# High Temperature Epoxy Encapsulating & Potting Compound 832HT Technical Data Sheet



## Description

The 832HT *High Temperature Epoxy Encapsulating and Potting Compound* is an electronic grade epoxy designed for high temperature environments. It is also an ideal encapsulant for very chemically aggressive environments and applications where extreme physical strength is required.

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 much harder to remove than standard epoxy encapsulating compounds.

## Applications & Usages

The 832HT epoxy is used to pot or encapsulate printed circuit assemblies in a protective block. The cured epoxy improves reliability, operational range, and lengthens the life of electrical and electronic parts.

Its primary applications involve protecting electronic devices in high temperature and chemically aggressive environments in the automobile, marine, aerospace, aviation, communication, instrumentation, and industrial control equipment.

## Benefits and Features

- **High service temperature range** of 200 °C [392 °F]
- **Very strong chemical resistance**
- **Extremely strong** Bis F epoxy compared to standard Bis A systems
- **Extreme resistance to water and humidity** allowing submersion if needed
- **Great intellectual property defense**: the cured epoxy hides parts and defies removal attempts
- **Protects electronics from** moisture, corrosion, fungus, thermal shock, and static discharges
- **Suitable for extreme environments** to brine, acids, bases, and aliphatic hydrocarbons

## Curing & Work Schedule

| *Properties* | *Value* |
|---|---|
| Working Life [a)] | 60 min |
| Shelf Life | 5 y |
| Full Cure @22 °C [72 °F] | 24 h |
| Full Cure @65 °C [149 °F] | 60 min |
| Full Cure @80 °C [176 °F] | 45 min |
| Full Cure @100 °C [212 °F] | 35 min |
| Full Cure @130 °C [266 °F] | 25 min |
| Full Cure @160 °C [320 °F] | 15 min |
| Full Cure @200 °C [392 °F] | 10 min |
| Storage Temperature of Unmixed Parts | 16 to 27 °C [60 to 80 °F] |

a) Working life and full cure assumes 100 g and room temperature. A 10 °C increase can decreases the pot life by half.

## Temperature Service Ranges

| *Properties* | *Value* |
|---|---|
| Constant Service Temperature | -30 to +225 °C [-22 to +437 °F] |
| Max Intermittent Temp. [b)] | 250 °C [482 °F] |

b) The maximum intermittent temperature provides temperature extremes that can be withstood without damage for short periods of time only.

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## Principal Components

| **Name** | ***CAS Number*** |
|---|---|
| Part A: Novalac Bis F Epoxy Resin | *28064-14-4* |
| Part B: Curing polyamide | *68082-29-1* |
| Curing Amine | *112-24-3* |

## Properties of Cured 832HT

| ***Physical Properties*** | ***Method*** | ***Value*** [a] | |
|---|---|---|---|
| Color | Visual | Black | |
| Density @23 °C [73.4 °C] | | 1.16 g/cm$^3$ | |
| Hardness | (Shore D durometer) | 87D | |
| Elongation | ASTM D 638 | 3.4% | |
| Tensile Strength | " | 54 N/mm$^2$ | [7 900 lb/in$^2$] |
| Compressive Strength | ASTM D 695 | 81.9 N/mm$^2$ | [11 900 lb/in$^2$] |
| Lap Shear Strength (Al 2024) | ASTM D 1002 | 12.3 N/mm$^2$ | [1 790 lb/in$^2$] |
| Flexural Strength | ASTM D 790 | 101 N/mm$^2$ | [14 600 lb/in$^2$] |
| Flexural Modulus | " | 2 750 N/mm$^2$ | [399 000 lb/in$^2$] |

| ***Electric Properties*** [b] | ***Method*** | ***Value*** | |
|---|---|---|---|
| Breakdown Voltage @0.630 mm | ASTM D 149 | 26.4 kV | |
| Dielectric Strength | " | 44.8 kV/mm [1 140 V/mil] | |
| Breakdown Voltage @3.175 mm [1/8″] | Reference fit [b] | 54.0 kV | |
| Dielectric Strength | | 17.0 kV/mm [432 V/mil] | |
| Volume Resistivity | ASTM D 257 | 9.3 x10$^{15}$ Ω·cm | |
| Surface Resistivity [c] | " | 8.9 x10$^{13}$ Ω | |
| Dielectric Dissipation & Constant | | *dissipation, D* | *constant, k′* |
| @1 kHz | ASTM D 150-98 | 0.007 | 2.96 |
| @10 kHz | " | 0.011 | 2.81 |
| @1 MHz | " | 0.014 | 2.83 |
| Insulating | | Yes | |
| Conductive | | No | |

