Starting Formulation

SF 4004 Ambiant Epoxy Adhesive 828 3125 Ambient Cure Epoxy Adhesive for Metallic Bonding
EPON™ Resin 828 / EPIKURE™ Curing Agent 3125

Introduction
This epoxy adhesive is especially good at bonding various metal substrates at ambient temperature of 25°C or more. It also provides some tolerance to trace amounts of lubricants which may remain on bond surfaces when cleaning conditions are not ideal.

Suggested Uses
- Bonding of metals, at ambient temperatures. It will also bond well to concrete, glass and many rigid plastics.

Features
- Ability to bond to various metal substrates
- Tolerance to trace/small amounts of residual surface oil
- At least one hour working time at 25°C
- Good strength development in 24 hours

Formula

<table>
<thead>
<tr>
<th>Material</th>
<th>Supplier</th>
<th>Pounds</th>
<th>Gallons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part A EPON Resin 828</td>
<td>Hexion</td>
<td>100.0</td>
<td>10.31</td>
</tr>
<tr>
<td></td>
<td>Aluminum Powder 120</td>
<td>100.0</td>
<td>4.44</td>
</tr>
<tr>
<td>Part A</td>
<td></td>
<td>200.0</td>
<td>14.75</td>
</tr>
<tr>
<td>Part B EPIKURE Curing Agent 3125</td>
<td>Hexion</td>
<td>54.5</td>
<td>6.73</td>
</tr>
<tr>
<td>Part B</td>
<td></td>
<td>54.5</td>
<td>6.73</td>
</tr>
<tr>
<td>Total Part A &amp; B</td>
<td></td>
<td>254.5</td>
<td>21.48</td>
</tr>
</tbody>
</table>

Mixing Instructions
Disperse the aluminum powder into a portion (50-70%) of the EPON Resin 828 using dispersing equipment capable of mixing viscous, paste-like materials, such as a planetary type mixer. Mix until uniform consistency is attained. Add remaining EPON Resin 828 and mix until a uniform consistency is attained.

This formulation is a basic starting point and can be modified with other filler types, such as talc, alumina, ground silica, wollastonite, or calcium carbonate.

Modification with silane coupling agents, such as DOW CORNING® Z-6040 silane improves bonds to concrete and glass.

Pigment may be incorporated into either or both portion for the purpose of color coding. As with all pigments, their effect on the performance of the final, cured product should be
investigated prior to production approval.

Typical Handling Table 1 / Handling Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mix Ratio, resin : curing agent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>by weight</td>
<td></td>
<td>100 : 27</td>
</tr>
<tr>
<td>by volume</td>
<td></td>
<td>2.2 : 1</td>
</tr>
<tr>
<td>Expected Working Life @ 25°C (1 pint)</td>
<td>min.</td>
<td>60</td>
</tr>
</tbody>
</table>

Viscosity

| Part A/Part B @ 25°C                  | ---   | Paste |
| Part A/Part B @ 40°C                  | P     | 80-120 |

Application

All surfaces to be bonded should be free of dust, dirt, grease, or other contaminants. For optimum adhesion it is recommended to roughen bonding surfaces. This can be accomplished with abrasive media appropriate for the materials being bonded (such as medium grit emery paper, abrasive disks, grit blasting, wire brushes, etc.). Abrasion should always be followed by degreasing to remove contaminates and loose particles. Chemical etching is another method to provide a rough surface for improved adhesion.

Thoroughly mix the adhesive components and apply immediately by spreading a thin film over the surface to be bonded. Maintain light pressure during cure for optimum bonding.

Cure Schedule

Room Temperature: 2-3 days @ 23°C

or

Elevated Temperature: Adhesive can be heat cured to shorten cure time. Maximum cure temperature should not exceed 250°F.

