K-Flex® Dibenzoate Coalescents for Paints and Coatings

Coalescents have been and continue to be a key material used to enhance film formation and other properties in coatings formulations. Dibenzoate chemistry is becoming the preferred low-VOC coalescent for use in coatings. Dibenzoates aid the formulator in lowering VOC content in formulations while improving key performance characteristics and providing the best balance of performance and value to alternative chemistries.

As polar coalescents, K-FLEX® dibenzoates are used to coalesce polar polymers ranging from acrylic types including styrene or ethylene copolymers, polyvinyl acetate and acrylics. The original dibenzoate products were diethylene glycol dibenzoate (DEGB) and dipropylene glycol dibenzoate (DPGB). Many commercial products blend these two materials to yield liquids with good handling and tailored performance features in the end-use application.

Emerald Kalama Chemical offers the classic dibenzoates, as well as some new grades and blends created for the needs of the marketplace. K-FLEX® coalescents offer an excellent low-VOC solution for formulators looking to satisfy both legislative requirements and consumer demand.

- Low-VOC
- Non-SVHC
- Non-phthalate
- Approval for use in direct food contact applications
- Global registrations
- REACH compliant

Classified as non-SVHC and non-PBT, K-FLEX® dibenzoates are label-free in the EU under CLP and GHS regulations. Additionally, K-FLEX® 975P and K-FLEX® 850P risk-phrase-free.

Next Generation Products

Coalescents based on dibenzoate chemistry are becoming increasing common in applications where coalescents such as 2,2,4-trimethyl-1,3-pentanediol monoisobutyrate (TMPDMIB) might traditionally have been used. This is because they provide comparable—or, in many cases, improved—performance properties in addition to lowering VOCs. Dibenzoate coalescents are also compatible with typical coating polymers, leading to stronger, better coalesced films with excellent scrub resistance, gloss, toughness, clarity, and MFFT/Tg suppression.

Dibenzoate coalescents such as K-FLEX® 850S and K-FLEX® 975P exhibit increased scrub resistance to higher-VOC coalescents while maintaining needed open time and block resistance.

* % weight lost, 110°C for 1 hour, ASTM D2369, Part of EPA 24

Evaluation Methodology

Emerald Kalama Chemical uses analytical instruments such as those depicted above to evaluate performance of coalescents in a variety of applications, including coatings.
Recommended Products for Paints and Coatings

**K-FLEX® 975P** – Economical to use and created to offer a broad range of compatibility with polar polymers, with improved handling due to its lower freeze point. Highly recommended low-VOC coalescent for interior and exterior latex paints, industrial coatings, and special purpose coatings.

**K-FLEX® 500P** – Specifically designed for coatings formulations where very low VOC content is required. Highly recommended for use in a variety of coatings, including interior and exterior latex paints, industrial coatings, lacquers, and special purpose coatings.

**K-FLEX® 850S** – A value-added blend of classic dibenzoate coalescents. Very effective and low-VOC choice for interior and exterior latex paints, industrial coatings, and special purpose coatings.

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**COATINGS PERFORMANCE CHARACTERISTICS**

In paints and coatings, our research & development Team found that low-VOC coalescents such as **K-FLEX® 850S and K-FLEX® 975P** developed better gloss than higher VOC coalescents such as TMPDMIB, forming tighter, better films while also maintaining compatibility. Because of gloss development with K-FLEX® coalescents, the formulator also has the opportunity to add more filler to keep the original gloss level, making the system more economical.

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**Emerald Kalama Chemical** is a business group of Emerald Performance Materials, a manufacturer of additives and polymers that make your products last longer, look, taste, smell, or perform better. We are a world scale producer of toluene oxidation products, shipping 425 million pounds annually to nearly 70 countries across the globe. Products include benzoic acid and various benzoate and dibenzoate ester, alcohol and aldehyde derivatives for food preservatives, flavor and fragrance ingredients, coalescents and industrial applications. Manufacturing in Kalama, WA (USA) and Rotterdam, The Netherlands – service to our customers globally.

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**Contact Us**

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+31.88.888.0512  
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CVC Thermoset Specialties

We Offer
- Products that deliver enhanced performance
- Application and technology expertise
- North American ISO-certified facilities
- Global service with regional distribution partners

Our Legacy
CVC Thermoset Specialties’ RLP Products are a unique, proprietary technology originally developed by BFGoodrich, which enhance performance in a wide array of technically challenging end-uses around the world. The product family had been sold for many decades under the Hycar® tradename by predecessor corporations – BFGoodrich, Noveon and Lubrizol. Following the formation of Emerald Performance Materials in 2006, the products were rebranded as Hypro® Reactive Liquid Polymers.

Prior to its acquisition by Emerald Performance Materials in 2008, CVC Specialty Chemicals had been creating and manufacturing specialty epoxy resins since 1982. Over the years, the company expanded its product offerings to coatings and adhesive formulators with the acquisition of the specialty epoxy resin line of CL Industries (Georgetown, IL) and substituted urea accelerators from Omicron Chemical. Manufacturing and R&D capabilities were enhanced by the 1995 purchase and subsequent expansions of the Akzo Chemical plant in Maple Shade, NJ.

CVC Thermoset Specialty Product Lines
- Specialty Epoxy Resins
- Reactive Liquid Polymers
- Elastomer-Modified Epoxy Resins
- Epoxy Functional Reactive Modifiers
- Curing Agents, Catalysts and Accelerators

EPALLOY® Specialty Epoxy Resins
Improved chemical resistance, thermal performance, modulus, cure speed, and UV stability over other standard resins for coatings, composite, and adhesive applications. Technologies include Epoxidized Phenol Novolacs, Resorcinol Modified Novolacs, Bis A Modified and Cycloaliphatic Epoxy Resins.

Hypro® Reactive Liquid Polymers
Addition of our innovative Hypro® Reactive Liquid Polymers (RLP) to your thermoset resin formulation will significantly enhance performance such as fracture toughness, low temperature mechanical properties, impact/crack/chip resistance, flexibility and adhesion to difficult to adhere-to substrates. Carboxy, Amine, Epoxy, Methacrylate(Vinyl), Glycidyl Ester and Hydroxy end-functionality allows for crosslinking in a variety of systems. Ideally suited for Epoxy, Vinyl Ester, UPE Urethane and Acrylic Resin Systems. Newer low viscosity epoxy functional grades can be used for glass and carbon fiber reinforced composites.

HYPOX® Elastomer-Modified Epoxy Resins
Elastomer modification of epoxy resins is a valuable way to further enhance performance features such as: fracture toughness, peel strength, flexibility, low temperature performance, durability and adhesion to non-polar surfaces versus unmodified products. Technologies include Dimer Acid and CTBN Adducts, and Urethane Modified Epoxy Resins.

ERISYS® Epoxy Functional Reactive Modifiers
Monomers are used in epoxy formulations to reduce viscosity and improve handling, processing, and application properties of formulations. Monomers and modifiers also enhance features, such as flexibility and toughness, and maintain chemical resistance and UV stability. Chemistries included Aromatic & Aliphatic Glycidyl Ethers, Glycidyl Amine and Glycidyl Esters.

OMICURE® Curing Agents, Catalysts and Accelerators
Accelerating the cure speed and/or reducing the cure temperature are important to optimize productivity, energy use, and ultimate physical properties. We offer Dicyandiamide and Boron-Based catalysts for Latent, one-component Heat Cured Epoxy Systems. Substituted Urea catalysts help to accelerate the cure speed and reduce cure temperatures of Dicyandiamide cured formulations and help to optimize productivity, energy use, and ultimate physical properties.

Emerald Corporation
CVC Thermoset Specialties is a division of Emerald Performance Materials (EPM). EPM produces a broad portfolio of additives and polymers used in diverse consumer and industrial products around the world. Its products play a variety of roles in the products that are consumed and used every day enabling them to last longer, look, smell, taste or perform better. For more information, visit www.emeraldmaterials.com.
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For more information on these products contact:

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Netherlands
+31 88 888 0500

**www.cvc.emeraldmaterials.com**
K-FLEX® Plasticizers:

• Non-Phthalate
• Low VOC
• Non-SVHC
• REACH Compliant
Emerald Kalama Chemical

General Uses

K-FLEX® plasticizers, modifiers and coalescents are used because of their excellent performance and balance of properties. They are non-phthalate, low in VOCs, and have positive attributes from a product safety and health perspective compared to other choices.

The K-FLEX product line continues to grow, to develop new technology, to expand into new applications and meet the evolving needs of the industries we serve. Our team is engaged – participating in key industry associations, delivering presentations on our latest technical development and seeking out new and creative ways to bring value-added solutions to our customers.

As a leader in benzoate chemistry, we focus on operational excellence. We now produce our K-FLEX product line in Rotterdam, the Netherlands and Kalama, WA (US), from operations strategically located on ports and rail lines to serve our customers globally. We are expanding worldwide and have recently added a new technical center, expanded operations and new reactors to increase our global footprint. Together, our plants ship approximately 200,000 MT to nearly 70 countries with more than half of our sales outside the Netherlands and United States. Both plants are backward integrated into key feedstocks to produce a wide array of benzoates, plasticizers, aroma chemicals and other intermediates.

One of the key properties of K-FLEX products is their compatibility with a wide range of polymers, particularly polar materials. This makes K-FLEX products highly effective in many of the most widely used non-olefin based polymers: vinyl-acetate, ethylene vinyl acetate, acrylic, styrenated acrylic, styrene-butadiene, PVC, polysulphide, nitrocellulose, nitrile, and polyurethane. These polymers are also widely used in many end-use applications, including adhesives, sealants, caulks, paint, coatings, graphic arts, resilient flooring, vinyl wall covering and artificial leather.

For many years, our adhesives customers have turned to dibenzoate plasticizers because they offer the best overall performance, providing excellent viscosity response, reduced set times, increased open times, increased film flexibility and clarity, reduced heat sealing temperatures, and improved film resistance to oil and grease. These properties are valued in mastics and caulking compounds, sealants, and adhesive applications used in the packaging industry for carton sealing and forming, book binding, labeling, furniture, luggage and shoes. Specific clearances for use in adhesives and coatings with direct contact to food (as indirect food additives) are shown in the product selection guide in this brochure.

In recent years, more customers have come to appreciate the value that benzoate plasticizers can bring, as they work to meet lower and lower VOC industry requirements or seek an alternative to phthalates. New technology and patent-pending materials deliver performance benefits to coatings which extend beyond the reduction of VOCs: improving scrub resistance and gloss while maintaining important features such as good blocking resistance and low dirt pick-up. This balance of performance features may be surprising to many formulators, who expect plasticizers—which are more persistent in the film than traditional volatile coalescents—to have unsatisfactory performance in these areas. The newest generation K-FLEX products definitely show very effective performance overall in coatings.

Our latest developments in plasticizers for vinyl applications likewise show some outstanding performance features. These very high solvators for PVC are fast fusing and will increase processing speed and lower processing temperatures. K-FLEX plasticizers also exhibit superior wear performance, increased stain resistance and resistance to extraction by solvents such as kerosene, cotton seed oil and other non-polar materials. These properties make it an excellent choice for the production of vinyl flooring, artificial leather (cloth), wallpaper, extrusions, calendaring and plastisols. Blends of K-FLEX plasticizers with general purpose-type plasticizers – or with other specialty plasticizers such as adipates and citrates – are often used to take advantage of the exceptional properties of the K-FLEX plasticizers.

Please contact us. Our K-FLEX team welcomes the opportunity to work with you.
Products Available

**K-FLEX® DP** – Dipropylene glycol dibenzoate is one of the most versatile polar, high solvating plasticizers. It is compatible with a wide range of polar polymers and rubbers, including TPU. It is an excellent choice for high solvating plasticizer applications.