*Note:* Specifications are for epoxy samples cured at 65 °C for 1 hour, with additional curing time at room temperature for optimal results. For most tests, samples were conditioned at 23 °C and 50% RH.

a) N/mm$^2$ = mPa; lb/in$^2$ = psi;

b) To allow comparison between products, the Tautscher equation was fitted to 10 experimental dielectric strengths and interpolated for a standard reference thickness of 1/8″ (3.175 mm).

c) The surface (sheet) resistivity unit is commonly referred to as "Ohm per square" (Ω/sq)

## Properties of Cured 832HT (*Continued*)

| *Thermal Properties* | *Method* | *Value* |
|---|---|---|
| Thermal Conductivity @25 °C [77 °F] | ASTM E 1461 | 0.228 W/(m·K) |
| @50 °C [122 °F] | " | 0.265 W/(m·K) |
| @100 °C [212 °F] | " | 0.266 W/(m·K) |
| Glass Transition Temperature ($T_g$) | ASTM D 3418 | 68 °C |
| Coefficient of Thermal Expansion (CTE) [d] | ASTM E 831 | |
| Before Tg | " | 74 ppm/°C |
| After Tg | " | 151 ppm/°C |
| Thermal Diffusivity @25 °C [77 °C] | " | 1.33 x $10^{-7}$ $m^2$/s |
| Specific Heat Capacity @25 °C [77 °C] | ASTM E 1269 01 | 1 419 J/(kg·K) |
| Heat Deflection Temperature [e] | ASTM D 648 | 53.9 °C [129 °F] |

d) Coefficient of Thermal Expansion (CTE) units are in ppm/°C = in/in/°C × $10^{-6}$ = unit/unit/°C × $10^{-6}$
e) HDT of plastic under load of 264 lb/$in^2$

## Properties of Uncured 832HT

| *Physical Property* | *Mixture (1.7A:1B by volume)* |
|---|---|
| Color | Black |
| Viscosity [a] @20 °C [73 °F] | 40 000 cP [40.0 Pa·s] |
| Density | 1.10 g/mL |
| Mix Ratio by weight (A:B) | 2.0:1.0 |
| Mix Ratio by volume (A:B) | 1.7:1.0 |

| *Physical Property* | *Part A* | *Part B* |
|---|---|---|
| Color | Black | Clear, amber tint |
| Viscosity [a] @24°C [73 °F] | 46 000 cP [46.0 Pa·s] | 5 800 cP [5.8 Pa·s] |
| Density | 1.18 g/mL | 0.96 g/mL |
| Flash Point | 150 °C [302 °F] | 110 °C [230 °F] |
| % solids | ~98% | 100% |
| Odor | Mild | Musty |

a) Brookfield viscometer at 50 RPM with spindle LV4

## Compatibility

**Adhesion**—As seen in the substrate adhesion table, the 832HT epoxy adheres to most materials found on printed circuit assemblies; however, it is not compatible with contaminants like water, oil, and greasy flux residues that may affect adhesion. If contamination is present, clean the printed circuit assembly with electronic cleaner such as MG Chemicals 4050 Safety Wash, 406B Superwash, or 824 Isopropyl Alcohol.

### Substrate Adhesion in Decreasing Order

| *Physical Properties* | *Adhesion* |
|---|---|
| Aluminum | Stronger |
| Steel | |
| Fiberglass | |
| Wood | |
| Paper, Fiber | |
| Glass | |
| Rubber | |
| Polycarbonate | |
| Acrylic | |
| Polypropylene [a)] | Weaker |

a) Does not bond to polypropylene

## 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.

## Health and Safety

Please see the 832HT **Safety Data Sheet** (SDS) parts A and B for more details on transportation, storage, handling and other security guidelines.

***Health and Safety:*** The 832HT parts can ignite if the liquid is both heated and exposed to flames or sparks.

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.

Use in well-ventilated area since vapors may cause irritation of the respiratory tract and cause respiratory sensitization in susceptible individuals.

