivity	ASTM D 257	5.3 x10 <sup>12</sup> ohm · cm
Surface Resistivity	ASTM D 257	3.1 x10 <sup>10</sup> ohm
Comparative Tracking Index	ASTM D 3628	Not established
Dielectric Dissipation & Constant	ASTM D 150-98	dissipation, D constant, k'
@ 60Hz		0.007, 3.90
@ 1 kHz		0.008, 2.95
@ 10 kHz		0.013, 2.89
@ 100 kHz		0.018, 2.83
@ 1 MHz		0.017, 2.77

## UNCURED PROPERTIES

	Part A	Part B	Mixed
Color	Black	Clear, Amber	Tint Black
Viscosity at 24°C [73 °F]	2,200 cP	5,800 cP	3,300 cP
Density	1.127 g/mL	0.967 g/mL	1.058 g/mL
Flash Point	154 °C [309 °F]	110 °C [230 °F]	
Odor	Mild	Musty	
Mix Ratio by Volume (A:B)			2.0 :1.0
Mix Ratio by Weight (A:B)			2.3 :1.0
Solids Content (w/w)			99%

## CHEMICAL SOLVENT RESISTANCE

	Weight Change in 3 days	Weight Change in 45 days
Water	< 0.0 %	< 1 %
Hydrochloric Acid	< 0.0 %	< 1 %
Isopropyl Alcohol	0.3 %	< 1 %
Mineral Spirits	0.3 %	0.3 %
Xylene	2 %	9 %
Ethyl Lactate	3 %	7 %
Iso Hexanes	5 %	8 %
Acetone	7 %	Destroyed

# C

# TRANSLUCENT EPOXY

For high voltage applications. Protects sensitive electronic components from impact, shock, vibration, heat, conductivity, moisture, chemicals. Allows visual inspection.

- Non-porous, water and chemical resistant
- Extremely impact resistant (contains a form of nylon)
- Affords total security, once cast it can not be removed
- Excellent machining proper ties
- Non-conductive, an electrical insulator
- Low toxicity
- Easy and simple to mix
- Long pot life
- Can be cured in one hour at 65°C (150°F)
- This product is RoHS compliant



Catalog Number	Sizes Available	Description
832C-375ML	375 mL (12 oz)	Liquid
832C-3L	2.55 L	Liquid
832C-60L	60 L	Liquid

## CURING & WORK SCHEDULE

	Test Method	Result
Working Life		60 minutes
Full Cure	at 20 °C [68 °F]	24 hours
	at 65 °C [149 °F]	60 minutes
	at 80 °C [176 °F]	45 minutes
	at 100 °C [212 °F]	35 minutes
Storage Temperature of Unmixed Parts		16 to 27 °C [60 to 80 °F]
Constant Service Temp.		-30 °C to 140 °C [-22 to 284 °F]
Service Temperature		≤ 30 to +145 °C [≤ 22 to +294 °F]

## CURED PROPERTIES: THERMAL

	Test Method	Result
Coefficient of Thermal Expansion (CTE)	ASTM E 831	104 ppm/°C
Glass Transition Temperature (Tg)	ASTM D 3418	Not established
Heat Deflection Temperature (HDT)	ASTM D 648	46.6 °C [115.6 °F]

## CURED PROPERTIES: PHYSICAL

	Test Method	Result
Color	Visual	Translucent, Yellow
Density (at 26 °C)	ASTM D 792	1.12 g/cm <sup>3</sup>
Hardness (Shore D durometer)		85D
Tensile Strength	ASTM D 638	55.7 N/mm <sup>2</sup> [8,100 lb/in <sup>2</sup> ]
Elongation	ASTM D 638	6.4%
Lap Shear Strength	ASTM D 1002	4.42 N/mm <sup>2</sup> [640 lb/in <sup>2</sup> ]
Izod Impact	ASTM D 256	1.47 kJ/m <sup>2</sup> [0.700 ft·lb/in]
Compression Strength	ASTM D 695	182 N/mm <sup>2</sup> [26,500 lb/in <sup>2</sup> ]
Modulus	ASTM D 695	2,170 N/mm <sup>2</sup> [315,000 lb/in <sup>2</sup> ]
Flexural Strength	ASTM D 790	38.26 N/mm <sup>2</sup> [5,00 lb/in <sup>2</sup> ]
Modulus	ASTM D 790	2,551 N/mm <sup>2</sup> [370,000 lb/in <sup>2</sup> ]

