

PER™

Pure Epoxy Resin



Building
&
Transportation



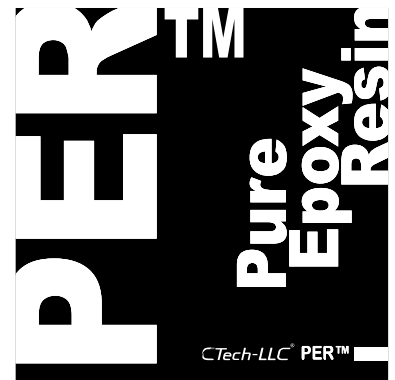
Oil, Gas
&
Industrial



Offshore
&
Onshore



Water
&
Wastewater



PRODUCT DESCRIPTION

CTech-LLC® PER™ is a General Pure Purpose Liquid Epoxy Resin and does not contain any diluents. Curing Agents used are Aliphatic Polyamines, Polyamides, Amidamines, Cyclo-Aliphatic Amines and modifiers of above curing agents.

CTech-LLC® PER™ is a clear difunctional bisphenol A/epichlorohydrin derived liquid epoxy resin. When cross-linked or hardened with appropriate curing agents, very good mechanical, adhesive, dielectric and chemical resistance properties are obtained. Because of this versatility, CTech-LLC® PER™ has become a standard epoxy resin used in formulation, fabrication and fusion technology.

ADVANTAGES

- Exceptional adhesive properties
- Good high and low temperature properties
- High strength
- Moisture insensitive
- Ambient-cure
- Even stress distribution
- Easy to apply
- Long-term durability
- Resistant to extreme shocks, vibrations and bending
- High fatigue strength
- Low odor
- Medium viscosity and high reactivity

TYPICAL USES

The low viscosity and cure properties of CTech-LLC® PER™ allow its use under various application and fabrication techniques including:

- Spraying and brushing
- Pultrusion
- Filament winding
- Casting
- Pressure laminating
- Molding
- Vacuum bag laminating
- Toweling
- Seismic retrofit and strengthening

INSTALLATION PROCEDURE

CTech-LLC® PER™ can be cured or cross-linked with a variety of curing agents depending on properties desired in the finished product and the processing conditions employed. Some commonly used curing agents, recommended concentrations, typical cure schedules employed in major end-use applications, plus sources for these curing agents are displayed in Table Curing Agents for CTech-LLC® PER™.

PERFORMANCE CHARACTERISTICS OF CURED PER™

- **Mechanical Properties:** High performance, high strength materials are obtained when this resin is cured with a variety of curing agents. Unfilled systems in common use have tensile values greater than 10,000 psi (69 MPa) with modulus values greater than 400,000 psi (2750 MPa). Such systems are normally very rigid. If greater flexibility is needed systems can be formulated to provide up to 300% elongation.
- **Adhesive Properties:** One of the most widely recognized properties of cured CTech-LLC® PER™ is strong adhesion to a broad range of substrates. Such systems exhibit shear strength of up to 6,000 psi (41Mpa). One factor which contributes to this property is the low shrinkage shown by these systems during cure. Compared to other polymers, epoxy resins have low internal stresses resulting in strong and durable finished products.
- **Electrical Properties:** CTech-LLC® PER™

cured systems have very good electrical insulating characteristics and dielectric properties. For example, systems can be obtained with anhydride and amine curing agents having volume resistivities up to 1×10^{16} ohm-cm, dielectric constants of 3-5 and dissipation factors of 0.002 to 0.020 at ambient conditions. Electrical encapsulations, laminates and molding compounds are frequently based on CTech-LLC® PER™.

- **Chemical Resistance:** Cured CTech-LLC® PER™ is highly resistant to a broad range of chemicals, including caustic, acids, fuels and solvents. Chemically resistant reinforced structures and linings or coatings over metal can be formulated with CTech-LLC® PER™.
- **Formulating Techniques:** The primary components of a thermosetting resin formula are the epoxy resin and the hardener or curing agent. However, in practice other materials are normally incorporated to achieve special properties. For example, inert fillers such as silicas, talcs, calcium silicates, micas, clays and calcium carbonate can be added to further reduce shrinkage and improve dimensional stability. Also, reactive diluents can be added to CTech-LLC® PER™ to reduce viscosity.

TECHNICAL DATA

	Unit	PER™
Density*	Kg/L	1.16
Flash point	°C	150
Epoxide Equivalent weight	g/eq	185-196
Epoxy Group Content	Mmol/Kg	5100-5400
Color of Resin	Pt-Co(Apha)	100
Viscosity @ 25°C **	Mpas	15000
Appearance	Visual	Clear Light Yellow Liquid
Saponifiable Chlorine Content	Ppm	2000
Non-Volatile	%wt	99

* temperature at 25°C

** DIN 53015

APPLICATION

The main application are in highly chemical resistant coatings, civil engineering, matrix adhesives, composites as well as in the fields of electrical insulation and filament winding for manufacturing large diameter pipes.