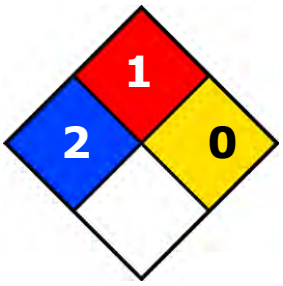
The cured epoxy resin presents no known hazard.

**Part A**

**HMIS® RATING**

| | |
|---|---|
| **HEALTH:** | * 2 |
| **FLAMMABILITY:** | 1 |
| **PHYSICAL HAZARD:** | 0 |
| **PERSONAL PROTECTION:** | |

**NFPA® 704 CODES**

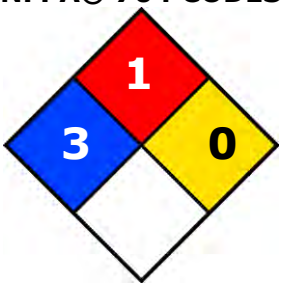



**Part B**

**HMIS® RATING**

| | |
|---|---|
| **HEALTH:** | * 3 |
| **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)

## Application Instructions

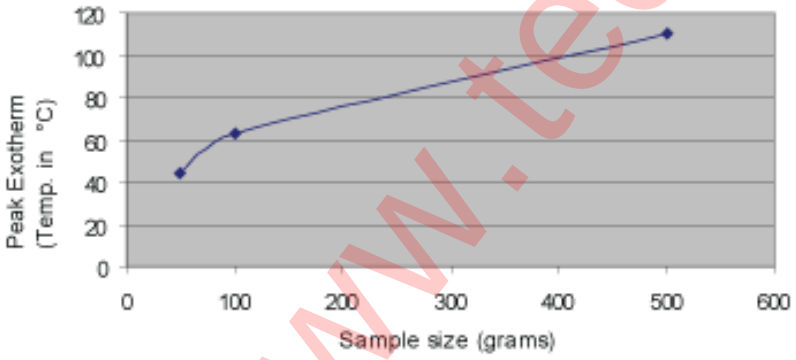
Follow the procedure below for best results. If you have little or no experience with the 832HT epoxy, please follow the long instructions instead. The short instructions provided here are not suitable for first time users.

**To prepare the epoxy mixture**

1. Stir and fold the material in the ***Part A*** container until fully homogenous.
2. With a different stirrer, stir and fold the material in the ***Part B*** container until fully homogenous.
3. Measure ***1.7*** parts by volume (***2 parts*** by weight) of pre-stirred ***A***, and pour in the mixing container.
4. Measure ***1*** part by volume (***1 part*** by weight) of pre-stirred ***B***, and slowly pour in the mixing container while stirring.
5. Let sit for 30 minutes to de-air.
   —OR—
   Put in a vacuum chamber, bring to 25 inHg pressure, and wait for 2 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.

### Peak Exotherm Temperature




**To room temperature cure the 832HT epoxy**

Let stand for 24 hours.

**To heat cure the 832HT epoxy**

Put in oven at 65 °C [149 °F] for 60 minutes.

–OR–

Put in oven at 80 °C [176 °F] for 45 minutes.

–OR–

Put in oven at 100 °C [212 °F] for 35 minutes.

–OR–

Put in oven at 130 °C [266 °F] for 25 minutes.

–OR–

Put in oven at 160 °C [320 °F] for 15 minutes.

–OR–

Put in oven at 200 °C [392 °F] for 10 minutes.

**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.

## Packaging and Supporting Products

| *Cat. No.* | *Form* | *Net Volume* | | *Net Weight* | | *Package Weight* | |
|---|---|---|---|---|---|---|---|
| **832HT-375ML** | Liquid | 340 mL | 11.5 fl oz | 373 g | 0.82 lb | 526 g | 1.16 lb |
| **832HT-3L** | Liquid | 2.3 L | 0.61 gal | 2.52 kg | 5.57 lb | 3.1 kg | 6.83 lb |

Note: Package weight is an estimate: it may vary due to the use of different boxes and packing material

**Supporting Products**

- *Epoxy and Adhesive Cleaner*: Cat. No. 8328-500ML, 8328-20L
- *Epoxy Mold Release (for temperature cures ≤85 °C)*: Cat. No. 8329-350G

## Technical Support

Contact us regarding any questions, improvement suggestions, or problems with this product. Application notes, instructions, and FAQs are located at www.mgchemicals.com.

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