**K-FLEX® PG** – Propylene glycol dibenzoate is designed primarily for use in PVC compositions. It imparts outstanding stain resistance and durability in vinyl applications and can be used in adhesives at higher loading levels without degrading performance.

**K-FLEX® 500** – A classic dibenzoate blend. As a polar plasticizer, it is a high solvator for PVC and compatible with polar polymers such as polyvinyl acetate. It is primarily used in adhesive applications.

**K-FLEX® 500P** – A dibenzoate blend designed for coatings or other applications where ultra low levels of VOCs are desired.

**K-FLEX® 850P** – A dibenzoate blend designed for vinyl applications with economy as a focus. It offers excellent stain resistance, durability and can be used alone or in blends with other plasticizers.

**K-FLEX® 850S** – A low VOC blend of dibenzoates optimized for use in waterborne latex applications. Widely used in the industry because of the excellent combination of efficiency, economy and performance benefits it provides to the formulator. In Europe K-FLEX® 850S is label free.

**K-FLEX® 975P** – A dibenzoate triblend compatible with polar polymers. It offers a lower freeze point and better handling properties than other modern binary dibenzoate blends.

We are strategically located near shipping ports and railways to ensure economical and fast delivery of products to our customers.

**Orders and Inquiries:** Emerald Kalama Chemical at 360-673-2550 / 800-223-0035 or kalama@emeraldmaterials.com
### Application Chart

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<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
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<tr>
<td><strong>Agriculture</strong></td>
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<td>●</td>
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</tr>
<tr>
<td>Pesticide</td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
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<tr>
<td><strong>Industrial Intermediates</strong></td>
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<td>●</td>
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<td>●</td>
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<td></td>
</tr>
<tr>
<td>Equipment Clean Out &amp; Purge</td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Highly Recommended
- Effective

K-FLEX® Plasticizers add value to a wide range of applications and are compatible in many polymers.
Typical Physical Properties

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Boiling Point (5 mm Hg, °C)</td>
<td>180</td>
<td>180</td>
<td>191</td>
<td>226</td>
<td>215</td>
<td>157</td>
<td>195</td>
</tr>
<tr>
<td>Boiling Point (750 mm Hg, °C, extrapolated)</td>
<td>&gt;330</td>
<td>&gt;330</td>
<td>&gt;350</td>
<td>&gt;350</td>
<td>&gt;350</td>
<td>&gt;300</td>
<td>&gt;350</td>
</tr>
<tr>
<td>Density, ASTM D1475, 25°C/g/ml</td>
<td>1.14</td>
<td>1.14</td>
<td>1.14</td>
<td>1.15</td>
<td>1.15</td>
<td>1.14</td>
<td>1.11</td>
</tr>
<tr>
<td>Density, ASTM D1475, 25°C/lb/gal</td>
<td>9.6</td>
<td>9.6</td>
<td>9.5</td>
<td>9.6</td>
<td>9.6</td>
<td>9.5</td>
<td>9.3</td>
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<tr>
<td>Freeze Point, °C</td>
<td>14</td>
<td>12</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td>-50**</td>
<td>-51**</td>
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<tr>
<td>Moisture Content, %</td>
<td>0.02</td>
<td>0.02</td>
<td>0.02</td>
<td>0.02</td>
<td>0.02</td>
<td>0.02</td>
<td>0.02</td>
</tr>
<tr>
<td>Viscosity, Brookfield RVT, 20 RPMs at 250°C, cps and mPa.s</td>
<td>72</td>
<td>76</td>
<td>80</td>
<td>107</td>
<td>73</td>
<td>81</td>
<td>99</td>
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<tr>
<td>Viscosity, Kinematic, 25°C/cSt</td>
<td>63</td>
<td>66</td>
<td>70</td>
<td>93</td>
<td>63</td>
<td>71</td>
<td>89</td>
</tr>
<tr>
<td>VOC%, ASTM D-2369</td>
<td>2.2</td>
<td>1.7</td>
<td>2.9</td>
<td>0.9</td>
<td>2</td>
<td>5.8</td>
<td>3.2</td>
</tr>
</tbody>
</table>

**| Source: The Technology of Plasticizers, Sears and Darby, John Wiley & Sons.
3 | Component of K-FLEX 850S, K-FLEX 500 and K-FLEX DP.
4 | Value for DEGDB and DPGB blend. No values were provided for the individual dibenzoates.

** | Glass Point by DSC

Plasticizer/Polymer Compatibility

<table>
<thead>
<tr>
<th>Plasticizer</th>
<th>Solubility Parameter (cal/cm²)</th>
<th>PVC</th>
<th>PMMA</th>
<th>PMAC</th>
<th>Polybutylin</th>
<th>Polyvinyl</th>
<th>Cellulose Nitrate</th>
<th>Cellulose Acetyl</th>
<th>Cellulose Acetyl (Acetyl content)</th>
<th>CAB</th>
<th>CAP</th>
<th>C6</th>
<th>C8</th>
<th>CR</th>
<th>N</th>
<th>Polyurethane</th>
<th>SBR</th>
<th>Chlorinated Rubber</th>
<th>Delaminated Rubber</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diethylene Glycol Dibenzoate (DEGDB)</td>
<td>10.1</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>33</td>
<td>100</td>
<td>10</td>
<td>10</td>
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<td>100</td>
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<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Dipropylene Glycol Dibenzate (DPGDB)</td>
<td>9.6</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>10</td>
<td>10</td>
<td>25</td>
<td>100</td>
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<td>33</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Acetyl Tri-n-butyl Citrate (ATBC)</td>
<td>9.0</td>
<td>100</td>
<td>100</td>
<td>50</td>
<td>50</td>
<td>100</td>
<td>30</td>
<td>50</td>
<td>100</td>
<td>100</td>
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<td>100</td>
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<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Butyl Benzyol Phthalate (BBP)</td>
<td>9.9</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>50</td>
<td>100</td>
<td>10</td>
<td>10</td>
<td>80</td>
<td>100</td>
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<td>100</td>
<td>25</td>
<td>60</td>
<td>100</td>
<td>50</td>
<td>80</td>
<td>30</td>
</tr>
<tr>
<td>Di-2-Ethylhexyl Adipate (DEHA)</td>
<td>8.5</td>
<td>75</td>
<td>0</td>
<td>25</td>
<td>25</td>
<td>35</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>25</td>
<td>25</td>
<td>100</td>
<td>100</td>
<td>15</td>
<td>10</td>
<td>15</td>
<td>50</td>
<td>100</td>
<td>30</td>
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<tr>
<td>Di-2-Ethylhexyl Phthalate (DEHP)</td>
<td>8.2</td>
<td>100</td>
<td>5</td>
<td>&gt;15</td>
<td>&gt;15</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>20</td>
<td>50</td>
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<td>25</td>
<td>25</td>
<td>25</td>
<td>100</td>
<td>50</td>
<td>100</td>
</tr>
</tbody>
</table>

1 | Source: The Technology of Plasticizers, Sears and Darby, John Wiley & Sons.
3 | Component of K-FLEX 850S, K-FLEX 500 and K-FLEX DP.
4 | Value for DEGDB and DPGB blend. No values were provided for the individual dibenzoates.
FDA Statement


21CFR§175.105: Indirect Food Additives – substances that may be safely used as components of adhesives.

21CFR§176.170: Indirect Food Additives – substances that may be safely used as components of the coated or uncoated food-contact surface of paper and paperboard intended for use in producing, manufacturing, packaging, processing, preparing, treating, packing, transporting or holding aqueous and fatty foods.

21CFR§176.180: Indirect Food Additives – substances that may be safely used as components of the coated or uncoated food-contact surface of paper and paperboard intended for use in producing, manufacturing, packaging, processing, preparing, treating, packing, transporting or holding dry food of the type(s) identified in 21CFR§176.170(c), Table 1.

*K-FLEX*® 975P may be used as a plasticizer at a level not to exceed 20% in an adhesive under 21 CFR 176.170 and 21 CFR 176.180, provided the adhesive is separated from the food by a functional barrier, or is limited to contact with food so as not to exceed trace amounts at seams and edges.

Bringing value with high quality products produced in our world-scale ISO 9001:2000 and ISO-14001 certified facility.
Global Inventory

All chemical substances in **K-FLEX® 850S, K-FLEX® 850P, K-FLEX® 500, K-FLEX® 500P, K-FLEX® 975P, K-FLEX® PG, and K-FLEX® DP** are included on or exempted from listing on the following inventories:

- **Australia**: AICS
- **Canada**: DSL, DSL
- **China**: IECSC
- **Europe**: EINECS
- **Japan**: ENCS
- **Korea**: KECI
- **New Zealand**: NZIoC
- **Philippines**: PICCS
- **Taiwan**: ECSI
- **United States**: TSCA

**U.S. OSHA Communication Standard**


**Canadian WHMIS Classification**


**STORAGE AND HANDLING:**

At Emerald Kalama Chemical’s production facility, the K-FLEX plasticizers are stored in type 304 stainless steel storage tanks. These storage tanks are nitrogen padded to reduce discoloration of the product. Type 304 stainless steel pipe and valves are also used. High density polyethylene has been shown to be suitable for product shipment but we have no direct experience in piping systems. Since K-FLEX products are excellent plasticizers for polyvinyl chloride (PVC), PVC piping systems should not be used. Sliding vane type positive displacement pumps have given us excellent service.

It is recommended that storage tanks be heated and insulated and that pumps and transfer piping also be heat-treated and insulated. Our engineers are always ready to discuss the storage and handling of any of our products.

Additional information can be found in the Material Safety Data Sheet.

* K-FLEX® 975P and K-FLEX® PG contain a component on Canada’s NDSL.

**Orders and Inquiries:** Emerald Kalama Chemical at 360-673-2550 / 800-223-0035 or kalama@emeraldmaterials.com
The information contained herein is believed to be reliable, but no representations, guarantees or warranties of any kind are made as to its accuracy, suitability for particular applications or the results to be obtained. The information is based on laboratory work with small-scale equipment and does not necessarily indicate end product performance. Because of the variations in methods, conditions and equipment used commercially in processing these materials, no warranties or guarantees are made as to the suitability of the products for the applications disclosed. Full-scale testing and end product performance are the responsibility of the user. Emerald Performance Materials shall not be liable for and the customer assumes all risk and liability of any use or handling of any material beyond Emerald Performance Materials’ direct control. The SELLER MAKES NO WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Nothing contained herein is to be considered as permission, recommendation, nor as an inducement to practice any patented invention without permission of the patent owner.
Capabilities & Product Selection Guide

EPALLOY® Specialty Epoxy Resins

ERISYS™ Epoxy Functional Reactive Modifiers

Hypro™ Reactive Liquid Polymers

HyPox™ Elastomer Modified Epoxy Resins

OMICURE™ Curing Agents, Accelerators and Catalysts
When your application requires high performance, turn to CVC Thermoset Specialties for resins, modifiers and additives.

CVC Thermoset Specialties provides specialty epoxies and other thermoset resins in demanding applications.

- Composites
- Adhesives
- Coatings
- Electrical Insulation

Automobile and aircraft frames, corrosion resistant pipes and valves, graphite golf club shafts and tennis racquet frames, electronic laminates, jet skis and marine hulls are just a few of the applications that benefit from our products.

The CVC Legacy

Emerald Performance Materials* created CVC Thermoset Specialties to combine the expertise of the Hypro™ Reactive Liquid Polymer (RLP) Line, a proprietary technology developed by BFGoodrich, and the specialty epoxy materials from CVC Specialty Chemicals Inc. CVC Thermoset Specialties’ technologies enhance thermoset performance in technically sophisticated applications around the world.

The Hypro RLP product family, previously sold under the Hycar® trade name, continues to grow and expand with new products and new application platforms in coatings, adhesives, composites, and electrical insulation.