- Adhesives, Casting and tooling
- Civil Engineering
- Composites Automotive Coatings
- Can and Coil Coatings
- Marine and Protective Coatings
- Electrical and electronics use
- Potting and Encapsulation
- Fiber reinforced pipes, tanks and composites
- Tooling, casting and molding compounds

- Construction, electrical and aerospace adhesives
- High solids/low VOC maintenance and marine coatings
- Electrical encapsulations and laminates
- Chemical resistant tank linings, flooring and grouts
- Base resin for epoxy fusion technology

STORAGE & SHELF LIFE

CTech-LLC® PER™ is normally shipped in bulk from 150 °F (66 °C) to 180 °F (82 °C) and can be stored at 120-140 °F (49-60 °C) for ease of handling. CTech-LLC® PER™ is susceptible to crystallization upon prolonged storage at normal ambient temperatures. It may be reconstituted by warming to 120-140 °F for 4-24 hours depending on the mass involved.

CAUTION

When checking viscosity of CTech-LLC® PER™ incoming samples, we caution you to make certain that the product is maintained at 25 +/- 0.01 °C before testing. According to the Department of Transportation regulations (Code of Federal Regulations), CTech-LLC® PER™ is not classified or regulated as a flammable or combustible material. No special labeling is required for transportation.

Curing Agents for CTech-LLC® PER™

Curing Agent*	Physical State	Recommended Concentration range, phr**	Typical Cure Schedule Time °C	Deflection Temperature °C***
Aliphatic Amines				
EPIKURE™ 3223 (DETA)	Liquid	12	7d, 25	120
CTech-LLC® TPR™	Liquid	13	7d, 25	85
CTech-LLC® CAH™	Liquid	20	24h, 25	90
EPIKURE 3270	Liquid	75	14d, 25	56
EPIKURE 3271	Liquid	18	14d, 25	66
EPIKURE 3274	Liquid	40	14d, 25	-
EPIKURE 3230	Liquid	35	7d, 25	68
D-400 Type PEA	Liquid	55	30min, 115	31
Cycloaliphatic Amines				
EPIKURE 3370	Liquid	38	7d, 25	56
EPIKURE 3382	Liquid	63	7d, 25	63
EPIKURE 3383	Liquid	60	24h, 25	54
Polyamides				
EPIKURE 3115	Liquid	120	1h, 100	85
EPIKURE 3125	Liquid	90	7d, 25	90
EPIKURE 3140	Liquid	75	7d, 25	115
Amindoamines				
EPIKURE 3015	Liquid	50	24h, 25 & 2h, 93	-
EPIKURE 3055	Liquid	50	24h, 25 & 2h, 93	67
EPIKURE 3072	Liquid	35	14d, 25	59
Aromatic Amines				
Metaphenylenediamine (MPDA)	Solid	14	2h, 80 & 2h, 150	150
Methylene dianiline(MDA)	Solid	27	2h, 80 & 2h, 150	160
Diaminodiphenyl Sulfone (DADS)	Solid	25	5h, 125 & 1h, 200	170
Anhydrides				
Methyl tetrahydrophthalic Anhydride (MTHPA)	Liquid	80	2h, 120 & 2h, 150	130
NADIC Methyl Anhydride (NMA)	Liquid	90	1h, 120 & 24h, 260	180
Hexahydrophthalic Anhydride (HHPA)	Solid	80	2h, 120 & 2h, 150	130

* Cures can be effected with these curing agents over a wide range of temperatures. Higher temperatures yield shorter cure times and highest Tg.

** Parts of curing agent per 100 parts of resin.

***Systems cured at room temperature were post cured at elevated temperature to achieve deflection values.

CTech-LLC®

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IMPORTANT NOTE:

Before using any CTech-LLC® product, the user must review the most recent version of the product's technical data sheet, material safety data sheet and other applicable documents, available at www.ctech-llc.com.

WARANTY:

CTech-LLC® warrants its products to be free from manufacturing defects. Buyer determines suitability of product for use and assumes all risks. Buyer's sole remedy shall be limited to replacement of product. Any claim for breach of this warranty must be brought within one month of the 'date of purchase. CTech-LLC® shall not be liable for any consequential or special damages of any kind, resulting from any claim or breach of warranty, breach of contract, negligence or any legal theory. The Buyer, by accepting the products described herein, agrees to be responsible for thoroughly testing any application to determine its suitability before utilizing.