## CURED PROPERTIES: ELECTRICAL

	Test Method	Result
Breakdown Voltage at 0.114"	ASTM D 149	48.5 kV @ avg. of 2.90 mm
Dielectric Strength	ASTM D 149	406 V/mil [16.7 kV/mm]
Breakdown Voltage at 1/8"	calculated	50.7 kV @ 3.175 mm
Dielectric Strength	calculated	406 V/mil [15.7 kV/mm]
Volume Resistivity	ASTM D 257	1.22 x 10 <sup>16</sup> ohm · cm
Surface Resistivity	ASTM D 257	N/E
Dielectric Dissipation & Constant	ASTM D 150	3.85 @60Hz
	ASTM D 150	3.19 @1 kHz
	ASTM D 150	2.99 @1 MHz

## UNCURED PROPERTIES

	Part A	Part B	Mixed
Color	Translucent Amber	Clear Amber	Translucent Amber
Viscosity at 24°C [73 °F]	2,200 cP	5,800 cP	3,300 cP
Density	1.127 g/mL	0.967 g/mL	1.058 g/mL
Flash Point	154 °C [309 °F]	110 °C [230 °F]	
Odor	Mild	Musty	
Mix Ratio by Volume (A:B)			2.0 : 1.0
Mix Ratio by Weight (A:B)			2.3 : 1.0
Solids Content (w/w)			100%

## CHEMICAL SOLVENT RESISTANCE

	Weight Change in 3 days	Weight Change in 45 days
Water	< 0.0 %	< 1 %
Hydrochloric Acid	< 0.0 %	< 1 %
Isopropyl Alcohol	0.3 %	< 1 %
Mineral Spirits	0.3 %	0.3 %
Xylene	2 %	9 %
Ethyl Lactate	3 %	7 %
Iso Hexanes	5 %	8 %
Acetone	7 %	Destroyed



# OPTICALLY CLEAR EPOXY

Our 8322 Optically Clear Epoxy offers a very strong and UV-resistant finish. This two part coating is simple to mix and use: it does not require special or costly equipment to apply.

The 8322 epoxy protects against static discharges, shocks, vibrations, and mechanical impacts. It insulates against heat and conductivity. It is extremely resistant to environmental humidity, salt water, and many harsh chemicals.

- **Excellent Chemical resistance**
- **Extreme resistance to water and humidity**
- **Optically Clear : Transmission @25  $\mu\text{m}$  [1 mil] <4.5% loss in optical range**
- **UV light stable: non yellowing**

Catalog Number	Sizes Available	Description
8322-1	1125 ml (38 fl. oz)	Liquid
8322-2	4.5 L (1.2 gal)	Liquid
8322-3	18.9 L (10.7 gal)	Liquid

## CURING & WORK SCHEDULE

	Test Method	Result
Working Life		2 hours
Full Cure		
at 65 °C [149 °F]		4 hours
at 80 °C [176 °F]		2 hours
Storage Temperature of Unmixed Parts		25 °C [77°F]
Service Temperature		-40 to +80 °C [-40 to +176 °F]
Max Withstand Temperature		+100 °C [+212 °F]

## CURED PROPERTIES: THERMAL

	Test Method	Result
Glass Transition Temperature (Tg)	ASTM D115	109 °C
Thermal Cycling Stability Thermal	-40 to 200 °C	Passed
Thermal Stability 24 h @ 80°C	on Cu/Al substrates	No yellowing
Thermal Stability 96 h @ 100 °C	on Cu/Al substrates	Slight yellowing

