



**Cardolite**

The World Leader in Cashew Liquid Technology

| Coating Products Portfolio

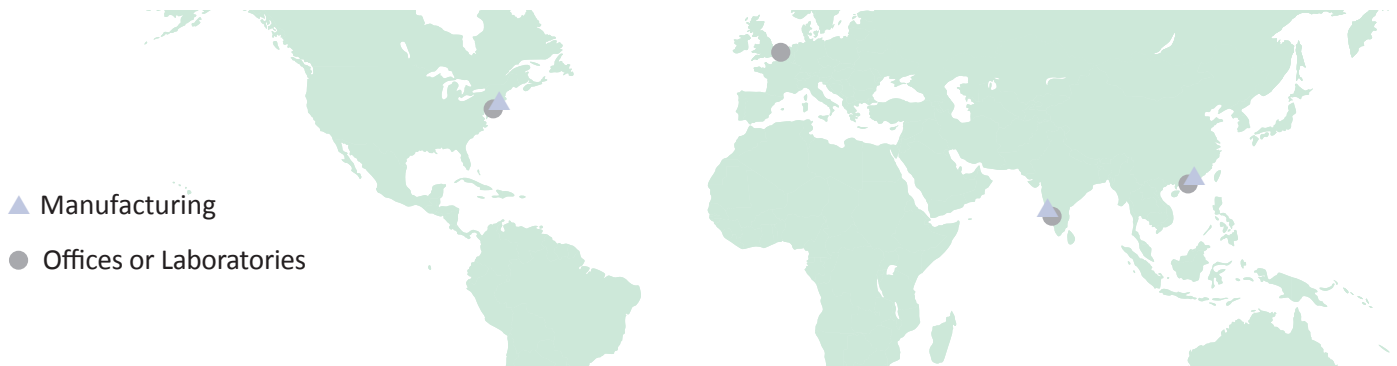


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# About Us



Cardolite Corporation is a privately held manufacturer of the world’s largest variety of products derived from cashew nutshell liquid (CNSL), a renewable natural resource. The unique properties of CNSL are used to develop and produce a wide range of specialty curing agents, resins, and diluents for the coatings, adhesives, composites and friction industries.

With over 30 years of experience, Cardolite is the leader in the production of high quality CNSL-based products with the most advanced CNSL technology manufacturing facilities in the world located in Newark, New Jersey (USA), Zhuhai, Guangdong (China), and Mangalore, Karnataka (India). These Cardolite facilities adhere strictly to local and best practice health, safety, environmental, and security standards and are ISO 9000 registered. With sales offices, representatives, and distribution facilities in the Americas, Europe, and Asia, Cardolite prides itself on delivering high quality products and services across the globe.

## Markets & Technologies

To support our customers in solving industry challenges, Cardolite continues to invest heavily on innovation that leverages the unique properties of CNSL technology. Cardolite operates two advanced research and technical service laboratories in the USA and China that use CNSL as a primary building block to develop and evaluate performance of specialty materials with demonstrated advantages over some traditional coating chemistries.



### Product Lines

- Epoxy Curing Agents
  - Phenalkamines
  - Phenalkamides
  - Polyamides
- Epoxy Resins & Modifiers
  - Diluents & Accelerators
  - Flexibilizers
  - Hydrocarbon Resins
- Polyol Resins

