

Thermally Conductive Epoxy – Product No. 16027

DESCRIPTION

Product No. 16027 – Thermally Conductive Epoxy, Encapsulating and Potting Compound, is an electric grade epoxy. It uses high purity aluminum oxide to provide excellent thermal conductivity at reasonable costs. This two parts black epoxy provides superior shock insulation and impact protection value; it is near 100% solids.

The Product No. 16027 – Epoxy provides very strong electrical insulation, and protects against static discharges, shocks, vibrations, mechanical impacts, environmental humidity, salt water, and many harsh chemicals.

APPLICATIONS & USAGES

Regular epoxies are thermally insulating and can trap heat within electronics assemblies, affecting the performance of temperature sensitive parts. Product No. 16027 – Epoxy protects circuits by reducing the risk of heat buildup; it should be used to pot or encapsulate printed circuit assemblies where thermal management is a concern. The cured Product No. 16027 – Epoxy improves reliability, operational range, and lengthens the life of electrical and electronic parts. It also helps hide and restrict access to proprietary design elements.

Its primary applications are in the automobile; marine; aerospace and aviation; communication, instrumentation; medical equipment and devices; and industrial control equipment industries. Additional applications include mounting temperature sensitive samples and parts to avoid heat build-up during processing.

BENEFITS

- Extreme protection against heat build up compared to normal epoxies
- Excellent thermal conductor
- Pigmented black for optimal radiative cooling
- Ideal 1A:1B mix ratio compatible with all dispensing equipment
- Two hour working time suitable for large production runs
- Strong chemical resistance to brine, acids, bases, and aliphatic hydrocarbons
- Opaque and very difficult to remove material providing high security for proprietary designs
- Superb protection against corrosion, fungus, thermal shock, physical impact, water, and static

CURING & WORK SCHEDULE

<i>Properties</i>	<i>Value</i>
Working Life ^{a)}	2 hour
Shelf Life	≥3 year
Full Cure (at 20 °C [68 °F])	96 hour
Full Cure (at 45 °C [113 °F])	8 hour
Full Cure (at 55 °C [131 °F])	4 hour
Full Cure (at 65 °C [149 °F])	2 hour
Storage Temperature of Unmixed Parts	16 to 27 °C [60 to 80 °F]

Note: Life and cure values are for 100 g and room temperature unless stated otherwise.

a) A 10 °C increase can decrease the pot life and cure times by half.

TEMPERATURE SERVICE RANGE

<i>Properties</i>	<i>Value</i>
Constant Service Temp.	-30 °C to 140 °C [-22 to 284 °F]
Maximum Withstand Temperature ^{b)}	225 °C [437 °F]

b) The maximum withstand or service temperature can be maintained for short periods of time only.

PRACTICAL COMPONENTS

Name	CAS Number
Part A: Bis-F Epoxide Resin	28064-14-4
Aluminum Oxides	1344-28-1
Part B: Curing Polyamide	68071-65-8
Triethylene tetramine	112-24-3
Aluminum Oxides	1344-28-1