## CURED PROPERTIES: PHYSICAL

	Test Method	Result
Color	Visual	Clear
Density (at 26 °C)	ASTM D 792	TBD
Hardness	Shore D durometer	86D
UV Resistant	—	Yes
Optical Transmission Loss @ 25 µm (1 mil)	UV-Vis Spectrophotometer	<4.5%

## UNCURED PROPERTIES

	Part A	Part B	Mixed
Color	Colorless	Colorless	Colorless
Viscosity at 24°C [73 °F]	2,500 cP [2.5 Pa·s]	20 cP [0.020 Pa·s]	TBD
Density	1.09 g/mL	0.92 g/mL	TBD
Flash Point	115 °C [239 °F]	112 °C [234 °F]	
Odor	Odorless	Ammonia like	
Mix Ratio by Volume (A:B)			4 : 1
Mix Ratio by Weight (A:B)			5 : 1
Solids Content (w/w)	100%	100%	

## CHEMICAL SOLVENT RESISTANCE

	Weight Change in 3 days	Weight Change in 45 days
Water	< 0.0 %	< 1 %
Hydrochloric Acid	< 0.0 %	< 1 %
Isopropyl Alcohol	0.3 %	< 1 %
Mineral Spirits	0.3 %	0.3 %
Xylene	2 %	9 %
Ethyl Lactate	3 %	7 %
Iso Hexanes	5 %	8 %
Acetone	7 %	Destroyed

# TC

# THERMALLY CONDUCTIVE EPOXY

100% solids. Formulated with undiluted Bis F resin for superior physical properties, and pigmented with high purity aluminum oxide pigment to provide excellent thermal conductivity at reasonable cost. Pigmented black for excellent thermal absorption and emission.

- Provides superior protection from impact, shock, conductivity, moisture, abuse, chemicals, and analysis
- Two part epoxy, with a 1 to 1 mixing ratio by volume
- Two hour working time
- Suitable for large production runs
- Excellent machining properties

Catalog Number	Sizes Available	Description
832TC-450ML	450 mL kit (16 oz)	Liquid
832TC-2L	1.7 L	Liquid
832TC-8L	6.8 L	Liquid
832TC-40L	40 L	Liquid



## CURING & WORK SCHEDULE

	Test Method	Result
Working time (100 g)		2 hours
Cure Time	at 20 °C [68 °F]	96 hours
	at 45 °C [113 °F]	8 hours
	at 55 °C [131 °F]	4 hours
	at 65 °C [149 °F]	2 hours

## CURED PROPERTIES: THERMAL

	Test Method	Result
Thermal Conductivity		0.682 W/(m·K) [4.73 Btu·in/(h·ft <sup>2</sup> ·°F)]
Thermal Diffusivity		0.38 mm <sup>2</sup> /s
Volumetric Specific Heat		1.9 MJ/m <sup>3</sup> ·K
Thermal Expansion	ASTM E 831	148.3 ppm/°C

## CURED PROPERTIES: PHYSICAL

	Test Method	Result
Shore Hardness		82 D
Tensile strength	ASTM D 638	18.85 N/mm <sup>2</sup> [2700 psi]
Elongation	ASTM D 638	1.9%
Compressive Strength	ASTM D 695	28.19 N/mm <sup>2</sup> [4,100 psi]
Flexural Strength	ASTM D 790	1/3.76 N/mm <sup>2</sup> [5,300psi]
Cantilever Beam (IZOD) Impact	ASTM D 256	1.7 kJ/mm <sup>2</sup>
Shear Strength	ASTM E 83	22.2 N/mm <sup>2</sup> [3,200 psi]

## CURED PROPERTIES: ELECTRICAL

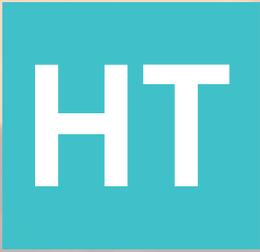
	Test Method	Result
Dielectric Strength	ASTM D 150	4.41
Dielectric Constant	ASTM D 150	0.0113
Volume Resistivity	ASTM D 257	2.58 x 10 <sup>15</sup> ohm · cm
Surface Resistivity	ASTM D 257	3.16 x 10 <sup>16</sup> ohm/sq