CVC Specialty Chemicals had been creating and manufacturing specialty epoxy resins since 1982. Over the years, the company expanded its manufacturing and R&D capabilities, and its product offerings of specialty and elastomer-modified epoxies, epoxy-reactive modifiers, catalysts and accelerators for epoxy formulators.
CVC’s specialty raw materials are critical building blocks for applications in coatings, adhesives, composites, civil engineering and electronics. These building blocks include five product platforms –

- **EPALLOY® Specialty Epoxy Resins**
- **ERISYS™ Epoxy Functional Reactive Modifiers**
- **Hypro™ Reactive Liquid Polymers**
- **HyPox™ Elastomer Modified Epoxy Resins**
- **OMICURE™ Catalysts, Accelerators and Curing Agents**

**EPALLOY** specialty epoxy technologies deliver improved performance in high performance maintenance/marine coatings, adhesives, encapsulants and composites. CVC offers four families of specialty epoxy resins:

- **EPALLOY 8000** - Phenol Novolac Epoxy
- **EPALLOY 7000** - Bis-A Modified Novolac Epoxy and Blends
- **EPALLOY 5000** - Cycloaliphatic Epoxy
- **ERISYS** - Resorcinol Epoxy and Resorcinol Novolac Epoxy

These specialty epoxy resins provide better chemical resistance, thermal performance, modulus, cure speed and UV resistance than standard liquid epoxy resins.

**ERISYS** epoxy functional reactive modifiers enhance performance, reduce viscosity, and improve handling and processing of epoxy formulations. CVC offers one of the broadest ranges of epoxy-functional modifiers:

- **ERISYS GE 5, 6, 7 & 8 Series** - Aliphatic Monoglycidyl Ethers
- **ERISYS GE 10 Series** - Aromatic Monoglycidyl Ethers
- **ERISYS GE 20 Series** - Aliphatic Diglycidyl Ethers
- **ERISYS GE 30 Series** - Aliphatic Triglycidyl Ethers
- **ERISYS GS Series** - Glycidyl Esters
- **ERISYS GA Series** - Glycidyl Amines
- **ERISYS GE 40 & 60 Series** - Aliphatic Polyglycidyl Ethers

Their benefits include enhanced flexibility and toughness, while maintaining chemical resistance and UV stability. Some of the products are high in bio-renewal content.

**Hypro RLP** Reactive Liquid Polymers are low molecular weight synthetic rubber with chemical functionality. These reactive additives incorporate rubber properties into epoxies, acrylates, vinyl esters and polyesters. They improve the toughness and low-temperature properties in coatings, adhesives, sealants and composites. Hypro reactive liquid polymers are butadiene homo-polymers and butadiene-acrylonitrile copolymers with terminal functionality.

- **Hypro CTBN** - Carboxyl-Terminated Butadiene-Acrylonitrile Copolymer
- **Hypro ATBN** - Amine-Terminated Butadiene-Acrylonitrile Copolymer
- **Hypro ETBN** - Epoxy-Terminated Butadiene-Acrylonitrile Copolymer
- **Hypro VTBNX** - Methacrylate(Vinyl)-Terminated Butadiene-Acrylonitrile Copolymer
- **Hypro HTB** - Hydroxyl-Terminated Polybutadiene (Polybutadiene Polyol)

The toughness shows in many attributes: crack resistance, fracture toughness, impact resistance, resilience, interlaminar adhesion, peel adhesion and thermo cycling. Hypro HTB is the key resin in specialty polyurethane potting compounds, coatings, adhesives and sealants.

**HyPox** elastomer modified epoxies enhance fracture toughness, low temperature mechanical properties, impact/crack/chip-resistance, peel strength and/or flexibility of epoxy coatings, adhesives, sealants and composites.

- **HyPox R** - Hypro CTBN Modified Epoxy Resin
- **HyPox D** - Dimer Acid Modified Epoxy Resin
- **HyPox U** - Urethane Modified Epoxy Resin

HyPox RF and RM elastomer-modified low viscosity epoxy resins combine high elastomer content with the convenience of handling epoxy resins.

**OMICURE** dicyandiamide, boron-based catalysts, and substituted urea catalysts are key components of latent, 1K heat cured epoxy systems.

- **OMICURE** - DDA Dicyandiamide
- **OMICURE** - Substituted Urea Accelerators
- **OMICURE** - Miscellaneous Catalysts, Curatives, Accelerators

They control the cure speed and reduce cure temperatures of dicyandiamide cured formulations and help optimize productivity, energy use, and ultimate physical properties.
**EPALLOY® Specialty Epoxy Resins**

Improved chemical resistance, thermal performance, modulus, cure speed and UV stability are just a few of the performance advantages with EPALLOY Specialty Epoxy Resins and blends over other standard resins. These products bring the critical difference to high performance coatings, composites and adhesives applications. Technologies and product lines include:

- **Phenol Novolac Epoxy Resins (EPALLOY 8000 Series)**
- **Resorcinol and Resorcinol Modified Novolac Epoxy Resins (ERISYS RDGE & RN Series)**
- **Bis-A Modified Novolac Epoxy Resins (EPALLOY 7000 Series)**
- **Cycloaliphatic Epoxy Resins (EPALLOY 5000 Series)**

### Phenol Novolac Epoxy Resins

- Excellent chemical resistance
- High-functionality, cross-link density & $T_g$

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Average Epoxy Functionality</th>
<th>Viscosity at 25°C, cP</th>
<th>EEW, g/eq</th>
<th>HCC, max %</th>
<th>Gardner Color, max</th>
<th>Description / Use</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bisphenol F Epoxy Resins</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EPALLOY 8220</td>
<td>2.05</td>
<td>1,800 - 2,800</td>
<td>164 - 176</td>
<td>0.10</td>
<td>2</td>
<td>Lowest viscosity Bis-F resin. Near monomeric product for blends to prevent crystallization in Bis-A resins.</td>
</tr>
<tr>
<td>EPALLOY 8230</td>
<td>2.15</td>
<td>3,500 - 4,700</td>
<td>164 - 176</td>
<td>0.10</td>
<td>3</td>
<td>Standard low viscosity non-crystallizing resin for excellent 100% solids coatings and composite applications. Resistant to 98% sulfuric acid and strong polar solvents.</td>
</tr>
<tr>
<td><strong>Epoxy Phenol Novolac Resins</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EPALLOY 8240</td>
<td>2.35</td>
<td>6,000 - 7,100</td>
<td>164 - 176</td>
<td>0.10</td>
<td>3</td>
<td>Lowest viscosity unmodified epoxy novolac available. Lower in viscosity than standard Bis-A resin. EPALLOY 8240 is preferred for secondary containment tank linings and industrial flooring.</td>
</tr>
<tr>
<td>EPALLOY 8250</td>
<td>2.60</td>
<td>18,000 - 28,000</td>
<td>165 - 178</td>
<td>0.10</td>
<td>3</td>
<td>Mid-range functionality epoxy novolac with viscosity only slightly higher than standard Bis-A resin. For high temperature, highly corrosive applications. Preferred replacement for novolac based vinyl esters.</td>
</tr>
<tr>
<td>EPALLOY 8280</td>
<td>2.8</td>
<td>1,100-1,700 @ 52°C</td>
<td>172 - 179</td>
<td>0.10</td>
<td>2</td>
<td>Mid-range functionality for improved $T_g$ and corrosion resistance.</td>
</tr>
<tr>
<td>EPALLOY 8330</td>
<td>3.60</td>
<td>20,000 - 30,000 @ 52°C</td>
<td>171 - 183</td>
<td>0.10</td>
<td>3</td>
<td>Standard epoxy novolac for highest chemical resistance and $T_g$.</td>
</tr>
<tr>
<td>EPALLOY 8350</td>
<td>3.60</td>
<td>30,000 - 50,000 @ 52°C</td>
<td>175 - 184</td>
<td>0.10</td>
<td>3</td>
<td>Higher viscosity equivalent to 8330.</td>
</tr>
<tr>
<td>EPALLOY 8370</td>
<td>3.90</td>
<td>15,000 - 25,000 @ 72°C</td>
<td>205 - 212</td>
<td>0.10</td>
<td>3</td>
<td>Highest functionality epoxy phenol novolac resin.</td>
</tr>
</tbody>
</table>
**EPALLOY® Specialty Epoxy Resins (cont.)**

**Multifunctional and Faster Cure**

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Average Epoxy Functionality</th>
<th>Viscosity at 72°C, cP</th>
<th>EEW, g/eq</th>
<th>HCC, max %</th>
<th>Gardner Color, max</th>
<th>Description / Use</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Multifunctional Epoxy Resin</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EPALLOY 9000</td>
<td>3.0</td>
<td>5,500 - 6,500</td>
<td>160 - 180</td>
<td>0.4</td>
<td>2</td>
<td>High functionality, low melt viscosity resin for high temperature applications and T_g modification of other epoxy resins.</td>
</tr>
<tr>
<td><strong>Modified Bis-A Epoxy for Faster Cure</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EPALLOY 7200</td>
<td>2,000 - 4,000</td>
<td>195 - 215</td>
<td>0.5</td>
<td>2</td>
<td></td>
<td>Modified BPA epoxy to provide for faster cure for all temperatures. Eliminates blushing in slower curing epoxies. Excellent for coatings.</td>
</tr>
</tbody>
</table>

Low HCC Bis-F and novolac products are available for some materials above as made to order products.

**Resorcinol Epoxy Resin**
- Low-viscosity modifier
- Excellent chemical resistance

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Average Epoxy Functionality</th>
<th>Viscosity at 25°C, cP</th>
<th>EEW, g/eq</th>
<th>HCC, max %</th>
<th>Gardner Color, max</th>
<th>Description / Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERISYS RDGE</td>
<td>2.0</td>
<td>300 - 500</td>
<td>120 - 135</td>
<td>0.10</td>
<td>2</td>
<td>Resorcinol Diglycidyl Ether. Very low viscosity, high reactivity epoxy resin. Modifying resin for novolacs in corrosion resistant coatings and composites.</td>
</tr>
</tbody>
</table>

High purity grade ERISYS RDGE-H is available as a made to order product.
### EPALLOY® Specialty Epoxy Resins (cont.)

**Resorcinol Modified Phenol Novolac Epoxy Resins**
- Maximum chemical resistance

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Average Epoxy Functionality</th>
<th>Viscosity at 25°C, cP</th>
<th>EEW, g/eq</th>
<th>HCC, max %</th>
<th>Gardner Color, max</th>
<th>Description / Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERISYS RF50</td>
<td>2.0</td>
<td>700 - 1,400</td>
<td>140 - 155</td>
<td>0.10</td>
<td>2</td>
<td>Non-crystallizing lowest viscosity resorcinol/phenol novolac epoxy resin.</td>
</tr>
<tr>
<td>ERISYS RN25</td>
<td>2.4</td>
<td>5,000 - 6,500</td>
<td>152 - 165</td>
<td>0.10</td>
<td>5</td>
<td>Non-crystallizing medium viscosity resorcinol/phenol novolac epoxy resin.</td>
</tr>
<tr>
<td>ERISYS RN3650</td>
<td>2.8</td>
<td>7,000 - 9,000</td>
<td>141 - 156</td>
<td>0.10</td>
<td>3</td>
<td>Highest functionality resorcinol modified phenol novolac epoxy resin. Maximum chemical resistance and T&lt;sub&gt;G&lt;/sub&gt;.</td>
</tr>
</tbody>
</table>

**Bisphenol A/F Modified Phenol Novolac Epoxy Resins**

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Average Epoxy Functionality</th>
<th>Viscosity at 25°C, cP</th>
<th>EEW, g/eq</th>
<th>HCC, max %</th>
<th>Gardner Color, max</th>
<th>Description / Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPALLOY 7138</td>
<td>2.0</td>
<td>5,500 - 7,500</td>
<td>175 - 185</td>
<td>0.10</td>
<td>1</td>
<td>Low viscosity non-crystallizing novolac modified Bis-A epoxy resin. Excellent replacement for high purity Bis-A resins in filament winding applications.</td>
</tr>
<tr>
<td>EPALLOY 7170</td>
<td>2.05</td>
<td>7,000 - 10,000</td>
<td>177 - 187</td>
<td>0.10</td>
<td>1</td>
<td>Non-crystallizing Bis-A/F resin. 30% epoxidized Bis-F content.</td>
</tr>
<tr>
<td>EPALLOY 9237-70</td>
<td>2.10</td>
<td>5,000 - 7,000</td>
<td>170 - 181</td>
<td>0.10</td>
<td>2</td>
<td>Non-crystallizing Bis-A modified Bis-F epoxy resin. Highest Bis-F content and highest T&lt;sub&gt;G&lt;/sub&gt; in this class.</td>
</tr>
</tbody>
</table>
### EPALLOY® Specialty Epoxy Resins (cont.)