### Coatings Markets

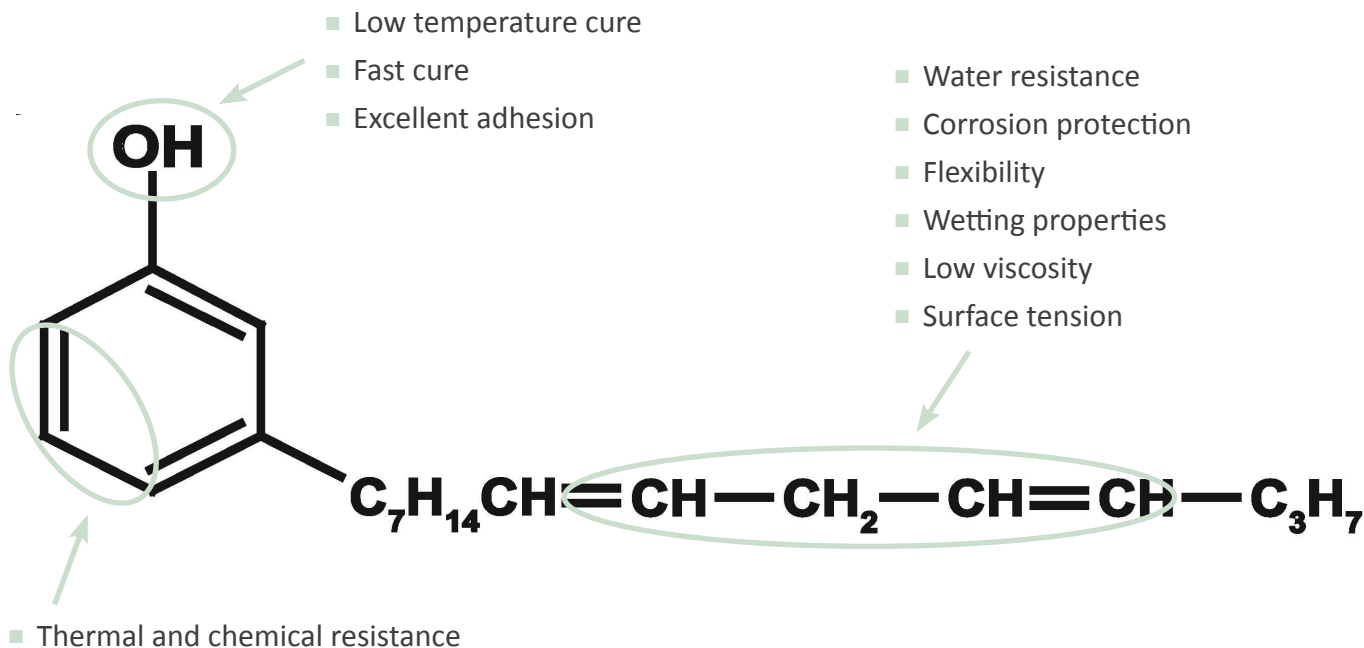
- Marine & Protective
- Industrial Coatings
  - OEM and general industrial
  - Transportation primers
  - Potable water
  - Food contact
- Concrete flooring
  - Primers and self-levelers
  - Top coats

### Other Markets

- Adhesives
  - Construction
  - Transportation
  - Electronics
- Composites
  - Prepreg, RTM, Hand lay-up
- Friction Particles & Resins
  - Brake pads, drum linings and train blocks
- Rigid and Flexible foams

# CNSL Technology

Cardanol is a unique natural phenolic material obtained by distilling CNSL and serves as the primary building block for Cardolite curing agents. The molecule is composed of an aromatic ring with an OH group and a long aliphatic side chain, which bring valuable intrinsic benefits to coating materials.



# Renewable



From the beginning, Cardolite products have been based on cashew nutshell liquid, a natural, non-food chain, and annually renewable biomaterial. The technology has been widely adopted because there are inherent performance benefits gained from using this starting raw material without sacrificing performance or cost. The relatively low viscosity of Cardolite products brings good workability to formulations as coatings trend towards higher solids and solvent free systems for the protection of applicators and the environment.

- Annually renewable
- Non-food chain
- High biocontent derivatives
- Low viscosity for low or zero V.O.C.
- High performance
- Cost effective

# Phenalkamine Technology

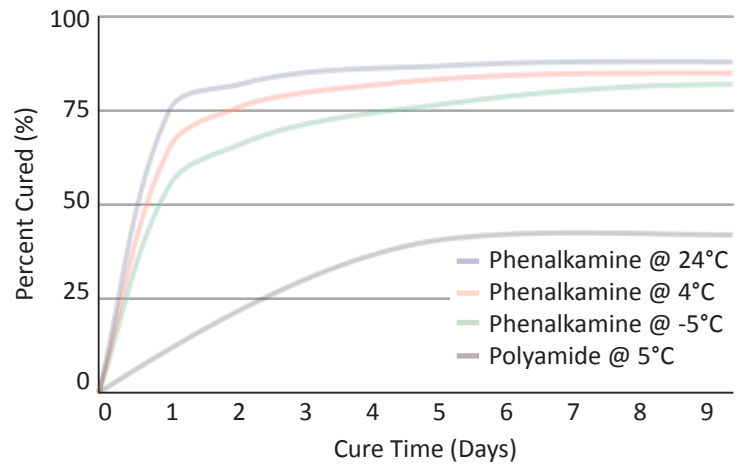
The Mannich reaction of CNSL, formaldehyde, and certain amines is called a phenalkamine. Phenalkamines share some similar advantages to other Mannich base curing agents, such as: extremely fast cure, low temperature cure (even below 0°C), good chemical resistance, good surface appearance, good moisture tolerance, and non-blushing properties. However, due to the long aliphatic side chain of cardanol, phenalkamines also have very good pot life, good flexibility, surface tolerance, and excellent water and salt water resistance. Many Cardolite phenalkamines are also approved for use in food contact and potable water coatings.