## UNCURED PROPERTIES

	Part A	Part B	Mixed
Mixed Viscosity at 25 °C (77 °F), 10 RPM			18,000 cP
Mixed Specific Gravity			1.616
Volume Mix Ratio (resin:hardener)			1:1
Viscosity at 25 °C (77 °F), 30 RPM	38,000 cP	15,000 cP	
Specific Gravity	1.802	1.504	
Color	Black	Black	

## CHEMICAL AND SOLVENT RESISTANCE

	Change after 3 days
Isopropyl Alcohol	~ 0 %
Iso hexanes	~ 0 %
Mineral spirits	~ 0 %
Hydrochloric Acid	< 0.50 %
Ethyl Lactate	< 1 %
Xylene	< 2 %
Acetone	< 3 %



# HIGH TEMPERATURE EPOXY

For encapsulating and potting electronics in high temperature environments, aggressive chemical environments, or where improved technology protection is desired. Bonds to a wide variety of substrates, including metals, glass, ceramics and many plastics.

- Extreme physical strength and chemical resistance
- Suitable for extreme environments, such as submersion in salt water, acids, bases, fuels, and alcohols
- Protects against strong vibrations, abrasions, and direct physical impact
- Extremely difficult to remove granting incredible technology protection
- Maximum service temperature of 250°C (482°F)

Catalog Number	Sizes Available	Description
832HT-375ML	375ml (12 oz)	Liquid
832HT-3L	2.3L	Liquid



## CURING & WORK SCHEDULE

	Test Method	Result
Curing Time (100 g)	@ room temp.	24 hours
	@ 65°C	60 minutes
	@ 80°C	45 minutes
	@ 100°C	35 minutes
	@ 130°C	25 minutes
	@ 160°C	15 minutes
	@ 200°C	10 minutes

## CURED PROPERTIES: THERMAL

	Test Method	Result
Coefficient of Thermal Expansion	ASTM D 648-01	
-40 °C to 50 °C		75.7 ppm/°C
-40 °C to +250 °C		125.3 ppm/°C
+25 °C to +250 °C		140.2 ppm/°C
+100 °C to +250 °C		154.0 ppm/°C
Heat Deflection Temperature (HDT)	ASTM D 648	53.9 °C (129.02 °F)
Thermal Conductivity	ASTM E 1530	0.210 W/m·K
Thermal Conductivity @ 25 °C (77 °F)	ASTM E 1461	0.218 W/m·K (1.51 Btu·in/(h·ft²·°F))
Glass Transition Temperature (Tg)	ASTM D 3418	68 °C
Thermal Diffusivity @ 25 °C (77 °F)	ASTM E 1461	1.33 x 10 <sup>-13</sup> /s
Specific Heat Capacity @ 25 °C (77 °F)	ASTM E 1269	1419 J/kg·°K

## CURED PROPERTIES: PHYSICAL

	Test Method	Result
Maximum Service Temperature		200 °C (392 °F)
Color		Black
Maximum Intermittent Temperature		250 °C (482 °F)
Working Time (100 gram sample)		1 hour
Hardness, Shore D		87 D
Tensile Strength	ASTM D 638-02a	54.22 N/mm <sup>2</sup> [7,861 PSI]
Elongation	ASTM D 638-02a	3.38%
Compressive Strength	ASTM-D 695 02a	81.842 N/mm <sup>2</sup> [11,870 PSI]
Flexural Strength	ASTM D 790-03	100.66 N/mm <sup>2</sup> [14,600 PSI]
Flexural Modulus	ASTM D 790-03	2,751 N/mm <sup>2</sup> [399,000 PSI]
Lap Shear Strength	ASTM D 1002-01	12.37 N/mm <sup>2</sup> [1,794 PSI]