#### Cycloaliphatic Epoxy Resins
- Excellent for non-yellowing coatings, electrical insulating components
- Bis-A free epoxy resins

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Viscosity at 25°C, cP</th>
<th>EEW, g/eq</th>
<th>HCC, max %</th>
<th>APHA Color, max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogenated Bisphenol A Epoxy Resins</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EPALLOY 5000</td>
<td>1,300 - 2,500</td>
<td>210 - 230</td>
<td>0.2</td>
<td>100</td>
</tr>
<tr>
<td>Description / Use</td>
<td>UV Resistant, lower viscosity cycloaliphatic alternative to standard Bis-A resin. Applications include weatherable coatings as replacement to urethane coatings. Excellent adhesion to metal.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EPALLOY 5001</td>
<td>2,000 - 4,500</td>
<td>190 - 210</td>
<td>0.3</td>
<td>3 Gardner</td>
</tr>
<tr>
<td>Description / Use</td>
<td>Faster cure version of EPALLOY 5000 through increased epoxy functionality. (Functionality = 2.4) Ideal for weatherable coatings.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cycloaliphatic Glycidyl Ester</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EPALLOY 5200</td>
<td>700 - 900</td>
<td>160 - 180</td>
<td>0.4</td>
<td>100</td>
</tr>
<tr>
<td>Description / Use</td>
<td>Low viscosity Cycloaliphatic Glycidyl Ester epoxy resin used mostly in applications for outdoor electrical insulation designed for medium and high voltage.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Other resin blends available upon request on a made-to-order basis.

### Bisphenol A Epoxy Resin & Blends

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Viscosity at 25°C, cP</th>
<th>EEW, g/eq</th>
<th>HCC, max %</th>
<th>Gardner Color, max</th>
<th>Description / Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNMODIFIED</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Undiluted Bisphenol A Epoxy Resin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EPALLOY 7192</td>
<td>0 - V (1)</td>
<td>230 - 280</td>
<td>0.1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Description / Use</td>
<td>Undiluted high molecular weight semi-solid Bisphenol A epoxy resin well suited for tough, durable formulations with improved adhesion.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DILUTED Bis-A epoxy resin blended with ERISYS diluent.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diluted Bisphenol A Epoxy Resins</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EPALLOY 7190 A83</td>
<td>500 - 700</td>
<td>185 - 198</td>
<td>0.1</td>
<td>2</td>
<td>LER diluted with 17% ERISYS GE-6</td>
</tr>
<tr>
<td>EPALLOY 7190 G76</td>
<td>500 - 800</td>
<td>179 - 193</td>
<td>0.1</td>
<td>2</td>
<td>LER diluted with 24% ERISYS GE-10</td>
</tr>
<tr>
<td>EPALLOY 7190 J82</td>
<td>500 - 700</td>
<td>197 - 207</td>
<td>0.1</td>
<td>2</td>
<td>LER diluted with 18% ERISYS GE-8</td>
</tr>
<tr>
<td>EPALLOY 7190 N75</td>
<td>500 - 800</td>
<td>163 - 175</td>
<td>0.1</td>
<td>2</td>
<td>LER diluted with 25% ERISYS GE-20</td>
</tr>
</tbody>
</table>

Other resin blends available upon request on a made-to-order basis.

(1) Gardner-Holdt Viscosity - 70% in Butyl Carbitol
### EPALLOY® Specialty Epoxy Resins (cont.)

#### Resin Solutions

<table>
<thead>
<tr>
<th>Product Name</th>
<th>NV%</th>
<th>Viscosity at 25°C, cP</th>
<th>EEW on Solids, g/eq</th>
<th>HCC, max %</th>
<th>Gardner Color, max</th>
<th>Description / Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPALLOY 7200 SOLUTIONS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Modifying resin for high solids primers with fast tack free time.</td>
</tr>
<tr>
<td>EPALLOY 7200 MIBK90</td>
<td>89 - 91</td>
<td>3,000 - 8,000</td>
<td>195 - 215</td>
<td>0.5</td>
<td>2</td>
<td>90% solids in Methyl Isobutyl Ketone</td>
</tr>
<tr>
<td>EPALLOY 7200 X90</td>
<td>89 - 91</td>
<td>3,500 - 7,500</td>
<td>195 - 215</td>
<td>0.5</td>
<td>2</td>
<td>90% solids in Xylene</td>
</tr>
<tr>
<td>EPALLOY 8330 SOLUTIONS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Solutions of high functionality epoxy novolacs in solvents for film coatings.</td>
</tr>
<tr>
<td>EPALLOY 8330 A85</td>
<td>84 - 86</td>
<td>500 - 1,200</td>
<td>171 - 183</td>
<td>0.10</td>
<td>3</td>
<td>85% solids in Acetone</td>
</tr>
<tr>
<td>EPALLOY 8330 MAK80</td>
<td>79 - 81</td>
<td>800 - 1,300</td>
<td>171 - 183</td>
<td>0.10</td>
<td>3</td>
<td>80% solids in Methyl n-Amyl Ketone</td>
</tr>
<tr>
<td>EPALLOY 8330 MEK85</td>
<td>84 - 86</td>
<td>800 - 1,400</td>
<td>171 - 183</td>
<td>0.10</td>
<td>3</td>
<td>85% solids in Methyl Ethyl Ketone</td>
</tr>
<tr>
<td>EPALLOY 8350 SOLUTIONS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Epoxidized Phenol Novolac Solutions</td>
</tr>
<tr>
<td>EPALLOY 8350 X80</td>
<td>79 - 81</td>
<td>1,200 - 3,000</td>
<td>175 - 184</td>
<td>0.1</td>
<td>3</td>
<td>80% solids in Xylene</td>
</tr>
<tr>
<td>EPALLOY 8370 SOLUTIONS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Epoxidized Phenol Novolac Solutions</td>
</tr>
<tr>
<td>EPALLOY 8370 A85</td>
<td>84 - 86</td>
<td>5,000 - 7,000</td>
<td>205 - 212</td>
<td>—</td>
<td>3</td>
<td>85% solids in Acetone</td>
</tr>
</tbody>
</table>

Other resin solutions available upon request on a made-to-order basis.
Monofunctional - Glycidyl Ethers

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Viscosity at 25°C, cP</th>
<th>EEW, g/eq</th>
<th>Specific Gravity at 25°C, g/cc</th>
<th>HCC, max %</th>
<th>APHA Color, max</th>
<th>Flash Point °F</th>
<th>Description / Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERISYS GE-5</td>
<td>2 max</td>
<td>145 - 155</td>
<td>0.91 - 0.92</td>
<td>0.10</td>
<td>100</td>
<td>&gt;129</td>
<td>n-Butyl Glycidyl Ether. Most efficient epoxy functional diluent available.</td>
</tr>
<tr>
<td>ERISYS GE-6</td>
<td>1 - 4</td>
<td>205 - 235</td>
<td>0.90 - 0.93</td>
<td>0.10</td>
<td>100</td>
<td>197</td>
<td>2-Ethylhexyl Glycidyl Ether. Excellent replacement for Butyl Glycidyl Ether as a low viscosity reactive diluent.</td>
</tr>
<tr>
<td>ERISYS GE-7</td>
<td>1 - 6</td>
<td>220 - 235</td>
<td>0.89 - 0.91</td>
<td>0.05</td>
<td>100</td>
<td>&gt;200</td>
<td>C₆-C₈ Aliphatic Glycidyl Ether. Natural alcohol based. Used for high solids coatings, tooling and civil engineering applications.</td>
</tr>
<tr>
<td>ERISYS GE-8</td>
<td>5 - 10</td>
<td>275 - 300</td>
<td>0.88 - 0.90</td>
<td>0.05</td>
<td>100</td>
<td>&gt;200</td>
<td>C₁₂-C₁₄ Aliphatic Glycidyl Ether. Natural alcohol based. Used in flooring, aggregate bonding and adhesives.</td>
</tr>
<tr>
<td>ERISYS GE-10</td>
<td>5 - 10</td>
<td>170 - 195</td>
<td>1.07 - 1.09</td>
<td>0.10</td>
<td>1 Gardener</td>
<td>&gt;250</td>
<td>α-Cresyl Glycidyl Ether. Viscosity modifier for construction, flooring and casting. Excellent moisture tolerance.</td>
</tr>
<tr>
<td>ERISYS GE-11</td>
<td>20 - 30</td>
<td>215 - 240</td>
<td>1.01 - 1.03</td>
<td>0.10</td>
<td>1 Gardener</td>
<td>&gt;250</td>
<td>p-tertiary Butyl Phenyl Glycidyl Ether. Modifier for Bisphenol A resins to eliminate crystallization. Good electrical properties. Easier to handle vs. GE-10 or GE-13.</td>
</tr>
<tr>
<td>ERISYS GE-12</td>
<td>100 - 140</td>
<td>300 - 325</td>
<td>0.97 - 1.00</td>
<td>0.15</td>
<td>2 Gardener</td>
<td>482</td>
<td>Methyl Phenyl Glycidyl Ether. Excellent compatibilizer for aliphatic curing agents. Reduced induction time with non-reactive modifier.</td>
</tr>
<tr>
<td>ERISYS GE-13</td>
<td>4 - 7</td>
<td>150 - 165</td>
<td>1.10 - 1.13</td>
<td>0.10</td>
<td>2 Gardener</td>
<td>237</td>
<td>Phenyl Glycidyl Ether. Lowest viscosity aromatic modifier. Excellent for electrical applications and for preparing resin/curing agent adducts.</td>
</tr>
</tbody>
</table>

ERISYS™ Epoxy Functional Reactive Modifiers

ERISYS GE Series glycidyl ether modifiers are low molecular weight epoxy functional products based on alcohols, glycols and phenols. The product line covers a broad range of TSCA approved modifiers from monofunctional to multifunctional materials. Classified at right.

- Aliphatic Monoglycidyl Ethers (ERISYS GE 5, 6, 7 and 8 Series)
- Aromatic Monoglycidyl Ethers (ERISYS GE 10 Series)
- Aliphatic Diglycidyl Ethers (ERISYS GE 20 Series)
- Aliphatic Triglycidyl Ethers (ERISYS GE 30 Series)
- Glycidyl Esters (ERISYS GS Series)
- Glycidyl Amines (ERISYS GA Series)
- Aliphatic Polyglycidyl Ethers (ERISYS GE 40 and 60)
ERISYS™ Epoxy Functional Reactive Modifiers (cont.)