PROPERTIES OF CURED PRODUCT NO. 16027 – THERMALLY CONDUCTIVE EPOXY

Physical Properties	Method	Value^{a)}
Color	Visual	Black
Density (at 26 °C)		1.83 g/cm ³
Hardness	(Shore D durometer)	82D
Tensile Strength	ASTM D 638	18.85 N/mm ² [2,734 lb/in ²]
Elongation	"	1.87%
Lap Shear Strength	ASTM D 1002	22.2 N/mm ² [3224 lb/in ²]
Izod Impact ^{b)}	ASTM D 256	1.7 kJ/m ² [0.80 ft·lb/in]
Compression Strength	ASTM D 695	28.19 N/mm ² [4,088 lb/in ²]
Flexural Strength	ASTM D 790	113.76 N/mm ² [5,352 lb/in ²]
Electric Properties	Method	Value
Breakdown Voltage @ 3.118 mm	ASTM D 149	45.7 kV
Dielectric Strength	"	14.7 kV/mm [373 V/mil]
Breakdown Voltage @3.175 mm [1/8"]	Reference fit ^{c)}	46.2 kV
Dielectric Strength	"	14.6 kV/mm [370 V/mil]
Volume Resistivity	ASTM D 257	2.58 x10 ¹⁵ Ω·cm
Surface Resistance ^{d)}	"	3.16 x10 ¹⁶ Ω/sq
Comparative Tracking Index	ASTM D 3628	Not established
Dielectric Dissipation & Constant @1 MHz	ASTM D 150-98	<i>dissipation, D</i> <i>constant, k'</i> 0.011 4.41
Thermal Properties	Method	Value
Thermal Conductivity		0.682 W/(m·K)
Thermal Diffusivity		0.38 mm ² /s
Volumetric Specific Heat		1.9 MJ/(m ³ ·K)
CTE (prior T _g) ^e	ASTM E 831	66.2 ppm/°C
CTE (after T _g) ^e	ASTM E 831	166.9 ppm/°C
Overall CTE (-40 to 250 °C) ^e	ASTM E 831	148.3 ppm/°C
Glass Transition Temperature (T _g)	ASTM D 3418	25.4 °C [77.7 °F]
Heat Deflection Temperature	ASTM D 648	35.4 °C [95.6 °F]

a) N/mm² = mPa; lb/in² = psi

b) Cantilever beam impact

c) To allow comparison between products, the Tautschter equation was fitted to 5 experimental dielectric strengths and extrapolated to a standard reference thickness of 1/8" (3.175 mm).


d) The surface (sheet) resistivity unit is commonly referred to as "Ohm per square"

e) Coefficient of Thermal Expansion (CTE) units are in ppm/°C = in/in/°C × 10⁻⁶ = unit/unit/°C × 10⁻⁶

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PROPERTIES OF CURED PRODUCT NO. 16027 – THERMALLY CONDUCTIVE EPOXY

Physical Property	Mixture (1A:1B)	
Color	Black	
Viscosity at 20 °C [73 °F] ^a	38,000 cP to 40,000 cP [38 Pa·s to 40 Pa·s]	
Density	1.616 g/mL	
Mix Ratio by Volume (A: B)	1.0: 1.0	
Mix Ratio by Weight (A: B)	1.2: 1.0	
Solids Content (w/w)	~100%	
		
Physical Property	Part A	Part B
Color	Black	Black
Viscosity at 24°C [73 °F] ^a	17,900 cP [17.9 Pa·s]	23,100 cP [23.1 Pa·s]
Density	1.802 g/mL	1.504 g/mL
Flash Point	190 °C [374 °F]	93 °C [199 °F]
Odor	Slight Odor	Slight Odor

a) Brookfield viscometer at 20 RPM for Part A and 10 RPM Part B with spindle LV4

COMPATIBILITY

Adhesion—As seen in the substrate adhesion table, Product No. 16027 – Epoxy adheres to most materials found; however, it is not compatible with contaminants like water, oil, and greasy flux residues that may affect adhesion. If contamination is present, clean the surface with a suitable cleaner or isopropanol.

SUBSTRATE ADHESION IN DECREASING ORDER

Physical Properties	Adhesion
Aluminum	Stronger
Steel	
Fiberglass	
Wood	
Glass	
Polycarbonate	
Acrylic	
Polypropylene ^{a)}	Weaker

a) Does not bond to polypropylene

16027 TN V1 05222013

Page 3 of 5

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Chemical Resistance— The chemical solvent resistance table presents the percent weight change over the indicated period. The results show low water absorption and a high chemical resistance to water and most ionic species. Softening and swelling occurs for aggressive organic solvents.

STORAGE

Store between 16 and 27 °C [60 and 80 °F] in dry area away from sunlight. Prolonged storage or storage at or near freezing temperatures can result in crystallization. If crystallization occurs, reconstitute the component to its original state by temporarily warming it to 50 to 60 °C [122 to 140 °F]. To ensure full homogeneity, stir thoroughly the warm component, reincorporating all settled material. Re-secure container lid and let cool down before use.