## CURED PROPERTIES: ELECTRICAL

	Test Method	Result
Breakdown Voltage at 0.114"	ASTM D 149	48.5 kV @ avg. of 2.90 mm
Dielectric Strength	ASTM D 149	425 V/mil [16.7 kV/mm]
Breakdown Voltage at 1/8"	calculated	50.7 kV @ 3.175 mm
Dielectric Strength	calculated	454 V/mil [15.7 kV/mm]
Volume Resistivity	ASTM D 257	9.3 x 10 <sup>15</sup> ohm · cm
Surface Resistivity	ASTM D 257	N/E
Dielectric Dissipation & Constant	ASTM D 150	3.85 @60Hz
	ASTM D 150	3.19 @1 kHz
	ASTM D 150	2.83 @1 MHz

## UNCURED PROPERTIES

	Part A	Part B	Mixed
Mixing Ratio by Volume (Part A: Part B)	1.7	1	
Mixing Ratio by Mass (Part A: Part B)	2	1	
Viscosity at 23 °C (73 °F)	40,000 cP	5,800 cP	40,000 cP
Specific Gravity @ 23 °C	1.198	0.963	1.12

# FRB

# FLAME RETARDANT EPOXY - REACH

The 834FRB Flame Retardant Epoxy Encapsulating and Potting Compound is a UL 94V-0 recognized electric grade epoxy in the QMFZ2 category. This two part self-extinguishing epoxy provides a black finish with great insulation and protection value.

It protects against static discharges, shocks, vibrations, and mechanical impacts. It insulates against heat and conductivity. It is extremely resistant to environmental humidity, salt water, and many harsh chemicals.

- **Certified UL 94V-0 (File # E334302)**
- **Specification verified as per UL 746A**
- **Mix ratio 2A:1B compatible with most dispensing equipment**
- **Extreme resistance to water and humidity allowing submersion if needed**
- **Protects electronics from moisture, corrosion, fungus, thermal shock, and static discharges**
- **Strong chemical resistance to brine, acids, bases, and aliphatic hydrocarbons**
- **Free of solvents**
- **Suitable for potting transformers & power supplies**



Catalog Number	Sizes Available	Description
834FRB-375ML	375 mL (12 oz)	Liquid
834FRB-3L	2.55 L	Liquid
834FRB-60L	60 L	Liquid

## CURING & WORK SCHEDULE

	Test Method	Result
Working Life		60 minutes
Shelf Life		≥ 3 years
Full Cure	at 20 °C [68 °F]	24 hours
	at 65 °C [149 °F]	60 minutes
	at 80 °C [176 °F]	45 minutes
	at 100 °C [212 °F]	35 minutes
Storage Temperature of Unmixed Parts		16 to 27 °C [60 to 80 °F]
Service Temperature		-40 to +175 °C [-40 to +347 °F]
Max Withstand Temperature		-65 °C to +225 °C [-85 °F to +437 °F]

## CURED PROPERTIES: THERMAL

	Test Method	Result
Coefficient of Thermal Expansion		Not established
Thermal Conductivity @ 25 °C	ASTM E 831	0.24W/(m·K) [1.63 Btu·in/(h·ft <sup>2</sup> ·°F)]
Glass Transition Temperature (T <sub>g</sub> )	ASTM D 3418	~ 56 °C
Heat Deflection Temperature	ASTM D 648	49.7 °C <sup>3</sup>

## CURED PROPERTIES: PHYSICAL

	Test Method	Result
Color	Visual	Black
Flammability	94V	94V-0
Density (at 26 °C)	ASTM D 792	1.39 g/cm <sup>3</sup>
Hardness (Shore D durometer)		83D to 84D
Flexural Strength	ASTM D 1002	65.4 N/mm <sup>2</sup> [9,490 lb/in <sup>2</sup> ]
Tensile Strength	ASTM D 790	44.13 N/mm <sup>2</sup> [6,401 lb/in <sup>2</sup> ]
Tensile Impact	ASTM D 1822	16.38 kJ/m <sup>2</sup> [7.793 ft·lb/in <sup>2</sup> ]
Izod Impact	ASTM D 256	2.394 kJ/m <sup>2</sup>
Outgassing (Total Mass Loss) @ 24h		1.88 %