**Difunctional- Glycidyl Ethers**

- Reduce viscosity – maintain physical properties better than monofunctional diluents
- Use higher concentrations

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Viscosity at 25°C, cP</th>
<th>EEW, g/eq</th>
<th>Specific Gravity at 25°C, g/cc</th>
<th>HCC, max %</th>
<th>APHA Color, max</th>
<th>Flash Point °F</th>
<th>Description / Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERISYS GE-20</td>
<td>10 - 18</td>
<td>125 - 137</td>
<td>1.05 - 1.07</td>
<td>0.10</td>
<td>100</td>
<td>&gt;230</td>
<td>Neopentyl Glycidyl Ether. Aliphatic difunctional modifier for filament winding, coatings and electrical applications.</td>
</tr>
<tr>
<td>ERISYS GE-21</td>
<td>10 - 18</td>
<td>120 - 130</td>
<td>1.09 - 1.11</td>
<td>0.10</td>
<td>100</td>
<td>&gt;230</td>
<td>1,4-Butanediol Glycidyl Ether. Aliphatic difunctional modifier for improved flexibility over GE-20 at comparable viscosity.</td>
</tr>
<tr>
<td>ERISYS GE-22</td>
<td>45 - 75</td>
<td>145 - 165</td>
<td>1.07 - 1.09</td>
<td>0.10</td>
<td>100</td>
<td>&gt;230</td>
<td>Cyclohexanedimethanol Glycidyl Ether. Cycloaliphatic difunctional modifier with outstanding weatherability. Excellent for machinery grouts and adhesives.</td>
</tr>
<tr>
<td>ERISYS GE-25</td>
<td>15 - 23</td>
<td>143 - 156</td>
<td>1.06 - 1.08</td>
<td>0.05</td>
<td>100</td>
<td>300</td>
<td>1,6-Hexanediol Glycidyl Ether. Aliphatic difunctional epoxy reactive diluent.</td>
</tr>
<tr>
<td>ERISYS GE-29</td>
<td>275 - 500</td>
<td>250 - 300</td>
<td>1.46 - 1.51</td>
<td>0.50</td>
<td>5</td>
<td>&gt;230</td>
<td>Dibromo Neopentyl Glycidyl Ether. High bromine containing, low viscosity, difunctional epoxy for flame retardant adhesives and encapsulants.</td>
</tr>
</tbody>
</table>

**Flexibilizers**

- Reduce viscosity, increase flexibility and elongation – improve impact resistance & toughening
- Lower T₉ and modulus

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Viscosity at 25°C, cP</th>
<th>EEW, g/eq</th>
<th>Specific Gravity at 25°C, g/cc</th>
<th>HCC, max %</th>
<th>Gardner Color, max</th>
<th>Flash Point °F</th>
<th>Description / Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERISYS GE-23</td>
<td>30 - 60</td>
<td>175 - 205</td>
<td>1.13 - 1.15</td>
<td>0.10</td>
<td>100 APHA</td>
<td>&gt;300</td>
<td>Dipropylene Glycol Glycidyl Ether. Standard grade for higher tensile elongation and flexibility. GE-23LV is a lower viscosity and lower chloride version of GE-23.</td>
</tr>
<tr>
<td>ERISYS GE-24</td>
<td>60 - 70</td>
<td>310 - 330</td>
<td>1.05 - 1.07</td>
<td>0.10</td>
<td>60 APHA</td>
<td>&gt;300</td>
<td>Polypropylene Glycol Glycidyl Ether. Diepoxide of an aliphatic polyglycol used as a diluent and/or flexibilizer in high viscosity, brittle epoxy formulations.</td>
</tr>
<tr>
<td>ERISYS GE-35</td>
<td>300 - 500</td>
<td>550 - 650</td>
<td>1.01 - 1.03</td>
<td>—</td>
<td>8</td>
<td>&gt;200</td>
<td>Castor Oil Triglycidyl Ether. Low viscosity trifunctional flexibilizer. Provides increased impact and thermal shock resistance to epoxy formulations. Low moisture pick-up.</td>
</tr>
<tr>
<td>ERISYS GE-35H</td>
<td>300 - 500</td>
<td>550 - 650</td>
<td>1.01 - 1.08</td>
<td>—</td>
<td>8</td>
<td>&gt;200</td>
<td>Castor Oil Glycidyl Ether. Lower modulus version of GE-35.</td>
</tr>
<tr>
<td>ERISYS GE-36</td>
<td>200 - 320</td>
<td>620 - 680</td>
<td>1.02 - 1.04</td>
<td>0.10</td>
<td>2</td>
<td>&gt;200</td>
<td>Propoxylated Glycerin Triglycidyl Ether. Aliphatic trifunctional flexibilizer. Used in severe thermal cycling conditions.</td>
</tr>
<tr>
<td>ERISYS GE-38</td>
<td>1,070 - 1,390</td>
<td>160 - 180</td>
<td>1.21 - 1.25</td>
<td>0.7</td>
<td>3</td>
<td>200</td>
<td>Polyglycerol-3-Polyglycidyl Ether. Flexible epoxy. Not TSCA registered.</td>
</tr>
</tbody>
</table>
### ERISYS™ Epoxy Functional Reactive Modifiers (cont.)

#### Multifunctional- Glycidyl Ethers
- Increase cross-link density and lower viscosity
- Use at much higher levels

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Viscosity at 25°C, cP</th>
<th>EEW, g/eq</th>
<th>Specific Gravity at 25°C, g/cc</th>
<th>HCC, max %</th>
<th>Gardner Color, max</th>
<th>Flash Point °F</th>
<th>Description / Use</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aliphatic Triglycidyl Ether</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ERISYS GE-30</td>
<td>100 - 200</td>
<td>135 - 150</td>
<td>1.14 - 1.16</td>
<td>0.10</td>
<td>100</td>
<td>&gt;200</td>
<td>Trimethylolpropane Triglycidyl Ether. Low viscosity, high functional epoxy modifier. Excellent for 100% solids adhesives and coatings.</td>
</tr>
<tr>
<td>ERISYS GE-31</td>
<td>200 - 300</td>
<td>150 - 170</td>
<td>1.19 - 1.21</td>
<td>0.10</td>
<td>4</td>
<td>&gt;200</td>
<td>Trimethylolethane Triglycidyl Ether. Low viscosity high functional epoxy modifier. Use to increase crosslink density and enhance chemical resistance.</td>
</tr>
<tr>
<td><strong>Polyfunctional Glycidyl Ether</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ERISYS GE-40</td>
<td>900 - 1,200</td>
<td>156 - 170</td>
<td>1.27 - 1.33</td>
<td>1.5</td>
<td>3</td>
<td>&gt;300</td>
<td>Pentaerythritol Glycidyl Ether. Medium viscosity tetrafunctional reactive modifier. Compatible with most standard epoxy resins at all concentrations. Not TSCA registered.</td>
</tr>
<tr>
<td>ERISYS GE-60</td>
<td>8,000 - 18,000</td>
<td>160 - 195</td>
<td>1.27 - 1.30</td>
<td>0.50</td>
<td>2</td>
<td>&gt;320</td>
<td>Sorbitol Polyglycidyl Ether. Aliphatic polyfunctional modifier to impart higher reactivity and crosslink density to epoxy resin formulations and crosslink acid functional polymers. Bis-A replacement alternative.</td>
</tr>
</tbody>
</table>

#### Glycidyl Esters

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Viscosity at 25°C, cP</th>
<th>EEW, g/eq</th>
<th>Specific Gravity at 25°C, g/cc</th>
<th>HCC, max %</th>
<th>Gardner Color, max</th>
<th>Flash Point °F</th>
<th>Description / Use</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Glycidyl Esters</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ERISYS GS-110</td>
<td>5 - 15</td>
<td>238 - 256</td>
<td>0.95 - 0.97</td>
<td>0.30</td>
<td>50</td>
<td>&gt;250</td>
<td>Glycidyl Ester of Neodecanoic Acid. Efficient and economical diluent for viscosity reduction.</td>
</tr>
<tr>
<td>ERISYS GS-120</td>
<td>400 - 900</td>
<td>390 - 470</td>
<td>0.97 - 1.00</td>
<td>2.0</td>
<td>9</td>
<td>&gt;200</td>
<td>Diglycidyl Ester of Dimer Acid. Flexibilizing modifier for rigid epoxy resin systems.</td>
</tr>
</tbody>
</table>

#### Glycidyl Amine

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Viscosity at 25°C, cP</th>
<th>EEW, g/eq</th>
<th>Specific Gravity at 25°C, g/cc</th>
<th>HCC, max %</th>
<th>Gardner Color, max</th>
<th>Flash Point °F</th>
<th>Description / Use</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Glycidyl Amine</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ERISYS GA-240</td>
<td>1,600 - 3,000</td>
<td>95 - 110</td>
<td>1.14 - 1.16</td>
<td>0.3</td>
<td>5</td>
<td>&gt;420</td>
<td>Epoxidized meta-Xylenediamine. Will increase crosslink density of modified systems. An alternative to MY-720 in tetra-functional epoxy matrix. Safer alternative to polyaziridines in acrylic emulsions.</td>
</tr>
</tbody>
</table>
**Hypro™ Reactive Liquid Polymers (RLP)**

Hypro Reactive Liquid Polymers (RLP) are synthetic rubber with chemical functionality. They incorporate rubber properties into brittle thermoset resins, adhesives, coatings and composites.

Hypro RLP combine the benefits of a low molecular weight butadiene-acrylonitrile rubber with terminal chemical functionality. They impart toughness, improve adhesion, and extend performance to low temperatures. The toughness shows in many attributes: crack resistance, fracture toughness, impact resistance, resilience, interlaminar adhesion, peel adhesion and thermal cycling.

**The Hypro RLP Toughening Mechanism**

With the proper selection of acrylonitrile content, RLP will be soluble with thermoset resins. When the resin system cures, the Hypro RLP terminal functionality reacts into the thermoset resin, and the synthetic rubber precipitates to form discreet rubber particles. These micron-scale particles absorb strain energy. Picture 1 shows a magnification of cured epoxy resin. It is a brittle, glassy resin. Picture 2 shows the same epoxy modified with Hypro RLP. The discrete rubber particles provide the toughening and the epoxy matrix maintains the strength of the unmodified epoxy.

**Typical Levels – Hypro RLP Toughened Systems**

The optimum Hypro RLP level varies with the type of resin. The general guidelines are that most systems require 5 phr to provide enough rubber particles for significant toughening and that above 20 phr enough RLP remains soluble with the resin, and it acts as a flexibilizer in addition to a toughening agent.

Epoxy composites and structural adhesives typically have < 15 phr, and sealants and coatings typically have >25 phr. Unsaturated polyester composites tend to have < 3 phr, and vinyl ester tends to have 5-to-10 phr. Acrylic adhesives and sealants tend to have multiple toughening agents and the Hypro RLP may be up to 20 phr.

Figure 1 graphically depicts the general guideline for RLP incorporation, demonstrating the relationships between CTBN content, Tg and toughness.

![Figure 1. General Guideline for Hypro RLP incorporation](image1)

![Picture 1. Cured, Unmodified Epoxy Resin](image2)

![Picture 2. Hypro RLP-Modified Epoxy Resin](image3)
Hypro™ Reactive Liquid Polymers (cont.)

Hypro CTBN typically requires chemical modification for effective incorporation into thermoset chemistries. Choice of terminal chemistry will depend on the application and end-use.

CVC Thermoset Specialties offers CTBN with alternative terminal reactivity (Figure 2) and the HyPox elastomer-modified epoxy resins for easy incorporation by formulators.

The Hypro CTBN can be used directly in epoxy-anhydride systems and in unsaturated polyester. Other thermoset systems require chemical modification.

Amine Terminated Butadiene-Acrylonitrile (ATBN) are typically used as co-curatives to epoxies and isocyanates in ambient-cure adhesives, coatings, sealants and in some heat-cured composites.

Methacrylate (Vinyl) Terminated Butadiene-Acrylonitrile (VTBNX) can be the primary toughening agent in acrylic adhesives, sealants, and composites and as complementary toughening agents in vinylester and in unsaturated polyester composites and adhesives.