APPLICATION INSTRUCTIONS

Follow the procedure below for best results. If you have little or no experience with Product No. 16027 – Epoxy, please follow the long instructions instead. The short instructions provided here are not suitable for first time users.

To prepare 1:1 (A:B) epoxy mixture (100g)

1. Carefully scrape any settled material in the *Part A* container; and stir and fold material until homogenous.
2. Carefully scrape any settled material in the *Part B* container; and stir and fold material until homogenous.
3. Measure *one* parts by volume of the pre-stirred *A*, and pour in the mixing container.
4. Measure *one* part by volume of the pre-stirred *B*, and slowly pour in the mixing container while stirring.
5. Put in a vacuum chamber, bring to 25 Hg/in pressure, and wait for 2 minutes to de-air. —OR— Let sit for 30 minutes to de-air.
6. If bubbles are present at top, use the mixing paddle to gently break them.
7. Pour mixture into the mold or container containing the components to be encapsulated.

ATTENTION! Mixing >500 g [0.4 L] of Part B at a time into A decreases working life and promotes flash cure. Use of epoxy mixing machines with static stirrer recommended for large volumes. Limit size of hand-mixed batches.

TIP: Due to the high viscosity and abrasiveness of the aluminum oxide filler, you may preheat parts A and part B with temperature jacket to increase the flow and improve air release. This will help reduce the wear on the mixing equipment, but it will shorten the working life.

To room temperature cure Product No. 16027 – Epoxy

Let stand for 24 hours.

To heat cure Product No. 16027 – Epoxy

Put in oven at 45 °C [113 °F] for 8 hours.

–OR–

Put in oven at 55 °C [131 °F] for 4 hour.

–OR–

Put in oven at 65 °C [149 °F] for 2 hour.

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.

HEALTH, SAFETY, AND ENVIRONMENTAL AWARENESS

Please see Product No. 16027 – Epoxy **Material Safety Data Sheet** (MSDS) parts A and B for more details on transportation, storage, handling and other security guidelines.

Health and Safety: Product No. 16027 – Epoxy parts can ignite if the liquid is heated.

Wear safety glasses or goggles and disposable polyvinyl chloride, neoprene, or nitrile gloves while handling liquids. Part B in particular causes skin burns and may cause sensitization if exposed over a long period of time. The epoxy is black and will not wash off once cured: wear protective work clothing. Wash hands thoroughly after use or if skin contact occurs. Do not ingest.

Although the product has low volatility and moderate odor, use it in a well-ventilated area.

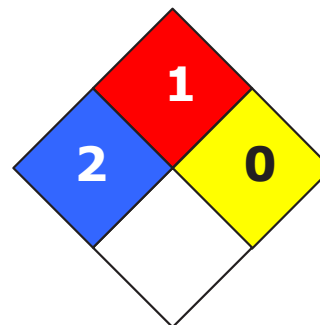
The cured epoxy resin presents no known hazard.

Part A

HMIS® RATING

HEALTH:	2
FLAMMABILITY:	1
PHYSICAL HAZARD:	0
PERSONAL PROTECTION:	

NFPA® 704 CODES

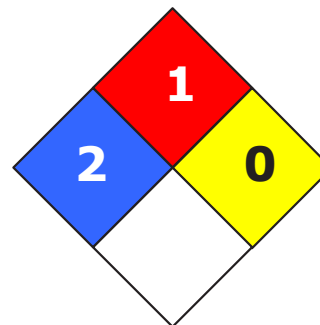


Part B

HMIS® RATING

HEALTH:	2
FLAMMABILITY:	1
PHYSICAL HAZARD:	0
PERSONAL PROTECTION:	

NFPA® 704 CODES



Approximate HMIS and NFPA Risk Ratings Legend:

0 (Low or none); 1 (Slight); 2 (Moderate); 3 (Serious); 4 (Severe)