## CURED PROPERTIES: ELECTRICAL

	Test Method	Result
Breakdown Voltage at 0.114"	ASTM D 149	27.4 kV @ avg. of 1.289 mm
Breakdown Voltage @3.175 mm [1/8"]	Reference fit	43.0 kV
Dielectric Strength	ASTM D 149	13.7 kV/mm [348 V/mil]
Volume Resistivity	ASTM D 257	1.35 x 10 <sup>15</sup> ohm·cm
Comparative Tracking Index	ASTM D 3628	100 V
Hot Wire Ignition		45.24 s
High-Current Arc Ignition		139.40 arc
High Voltage Arc Tracking Rate		24.58 mm/min
High Voltage, Low Current, Dry Arc Resistance	ASTM D 495	69.24 s
High Voltage Arc Resist. to Ignition	ASTM D 495	27.33 s

## UNCURED PROPERTIES

	Part A	Part B	Mixed
Color	Dark Grey	Black	Black
Viscosity at 24°C [73 °F]	1,600 cP [1.6 Pa·s]	3,600 cP [3.6 Pa·s]	2,600 cP [2.6 Pa·s]
Density	1.39 g/mL	1.16 g/mL	1.31 g/mL
Flash Point	150 °C [302 °F]	148 °C [221 °F]	
Odor	Musty	Mild	
Mix Ratio by Volume (A:B)			2.0 : 1.0
Mix Ratio by Weight (A:B)			2.4 : 1.0
Solids Content (w/w)			~96 %



# ATH FLAME RETARDANT EPOXY

The 834ATH Flame Retardant Epoxy Encapsulating and Potting Compound is a two-part, economical, electronic-grade, self-extinguishing, flame retardant epoxy that provides excellent physical, chemical, and electrical protection and offers a degree of thermal conductivity.

It protects against static discharges, shocks, vibrations, and mechanical impacts. It is extremely resistant to environmental humidity, salt water, and harsh chemicals. It also helps hide and restrict access to intellectual property, and it is much harder to remove than standard epoxy encapsulating compounds.

- **Certified UL 94V-0 (File # E334302)**
- **Specification Verified as per UL 746A**
- **Cost effective**
- **Good thermal conductivity**
- **Mix ratio 2A:1B compatible with most dispensing equipment**
- **Resistance to water and humidity allowing submersion if needed**
- **Protects electronics from moisture, corrosion, fungus, thermal shock, and static discharges**
- **Free of solvents**
- **Suitable for potting transformers & power supplies**

Catalog Number	Sizes Available	Description
834ATH-375ML	375 mL (12 oz)	Liquid
834ATH-3L	2.55 L	Liquid
834ATH-60L	60 L	Liquid

## CURING & WORK SCHEDULE

	Test Method	Result
Working Life		2 hours
Shelf Life		5 years
Full Cure	at 20 °C [68 °F]	24 hours
	at 80 °C [176 °F]	60 minutes
	at 100 °C [212 °F]	45 minutes
Storage Temperature of Unmixed Parts		16 to 27 °C [60 to 80 °F]
Service Temperature		-30 to +175 °C [-22 to +347 °F]
Max Withstand Temp		-40 to +200 °C [-40 to +392 °F]

## CURED PROPERTIES: THERMAL

	Test Method	Result
Coefficient of Thermal Expansion (CTE)		
Below Tg	ASTM E 831	178 ppm/°C
Above Tg	ASTM E 831	178 ppm/°C
Thermal Conductivity @ 25 °C [77 °C]	ASTM E 1530	0.37 W/m K
Thermal Diffusivity @ 25 °C [77 °C]	ASTM E 1461 92	2.1 x 10 <sup>-7</sup> m <sup>2</sup> /s
Specific Heat Capacity @ 25 °C [77 °C]	ASTM E 1269 01	1.2 J/(kg·K)
Glass Transition Temperature (Tg)	ASTM D 3418	51 °C [124 °F]
Heat Deflection Temperature	ASTM D 648	53.7 °C [129 °F]