Epoxy-Terminated Butadiene-Acrylonitrile (ETBN) include both glycidyl esters of a CTBN and epoxy adducts of CTBN. Some of these are sold as HyPox Elastomer-Modified Epoxy Resins. The Hypro ETBN and the HyPox resins are toughening agents for epoxy coatings, adhesives and composites. Other specialty applications are as toughening agents for cyanate esters and for unsaturated polyester. Many formulators perform custom reactions with the Hypro CTBN to meet the requirements of their systems.

Hydroxyl-Terminated Butadiene (HTB) is principally used for polyurethane potting compounds, coatings, sealants and other thermosets, providing excellent moisture resistance, electrical insulation, low glass transition temperature and extraordinary compatibility with fillers (Figure 3).

Figure 2. Hypro CTBN and Derivitives Chemical Structure

Figure 3. Hypro HTB Chemical Structure
Guidelines for Pre-Reacting Hypro™ RLP Adducts

The Hypro CTBN synthetic rubbers are butadiene polymers and butadiene-acrylonitrile copolymers with carboxyl groups at the polymer chain ends. Most formulators use a pre-reacted CTBN to attain the optimum benefits. The pre-reaction may be a simple modification of the carboxyl to another reactive moiety or a reaction with resins (typically epoxy or vinyl ester) to make a master batch ready for dilution.

The typical process steps

1. Choose the epoxy resin most compatible with the final product.
2. Choose the Hypro CTBN for the desired compatibility and performance.
3. Combine a molar excess (10:1) or weight excess (60:40) of epoxy to CTBN.
4. Heat and react under dry nitrogen with agitation until the acid number is <1.
   a. Typical temperatures range from 60°C with catalyst to 175°C for solid resins.
   b. Typical time is 30 minutes-to-7 hours and varies with temperature and catalyst.
5. Dilute with additional epoxy resin to the desired CTBN concentration, typically 6-to-12phr for composites and structural adhesives.

Processing options

- Catalysts increase the reaction rate, and the resultant adduct tends to increase in viscosity with time. Catalyst options include triphenyl phosphine (preferred), ethyltriphenylphosphoniumiodide, benzyl dimethyl amine, and other esterification catalysts.
- Epoxy resin can be co-reacted with CTBN to form an adduct. Addition of these adducts in the epoxy matrix increases ductility and toughness after cure.

Other processing notes

- Solid epoxy-CTBN adducts can be made by adducting solid epoxy resin or by advancing liquid epoxy and CTBN with BPA or by vulcanizing CTBN-epoxy adducts.
- Vinyl ester-CTBN adducts can be one step—combine epoxy resin, CTBN, and methacrylic acid and react or multi-step—react epoxy and CTBN before adding and reacting methacrylic acid. This typically requires a stabilizer.
- Water-dispersed CTBN-epoxy adducts for electrodeposition coating require several subsequent steps after producing the CTBN-epoxy adduct.
Carboxyl-terminated butadiene (CTB) and butadiene-acrylonitrile (CTBN) copolymers improve toughness, low-temperature properties, chemical and water resistance in epoxy, coating, vinyl ester, SMC/BMC, acrylic, plastisol and other thermoset systems. Global standard as a chemical intermediate for adducts for thermoset systems.

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Acrylonitrile %</th>
<th>Viscosity* at 27°C, cP</th>
<th>Carboxyl Equivalent, mgKOH/g</th>
<th>Molecular Weight</th>
<th>Functionality</th>
<th>Glass Transition, Tg, °C</th>
<th>Specific Gravity at 25°C, g/cc</th>
<th>Solubility Parameter, (cal/cm^3)1/2</th>
<th>Description / Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypro 2000X162 CTB</td>
<td>0</td>
<td>50,000</td>
<td>0.045</td>
<td>25</td>
<td>4,200</td>
<td>1.9</td>
<td>3</td>
<td>-77</td>
<td>0.907</td>
</tr>
<tr>
<td>Hypro 1300X31 CTBN</td>
<td>10</td>
<td>65,000</td>
<td>0.050</td>
<td>30</td>
<td>3,800</td>
<td>1.9</td>
<td>5</td>
<td>-66</td>
<td>0.924</td>
</tr>
<tr>
<td>Hypro 1300X47 CTBN</td>
<td>10</td>
<td>6,750</td>
<td>0.050</td>
<td>30</td>
<td>3,800</td>
<td>1.9</td>
<td>5</td>
<td>-66</td>
<td>0.920</td>
</tr>
<tr>
<td>Hypro 1300X8 CTBN</td>
<td>18</td>
<td>135,000</td>
<td>0.052</td>
<td>29</td>
<td>3,550</td>
<td>1.9</td>
<td>9</td>
<td>-52</td>
<td>0.948</td>
</tr>
<tr>
<td>Hypro 1300X13 CTBN</td>
<td>26</td>
<td>500,000</td>
<td>0.057</td>
<td>32</td>
<td>3,150</td>
<td>1.9</td>
<td>5</td>
<td>-39</td>
<td>0.960</td>
</tr>
<tr>
<td>Hypro 1300X9 CTBNX</td>
<td>18</td>
<td>160,000</td>
<td>0.067</td>
<td>38</td>
<td>3,600</td>
<td>2.4</td>
<td>4</td>
<td>-52</td>
<td>0.955</td>
</tr>
<tr>
<td>Hypro 1300X18 CTBNX</td>
<td>22</td>
<td>350,000</td>
<td>0.070</td>
<td>39</td>
<td>3,400</td>
<td>2.4</td>
<td>5</td>
<td>-46</td>
<td>0.961</td>
</tr>
</tbody>
</table>

Note 1 - Hypro 1300X8 is also available as Hypro 1300X8F with an FDA compliant stabilizer.
Note 2 - Hypro 1300X13 is also available as Hypro 1300X13F with an FDA compliant stabilizer and as 1300X13NA (lower sodium version) and 1300X13CL (lower chloride version).
* Viscosity reflects mid-point.
### Hypro™ Reactive Liquid Polymers (cont.)

**Amine-Terminated Butadiene (ATB) and Butadiene-Acrylonitrile (ATBN) Polymers**

Amine-terminated butadiene (ATB) and butadiene-acrylonitrile (ATBN) copolymers enhance toughness, flexibility, low-temperature properties and adhesion to substrates in two-part amine-cured epoxies, and impact resistance and adhesion to substrates in two-part coatings. Typical uses include structural adhesives, coatings and linings for improved corrosion resistance, construction joint sealers and mastics, powder coatings and filament-wound pressure vessels.

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Acrylonitrile %</th>
<th>Viscosity* at 27°C, cP</th>
<th>AHEW, g/eq</th>
<th>AEW,* g/eq</th>
<th>Amine Value, mgKOH/g</th>
<th>Molecular Weight</th>
<th>Functionality</th>
<th>Gardner Color max</th>
<th>Glass Transition, Tg, °C</th>
<th>Specific Gravity at 25°C, g/cc</th>
<th>Free Amine, %</th>
<th>Description / Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypro 2000X173 ATB</td>
<td>0</td>
<td>185,000</td>
<td>950</td>
<td>950</td>
<td>59</td>
<td>4,450</td>
<td>1.9</td>
<td>3</td>
<td>-80</td>
<td>0.915</td>
<td>4.0</td>
<td>Amine-terminated polybutadiene, lowest polarity, excellent compatibility with fillers, cross-links at double bonds, reacts at terminal amine moiety.</td>
</tr>
<tr>
<td>Hypro 1300X21 ATBN</td>
<td>10</td>
<td>160,000</td>
<td>1,200</td>
<td>1,200</td>
<td>47</td>
<td>4,050</td>
<td>1.9</td>
<td>8</td>
<td>-65</td>
<td>0.938</td>
<td>2.0</td>
<td>Co-curate in polyurethane and epoxy adhesives and sealants. Excellent low-temperature properties.</td>
</tr>
<tr>
<td>Hypro 1300X16 ATBN</td>
<td>18</td>
<td>200,000</td>
<td>900</td>
<td>900</td>
<td>62</td>
<td>3,800</td>
<td>1.8</td>
<td>8</td>
<td>-51</td>
<td>0.956</td>
<td>3.5</td>
<td>Most popular balance of compatibility, viscosity, and toughening. Excellent in adhesives, composites and coatings.</td>
</tr>
<tr>
<td>Hypro 1300X35 ATBN</td>
<td>26</td>
<td>500,000</td>
<td>700</td>
<td>700</td>
<td>80</td>
<td>3,500</td>
<td>1.8</td>
<td>10</td>
<td>-38</td>
<td>0.978</td>
<td>7.0</td>
<td>Highest level of acrylonitrile, best compatibility with polar components.</td>
</tr>
<tr>
<td>Hypro 1300X45 ATBN</td>
<td>18</td>
<td>375,000</td>
<td>1,850</td>
<td>1,850</td>
<td>30</td>
<td>3,800</td>
<td>1.8</td>
<td>8</td>
<td>-55</td>
<td>0.955</td>
<td>&lt;0.1</td>
<td>Hypro 1300X16 with no residual amine (AEP), designed for electrodeposition and powder coatings.</td>
</tr>
<tr>
<td>Hypro 1300X42 ATBN</td>
<td>18</td>
<td>100,000</td>
<td>225</td>
<td>450</td>
<td>125</td>
<td>3,800</td>
<td>1.8</td>
<td>10</td>
<td>-59</td>
<td>0.942</td>
<td>10.0</td>
<td>Similar to Hypro 1300X16 with primary amine (2-methylpentamethylenediamine)—No AEP.</td>
</tr>
</tbody>
</table>

For Hypro 1300X42 ATBN, a primary amine terminated material, Weight per Active Hydrogen is AEW/2.

* Viscosity and AEW reflect mid-point.
Hypro™ Reactive Liquid Polymers (cont.)

Epoxy-Terminated Butadiene (ETB) and Butadiene-Acrylonitrile (ETBN) Glycidyl Ester Polymers

Glycidyl-esters of butadiene (ETB) and butadiene-acrylonitrile (ETBN) copolymers incorporate 100% rubber toughening into epoxy matrix without pre-reaction or additional epoxy resin. Excellent for epoxy composites and adhesives. Contains no Bisphenol A or Bisphenol A Diglycidyl Ether (BADGE).

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Acrylonitrile %</th>
<th>Viscosity at 27°C, cP</th>
<th>Viscosity at 52°C, cP</th>
<th>EEW, g/eq</th>
<th>Acid number, mgKOH/g</th>
<th>Molecular Weight</th>
<th>Gardner Color, max</th>
<th>Glass Transition, Tg, °C</th>
<th>Solids, %</th>
<th>Description / Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypro 2000X174 ETB</td>
<td>0</td>
<td>20,000</td>
<td>3,500</td>
<td>2,800</td>
<td>&lt;0.1</td>
<td>4,350</td>
<td>7</td>
<td>-77</td>
<td>100</td>
<td>Lowest viscosity epoxy-functional rubber toughener, good compatibility with fillers.</td>
</tr>
<tr>
<td>Hypro 1300X68 ETBN</td>
<td>18</td>
<td>300,000</td>
<td>20,000</td>
<td>2,500</td>
<td>&lt;0.1</td>
<td>3,700</td>
<td>8</td>
<td>-52</td>
<td>100</td>
<td>Balanced viscosity and compatibility, excellent for mix-and-use epoxy adhesives and for composites.</td>
</tr>
<tr>
<td>Hypro 1300X63 ETBN</td>
<td>26</td>
<td>725,000</td>
<td>40,000</td>
<td>2,000</td>
<td>&lt;0.1</td>
<td>3,300</td>
<td>11</td>
<td>-39</td>
<td>100</td>
<td>Best compatibility with Bis-A, Bis-F, and novalac epoxies for shelf stable systems.</td>
</tr>
</tbody>
</table>

* Viscosity and EEW reflect mid-point.