Typical Cured State Table 2 / Adhesive Properties – Aluminum 2024 T-3, Acid Etched

<table>
<thead>
<tr>
<th>Test Property</th>
<th>ASTM</th>
<th>Tested at</th>
<th>Units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Shear Strength</td>
<td>D-1002</td>
<td>25°C</td>
<td>psi</td>
<td>1500</td>
</tr>
<tr>
<td>Cured 24 hrs @ 23°C</td>
<td></td>
<td>25°C</td>
<td>psi</td>
<td>2050</td>
</tr>
<tr>
<td>Cured 48 hrs @ 23°C</td>
<td></td>
<td>121°C</td>
<td>psi</td>
<td>550</td>
</tr>
<tr>
<td>Cured 24 hrs @ 23°C</td>
<td></td>
<td>121°C</td>
<td>psi</td>
<td>775</td>
</tr>
</tbody>
</table>

Typical Adhesive Table 2 / Adhesive Properties

<table>
<thead>
<tr>
<th>Substrate</th>
<th>Cure Schedule</th>
<th>Tensile Shear Strength at 25°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Etched Aluminum, 2024T-3</td>
<td>15 minutes at 25 °C</td>
<td>180 psi</td>
</tr>
<tr>
<td></td>
<td>1 hour at 25 °C</td>
<td>340 psi</td>
</tr>
<tr>
<td></td>
<td>2 hours at 25 °C</td>
<td>900 psi</td>
</tr>
<tr>
<td></td>
<td>3 hours at 25 °C</td>
<td>1800 psi</td>
</tr>
<tr>
<td></td>
<td>24 hours at 25 °C</td>
<td>2600 psi</td>
</tr>
</tbody>
</table>
### Compressive Shear Strength at 25 °C

<table>
<thead>
<tr>
<th>Material</th>
<th>Condition</th>
<th>Strength (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold-rolled Steel, solvent-wiped</td>
<td>1 day at 25 °C followed by 2 hours at 100 °C</td>
<td>1200 psi</td>
</tr>
<tr>
<td>Concrete, dry</td>
<td>7 days at 25 °C</td>
<td>&gt;900 (concrete failure)</td>
</tr>
<tr>
<td>Concrete, dry to steel</td>
<td>3 days at 25 °C</td>
<td>&gt;300 (concrete failure)</td>
</tr>
<tr>
<td>Concrete, damp to steel</td>
<td>3 days at 25 °C</td>
<td>&gt;300 (concrete failure)</td>
</tr>
</tbody>
</table>

### Tensile Bond Strength at 25 °C

<table>
<thead>
<tr>
<th>Material</th>
<th>Condition</th>
<th>Strength (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete, dry to steel</td>
<td>3 days at 25 °C</td>
<td>&gt;300 (concrete failure)</td>
</tr>
<tr>
<td>Concrete, damp to steel</td>
<td>3 days at 25 °C</td>
<td>&gt;300 (concrete failure)</td>
</tr>
</tbody>
</table>

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**General Information**

These are starting formulations and are not proven in the user’s particular application but are simply meant to demonstrate the efficacy of the products and to assist in the development of the user’s own formulation. It is the user’s responsibility to fully-test and qualify the formulation, along with the ingredients, methods, applications or equipment identified herein (“Information”), by the user’s knowledgeable formulator or scientist, and to determine the appropriate use conditions and legal restrictions, prior to use of any Information.

**Safety, Storage & Handling**

Please refer to the MSDS for the most current Safety and Handling information.

Exposure to these materials should be minimized and avoided, if feasible, through the observance of proper precautions, use of appropriate engineering controls and proper personal protective clothing and equipment, and adherence to proper handling procedures. None of these materials should be used, stored, or transported until the handling precautions and recommendations as stated in the Material Safety Data Sheet (MSDS) for these and all other products being used are understood by all persons who will work with them. Questions and requests for information on Hexion Inc. (“Hexion”) products should be directed to your Hexion sales representative, or the nearest Hexion sales office. Information and MSDSs on non-Hexion products should be obtained from the respective manufacturer.

**Contact Information**

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For literature and technical assistance, visit our website at [www.hexion.com](http://www.hexion.com)