## CURED PROPERTIES: PHYSICAL

	Test Method	Result
Color	Visual	Translucent, Yellow
Density (at 26 °C)	ASTM D 792	1.12 g/cm <sup>3</sup>
Hardness (Shore D durometer)		85D
Tensile Strength	ASTM D 638	55.7 N/mm <sup>2</sup> [8,080 lb/in <sup>2</sup> ]
Elongation	ASTM D 638	6.4%
Lap Shear Strength	ASTM D 1002	4.42 N/mm <sup>2</sup> [641 lb/in <sup>2</sup> ]
Izod Impact	ASTM D 256	1.47 kJ/m <sup>2</sup> [0.700 ft·lb/in]
Compression Strength	ASTM D 695	182 N/mm <sup>2</sup> [26,500 lb/in <sup>2</sup> ]
Modulus	ASTM D 695	2,170 N/mm <sup>2</sup> [315,000 lb/in <sup>2</sup> ]
Flexural Strength	ASTM D 790	38.26 N/mm <sup>2</sup> [5,549 lb/in <sup>2</sup> ]
Modulus	ASTM D 790	2,551 N/mm <sup>2</sup> [370,000 lb/in <sup>2</sup> ]

## CURED PROPERTIES: ELECTRICAL

	Test Method	Result
Breakdown Voltage at 0.114"	ASTM D 149	33 kV
Dielectric Strength	ASTM D 149	22 kV/mm [550 V/mil]
Breakdown Voltage @3.175 mm [1/8"]	Reference fit	43.0 kV
Dielectric Strength	ASTM D 149	13.7 kV/mm [380 V/mil]
Volume Resistivity @23 °C & 50% RH	ASTM D 257	7 x 10 <sup>14</sup> Ω·cm
Volume Resistivity @35 °C & 90% RH	ASTM D 257	2 x 10 <sup>14</sup> Ω·cm
Comparative Tracking Index (CTI)	ASTM D 3628	400 V to 599 V
		Performance Level Class (PCL) = 1
Hot Wire Ignition (HWI)	ASTM D3874	120 s
High Voltage Arc Tracking Rate (HVTR)		121 mm/min
High Voltage Arc Resistance to Ignition (HVAR)		300 s
High Voltage, Low Current, Dry Arc Resistance	ASTM D 495	127 s
High-Current Arc Ignition (HAI)	CSA C22.2	+150 arc

## UNCURED PROPERTIES

	Part A	Part B	Mixed
Color	Black	Black	Black
Viscosity at 24°C [73 °F]	4,600 cP [4.6 Pa·s]	12,900 cP [12.9 Pa·s]	5,900 cP [5.9 Pa·s]
Density	1.40 g/mL	1.26 g/mL	1.39 g/mL
Flash Point	150 °C [302 °F]	185 °C [365 °F]	
Odor	Mild aromatic	Ammonia like	
Mix Ratio by Volume (A:B)			2 : 1
Mix Ratio by Weight (A:B)			2.25 : 1.00
Solids Content (w/w)	~ 98%	100%	

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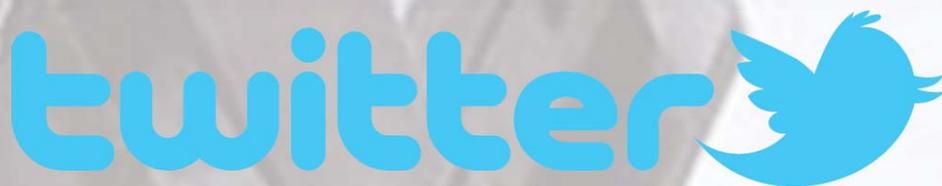
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