Epoxy-Terminated Butadiene-Acrylonitrile (ETBN) Resin Adducts

Epoxy-terminated butadiene-acrylonitrile (ETBN) resin adducts with no excess epoxy. The Hypro ETBN have much higher rubber content when compared to HyPox CTBN-modified epoxies.

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Acrylonitrile %</th>
<th>Viscosity at 25°C, cP</th>
<th>Viscosity at 50°C, cP</th>
<th>EEW, g/eq</th>
<th>Acid number, mgKOH/g</th>
<th>Molecular Weight</th>
<th>Specific Gravity at 25°C, g/cc</th>
<th>Elastomer Content, %</th>
<th>Solids, %</th>
<th>Description / Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypro 1300X40 ETBN</td>
<td>18</td>
<td>1,450</td>
<td>N.A.</td>
<td>2,300</td>
<td>&lt;1.5</td>
<td>4,230</td>
<td>0.945</td>
<td>40</td>
<td>50</td>
<td>Toughening agent for vinyl ester, acrylic, UPE resins and composites. Improves crack-resistance and appearance in Sheet Molding Compounds (SMC).</td>
</tr>
<tr>
<td>Hypro 1300X44 ETBN</td>
<td>18</td>
<td>N.A.</td>
<td>1350k</td>
<td>2,300</td>
<td>&lt;3</td>
<td>4,230</td>
<td>—</td>
<td>80</td>
<td>100</td>
<td>Excellent toughening agent for cyanate ester resins, adhesives and composites.</td>
</tr>
</tbody>
</table>

* Viscosity and EEW reflect mid-point.
### Hypro™ Reactive Liquid Polymers (cont.)

#### Methacrylate (Vinyl) Terminated Butadiene (VTB) and Butadiene-Acrylonitrile (VTBNX) Polymers

Methacrylate (vinyl) terminated butadiene (VTB) and butadiene-acrylonitrile (VTBNX) liquid rubber for low temperature toughness, impact resistance and improved resilience in acrylic adhesives, sealants and coatings and in vinyl ester composites. The new, LC versions have less color and are more stable for longer shelf life.

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Acrylonitrile %</th>
<th>Acid Number, mgKOH/g</th>
<th>Viscosity* @ 27°C, cP</th>
<th>Molecular Weight</th>
<th>Functionality</th>
<th>Gardner Color, max</th>
<th>Glass Transition, Tg °C</th>
<th>Specific Gravity at 25°C, g/cc</th>
<th>Solubility Parameter, (cal/cm³)⁰.⁵</th>
<th>Solids, %</th>
<th>Description / Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypro 2000X168LC VTB</td>
<td>0.0</td>
<td>4.0</td>
<td>80,000</td>
<td>4,450</td>
<td>3</td>
<td>-80</td>
<td></td>
<td>0.929</td>
<td>8.40</td>
<td>100</td>
<td>Lowest Tg, lowest viscosity, most effective for lower temperature properties. More stable, less color.</td>
</tr>
<tr>
<td>Hypro 1300X33LC VTBNX</td>
<td>18.0</td>
<td>4.0</td>
<td>250,000</td>
<td>3,900</td>
<td>2</td>
<td>-49</td>
<td></td>
<td>0.967</td>
<td>8.90</td>
<td>100</td>
<td>Best balance of viscosity, low temperature properties and improved adhesion. More stable, less color.</td>
</tr>
<tr>
<td>Hypro 1300X43LC VTBNX</td>
<td>21.5</td>
<td>4.0</td>
<td>400,000</td>
<td>3,700</td>
<td>2</td>
<td>-45</td>
<td></td>
<td>0.981</td>
<td>9.09</td>
<td>100</td>
<td>Excellent improvement in adhesion, resilience, toughness. More stable, less color.</td>
</tr>
</tbody>
</table>

Hypro 2000X168LC is a developmental product and specification ranges are subject to change based on manufacturing history. Properties in the table reflect target properties only.

* Viscosity reflects mid-point.

### Hydroxyl-Terminated Polybutadiene (HTB), Polybutadiene Polyol

Polybutadiene polyols (HTB) feature hydrophobicity, low glass-transition temperature, electrical resistivity, compatibility with fillers and extenders, and hydroxyl functionality for reaction in polyurethane systems or as chemical intermediates.

These are much lower viscosity than the other Hypro polymers. They are the industry standard polymer for polyurethane potting compounds and for the inclusion of polybutadiene properties into thermoset formulations.

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Viscosity at 30°C, cP</th>
<th>OH Value*, meq/g</th>
<th>OH Eqw. wt. g/eq</th>
<th>OH No. mg KOH/g</th>
<th>Molecular Weight</th>
<th>Functionality</th>
<th>Gardner Color, max</th>
<th>Glass Transition, Tg °C</th>
<th>Specific Gravity at 25°C, g/cc</th>
<th>Solubility Parameter, (cal/cm³)⁰.⁵</th>
<th>1,2-Vinyl, %</th>
<th>Description / Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypro 2800X95 HTB</td>
<td>5,000</td>
<td>0.83</td>
<td>1,205</td>
<td>46</td>
<td>2,800</td>
<td>2.5</td>
<td>&lt; 1</td>
<td>-75</td>
<td>0.904</td>
<td>8.12</td>
<td>20</td>
<td>Industry standard grade</td>
</tr>
<tr>
<td>Hypro 1200X90 HTB</td>
<td>1,400</td>
<td>1.80</td>
<td>556</td>
<td>101</td>
<td>1,200</td>
<td>2.5</td>
<td>&lt; 1</td>
<td>-70</td>
<td>0.913</td>
<td>8.27</td>
<td>20</td>
<td>Lower viscosity</td>
</tr>
</tbody>
</table>

* Viscosity and OH Value reflect mid-point.
# HyPox™ Elastomer Modified Epoxy Resins

Elastomer modification to epoxy resins is a valuable way to merge the benefits of alternate polymer chemistry with the convenience of conventional 1 or 2 part epoxy handling and performance. CVC offers CTBN modification for toughening and chip resistance, Dimer Acid modification for flexibility and Urethane modification for adhesion to difficult surfaces.

## Dimer Acid Modified Epoxies

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Elastomer Content %</th>
<th>Viscosity* at 52°C, cP</th>
<th>EEW,* g/eq</th>
<th>Gardner Color, max</th>
<th>Acid No., max</th>
<th>Description / Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimer Acid Modified Epoxy Resin</td>
<td>HyPox DA323</td>
<td>40</td>
<td>50,000</td>
<td>660</td>
<td>12</td>
<td>0.1</td>
</tr>
</tbody>
</table>

* Viscosity and EEW reflect mid-point.

## Urethane Modified Epoxies

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Elastomer Content %</th>
<th>Viscosity* at 25°C, cP</th>
<th>EEW,* g/eq</th>
<th>Gardner Color, max</th>
<th>Description / Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urethane Modified Epoxy Resin</td>
<td>HyPox UA10</td>
<td>12</td>
<td>650,000</td>
<td>215</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>HyPox UA11</td>
<td>5</td>
<td>35,000</td>
<td>215</td>
<td>2</td>
</tr>
</tbody>
</table>

* Viscosity and EEW reflect mid-point.
## HyPox™ Elastomer Modified Epoxy Resins (cont.)
### CTBN Modified Epoxies

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Elastomer Content %</th>
<th>Viscosity* at 25°C, cP</th>
<th>EEW,* g/eq</th>
<th>Gardner Color, max</th>
<th>Acid Number, mgKOH/g</th>
<th>Description / Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>HyPox RA 95</td>
<td>5 - 7</td>
<td>22,500 @ 52°C</td>
<td>200</td>
<td>4</td>
<td>0.2</td>
<td>Bis-A epoxy resin adduct with solid CTBN for good high-temperature performance and green strength. Is used as a tackifier for adhesives and composites.</td>
</tr>
<tr>
<td>HyPox RA 840</td>
<td>40</td>
<td>190,000</td>
<td>340</td>
<td>10</td>
<td>0.1</td>
<td>Bis-A epoxy resin adduct with 1300X8 CTBN used as a reactive toughener to increase toughness, impact resistance, and peel adhesion in liquid Bis-A systems.</td>
</tr>
<tr>
<td>HyPox RA 1340</td>
<td>40</td>
<td>450,000</td>
<td>350</td>
<td>10</td>
<td>0.1</td>
<td>Bis-A epoxy resin adduct with 1300X13 CTBN used as a reactive toughener to increase toughness, impact resistance, and peel adhesion. Excellent compatibility in liquid Bis-A systems.</td>
</tr>
<tr>
<td>HyPox RA 16213</td>
<td>29</td>
<td>240,000 @ 27°C</td>
<td>265</td>
<td>—</td>
<td>1</td>
<td>Bis-A epoxy resin adduct with 2000X162 CTB and 1300X13 CTBN. Best combination of rubber toughening and solubility with liquid epoxy with excellent properties at -40°C with Dicyandiamide cured adhesives.</td>
</tr>
<tr>
<td>HyPox RF 1320</td>
<td>20</td>
<td>38,000</td>
<td>215</td>
<td>6</td>
<td>0.1</td>
<td>Bis-F epoxy resin adduct with 1300X13 CTBN to increase toughness, impact resistance, and peel adhesion for low-viscosity epoxy phenol novolac systems.</td>
</tr>
<tr>
<td>HyPox RF 1341</td>
<td>40</td>
<td>225,000</td>
<td>308</td>
<td>—</td>
<td>0.2</td>
<td>Bis-F epoxy resin adduct with 1300X13 CTBN. Higher rubber content for lower dosing level than RF1320 to increase toughness, impact resistance, and peel adhesion for low-viscosity epoxy phenol novolac systems.</td>
</tr>
<tr>
<td>HyPox RF 928</td>
<td>20</td>
<td>55,000</td>
<td>210</td>
<td>10</td>
<td>0.1</td>
<td>Epoxy Phenol Novolac resin adduct with 1300X13 CTBN with 2.3 functionality. Increases toughness, impact resistance, and peel adhesion for medium-viscosity, higher T&lt;sub&gt;g&lt;/sub&gt; epoxy novolac systems.</td>
</tr>
<tr>
<td>HyPox RF 933</td>
<td>20</td>
<td>150,000</td>
<td>220</td>
<td>10</td>
<td>0.1</td>
<td>Epoxy Phenol Novolac resin adduct with 1300X13 CTBN with 2.6 functionality. Highest functionality for best chemical and heat resistance to increase toughness, impact resistance, and peel adhesion.</td>
</tr>
<tr>
<td>HyPox RM 20</td>
<td>50</td>
<td>6,000</td>
<td>290</td>
<td>10</td>
<td>0.1</td>
<td>Neopentyl Glycol Diglycidyl ether adduct with 1300X6 CTBN having lower viscosity than liquid Bis-A epoxy resin. Increases flexibility, impact resistance, resilience to fatigue and improves adhesion.</td>
</tr>
<tr>
<td>HyPox RM 22</td>
<td>50</td>
<td>20,000</td>
<td>340</td>
<td>10</td>
<td>0.1</td>
<td>Cyclohexanedimethanol Diglycidyl ether adduct with 1300X13 CTBN having higher viscosity and better compatibility than RM20. Increases flexibility, impact resistance, resilience to fatigue and improves adhesion.</td>
</tr>
<tr>
<td>HyPox RK 84L</td>
<td>32</td>
<td>—</td>
<td>1,375</td>
<td>Amber</td>
<td>—</td>
<td>Solid Bis-A epoxy resin modified 1300X13 CTBN useful as a reactive toughener for structural reinforcement in solid Bis-A systems.</td>
</tr>
<tr>
<td>HyPox RK 820</td>
<td>20</td>
<td>—</td>
<td>950</td>
<td>Amber</td>
<td>—</td>
<td>Solid Bis-A epoxy resin modified 1300X13 CTBN useful as a reactive toughener for structural reinforcement in solid Bis-A systems.</td>
</tr>
</tbody>
</table>

* Viscosity and EEW reflect mid-point.
**OMICURE™ Curing Agents, Accelerators & Catalysts**

Accelerating the cure speed or lowering the cure temperature is the role of these versatile additions. Whether the need is for acceleration of Dicyandiamide (Dicy) and anhydrides or catalytic cures of epoxy resins, a CVC product is available to fit your needs for latency or cure profile.

These products include:

- Dicyandiamide (OMICURE DDA Series)
- Substituted Urea Accelerators for Dicyandiamide (OMICURE U Series)
- Boron-Based Catalysts (OMICURE B Series)

**Curing Agents**

**Dicyandiamide Curing Agent – Typical use levels in DGEBA from 5-10 phr.**

- Common curative for 1k epoxy systems
  - composites and prepregs
  - automotive, adhesives and coatings

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Onset Melting Point (°C)</th>
<th>Particle Size</th>
<th>Color</th>
<th>Typical Flow Control Content</th>
<th>Description / Use</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OMICURE DDA 5</strong></td>
<td>207-212</td>
<td>4μ &lt;2μ &lt;7μ &lt;10μ</td>
<td>White</td>
<td>2 to 3%</td>
<td>Ultra-fine particle size Dicyandiamide for the most critical applications. Provides for excellent dispersability, maximum reactivity, uniform cure, and low settling potential.</td>
</tr>
<tr>
<td><strong>OMICURE DDA 10</strong></td>
<td>207-212</td>
<td>12μ &lt;4μ &lt;11μ &lt;30μ</td>
<td>White</td>
<td>1.5 to 2.5%</td>
<td>Fine particle size with good dispersability, reactivity and uniform cure.</td>
</tr>
<tr>
<td><strong>OMICURE DDA 50</strong></td>
<td>207-212</td>
<td>21μ &lt;7μ &lt;16μ &lt;40μ</td>
<td>White</td>
<td>1.5 to 2.5%</td>
<td>Intermediate particle size product provides for cost effective, stable, one part systems for elevated temperature cure applications.</td>
</tr>
<tr>
<td><strong>OMICURE DDA 100</strong></td>
<td>207-212</td>
<td>Coarse Grade</td>
<td>White</td>
<td>0%</td>
<td>Coarse, unground grade of Dicyandiamide for those applications where particle size is not an issue. Contains no flow control agent.</td>
</tr>
</tbody>
</table>

**Aromatic Amine Curing Agent**

<table>
<thead>
<tr>
<th>Product Name</th>
<th>MP, °C</th>
<th>Color</th>
<th>Use Level PHR</th>
<th>Gardner Color, max</th>
<th>Glass Transition, Tg °C</th>
<th>Description / Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aromatic Amine Curing Agent</td>
<td><strong>OMICURE 33-DDS</strong></td>
<td>162-177</td>
<td>Tan to Off-White</td>
<td>36</td>
<td>—</td>
<td>Safer replacement for MDA. 33-DDS cured systems can yield higher compressive strength, higher HDT and less brittleness than MDA.</td>
</tr>
</tbody>
</table>
**OMICURE™ Curing Agents, Accelerators & Catalysts (cont.)**

OMICURE Substituted Urea Accelerators
Accelerators used with Dicyandiamide to lower required cure temperatures and increase speed of reaction

- Lower the reaction temperature and time for dicy-epoxy cure
  - reduces stability (shelf life) of mixed systems
- Optimum level = 1-5 phr

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Typical Peak Melting Point (°C)</th>
<th>Color</th>
<th>Use level PHR with Dicyandiamide</th>
<th>Particle Size (percent through 325 screen)</th>
<th>Time to Double in Viscosity @ 25°C (weeks)</th>
<th>Time to Cure to 95% Full Cure (°C) at 120°C</th>
<th>Time to Cure to 95% Full Cure (°C) at 140°C</th>
<th>Tg (°C)</th>
<th>Description / Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>OMICURE U-405</td>
<td>126 - 136</td>
<td>off-white</td>
<td>1 - 5</td>
<td>80</td>
<td>95</td>
<td>10</td>
<td>22</td>
<td>9</td>
<td>118 Phenyl Dimethyl Urea</td>
</tr>
<tr>
<td>OMICURE U-24</td>
<td>180 - 195</td>
<td>off-white</td>
<td>1 - 5</td>
<td>80</td>
<td>95</td>
<td>10</td>
<td>20</td>
<td>7</td>
<td>127 2,4-Toluene bis Dimethyl Urea - Isomer Grade</td>
</tr>
<tr>
<td>OMICURE U-410</td>
<td>180 - 195</td>
<td>off-white</td>
<td>1 - 5</td>
<td>80</td>
<td>95</td>
<td>10</td>
<td>18</td>
<td>7</td>
<td>123 80/20 Toluene bis Dimethyl Urea - Technical Grade</td>
</tr>
<tr>
<td>OMICURE U-52</td>
<td>220 - 230</td>
<td>off-white</td>
<td>1 - 5</td>
<td>80</td>
<td>95</td>
<td>55</td>
<td>27</td>
<td>12</td>
<td>127 4,4’-Methylene bis (phenyl dimethyl urea) Isomer Grade</td>
</tr>
<tr>
<td>OMICURE U-415</td>
<td>190 - 220</td>
<td>off-white</td>
<td>1 - 5</td>
<td>80</td>
<td>95</td>
<td>20</td>
<td>33</td>
<td>12</td>
<td>128 4,4’-Methylene bis (phenyl dimethyl urea) Technical Grade</td>
</tr>
<tr>
<td>OMICURE U-35</td>
<td>190 - 210</td>
<td>off-white</td>
<td>1 - 5</td>
<td>80</td>
<td>95</td>
<td>134</td>
<td>46</td>
<td>15</td>
<td>124 Cycloaliphatic bisurea</td>
</tr>
<tr>
<td>OMICURE U-210</td>
<td>172 - 182</td>
<td>off-white</td>
<td>1 - 5</td>
<td>80</td>
<td>95</td>
<td>16</td>
<td>29</td>
<td>15</td>
<td>121 N-(4-chlorophenyl) N, N-Dimethyl Urea</td>
</tr>
</tbody>
</table>

(1) with DGEBA (EEW=190) and dicy
(2) substituted urea @ 3phr; dicy @ 8phr; with DGEBA (EEW=190)
(3) Cure - DSC scan at 20°C/minute to 275°C, substituted urea @ 3phr; dicy @ 8phr, with DGEBA (EEW=190)

**Catalysts**

<table>
<thead>
<tr>
<th>Product Name</th>
<th>MP, °C</th>
<th>Color</th>
<th>Use Level PHR</th>
<th>Gardner Color, max</th>
<th>Glass Transition, Tg, °C</th>
<th>Description / Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>OMICURE 24EMI</td>
<td>liquid</td>
<td>Brown</td>
<td>0.1-10(1)</td>
<td>16</td>
<td>—</td>
<td>Accelerator for Anhydrides and catalyst for high temperature epoxies. Faster reactivity vs. BDMA or tertiary amine substituted phenols.</td>
</tr>
<tr>
<td>OMICURE BC-120</td>
<td>25-35</td>
<td>Amber/Brown</td>
<td>0.1-10(1)</td>
<td>—</td>
<td>130(2)</td>
<td>Can be used as sole curing agent or as accelerator for Anhydrides, Dicyandiamide or Aromatic Amines. Clear, compatible formulations. Very long room temperature shelf life.</td>
</tr>
</tbody>
</table>

(1) low levels to accelerate acid anhydrides, mid-range or higher levels as sole curing agent. Determine optimum concentration empirically.
(2) with DGEBA, EEW=190; @ 8phr
EPALLOY® 9000
Tris hydroxyl phenyl ethane
CAS no: 87093-13-8

EPALLOY® 5000
Hydrogenated Bisphenol-A diglycidyl ether
CAS no: 30583-72-3

EPALLOY® 5200
Hexahydro phthalic acid diglycidyl ester
CAS no: 5493-45-8

ERISYS™ RDGE, RDGE-H
Resorcinol diglycidyl ether
CAS no: 101-90-6

EPALLOY® 7200
Modified Bisphenol-A diglycidyl ether

ERISYS™ GA 240
Glycidyl amine of m-xylenediamine
CAS no: 63738-22-7

EPALLOY® 8000 Series
Phenol novolac epoxy resin
Chemical Structures (cont.)

**ALIPHATIC MONOGLYCIDYL ETHERS**

- **ERISYS™ GE 5**
  - n-Butyl glycidyl ether
  - CAS no: 2426-08-6

- **ERISYS™ GE 6**
  - 2-Ethyl hexyl glycidyl ether
  - CAS no: 2461-15-6

- **ERISYS™ GE 10**
  - Cresyl glycidyl ether
  - CAS no: 2210-79-9

- **ERISYS™ GE 11**
  - p-tert butyl glycidyl ether
  - CAS no: 3101-60-8

**ERISYS™ GE 21**
- 1,4-Butanediol diglycidyl ether
- CAS no: 2425-79-8

**ERISYS™ GE 22 & 22S**
- 1,4-Cyclohexane dimethanol diglycidyl ether
- CAS no: 14228-73-0

**ERISYS™ GE 23**
- Dipropylene glycol diglycidyl ether
- CAS no: 41638-13-5

**ERISYS™ GE 24**
- Polypropylene glycol(400) diglycidyl ether
- CAS no: 26142-30-3

**ERISYS™ GE 25**
- 1,6-Hexanediol diglycidyl ether
- CAS no: 16096-31-4

**ERISYS™ EGDGE**
- Ethylene glycol diglycidyl ether
- CAS no: 2224-15-9

**AROMATIC MONOGLYCIDYL ETHERS**

- **ERISYS™ GE 12**
  - Nonyl phenyl glycidyl ether
  - CAS no: 147094-54-0

- **ERISYS™ GE 13**
  - Phenyl glycidyl ether
  - CAS no: 122-60-1

**ERISYS™ GE 7**
- C8-C10 glycidyl ether
  - CAS no: 68609-96-1

**ERISYS™ GE 8**
- C12-C14 glycidyl ether
  - CAS no: 68609-97-2
Chemical Structures (cont.)

ALIPHATIC TRIGLYCIDYL ETHER MODIFIERS

ERISYS™ GE 30
Trimethylol propane triglycidyl ether
CAS no: 30499-70-8

ERISYS™ GE 31
Trimethylol ethane triglycidyl ether
CAS no: 68460-21-9

ERISYS™ GE 35 & 35H
Castor oil glycidyl ether
CAS no: 74398-71-3

ERISYS™ GE 36
Propoxylated glycol triglycidyl ether
CAS no: 37237-76-6
Approximate MW = 2000

ERISYS™ GE 38
Poly glycerol-3-polyglycidyl ether
CAS no: 118549-88-5

POLYFUNCTIONAL GLYCIDYL ETHER

ERISYS™ GE 40
Pentaerythritol polyglycidyl ether
CAS no: 30973-88-7

GLYCIDYL ESTER MODIFIERS

ERISYS™ GS 110
Glycidyl ester of neodecanoic acid
CAS no: 26761-45-5

ERISYS™ GE 40
Pentaerythritol polyglycidyl ether
CAS no: 30973-88-7

ERISYS™ GE 60
Sorbitol polyglycidyl ether
CAS no: 68412-01-1
Chemical Structures (cont.)
OMICURE™ SUBSTITUTED UREA ACCELERATORS

OMICURE™ U-210
CAS no: 150-68-5

OMICURE™ U-24
CAS no: 17526-94-2

OMICURE™ U-405
CAS no: 101-42-8

OMICURE™ U-52/U-415
CAS no: 10097-09-3
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