- Fast cure even at low temperatures
- Lower application failure risks
- Increased productivity
- Quick return-to-service
- Surface tolerance and corrosion protection
- Chemical resistance and durability

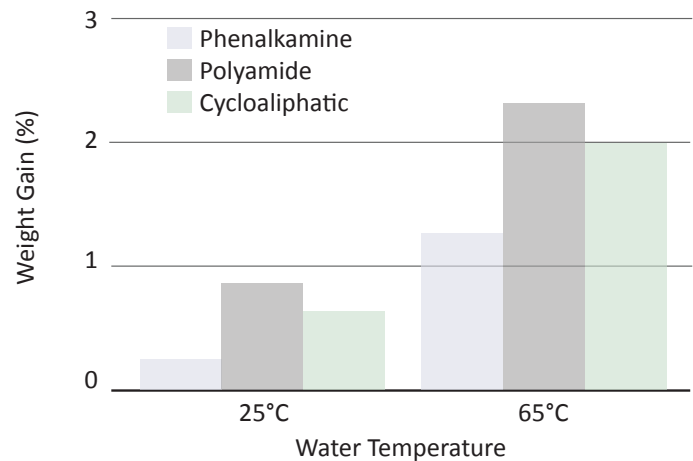
The high hydrophobicity of phenalkamines provided by the long linear side chain also brings many benefits to coating formulations compared with some other technologies. Water sensitivity of the phenolic hydroxyl and other formulation components can be counteracted, which reduces the chance the resin binder barrier will be broken and increases corrosion protection. Adhesion to poorly prepared or tough wet surfaces, such as water saturated concrete is especially good with phenalkamines because this hydrophobic effect ensures surrounding water does not influence the surface resin bond.



Phenalkamine Low Temperature Cure Data Comparison



Comparative Water Resistance of Phenalkamines



# Waterborne Technology

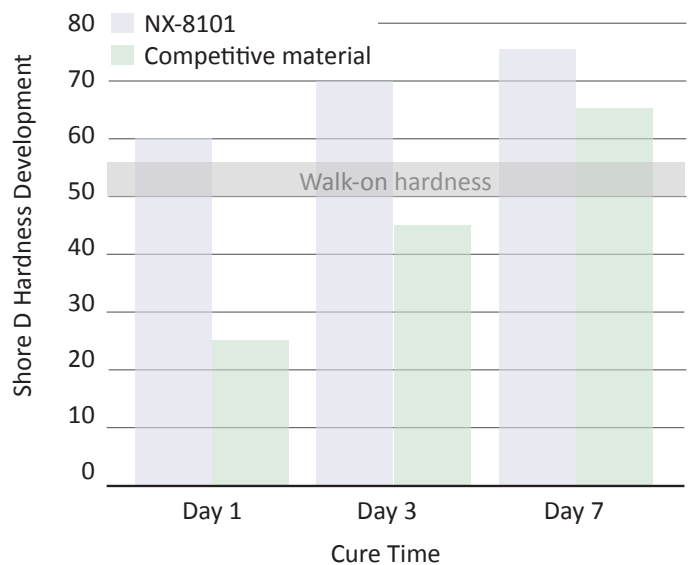
The NX-8100 Series is the first CNSL-based waterborne curing agent product line available in the market. Phenalkamine grade NX-8101 is designed for cost effective water-based concrete epoxy primers and self-levelers that require quick return-to-service, excellent adhesion to concrete and top coats, and superior durability. This new low odor epoxy curing agent is supplied in water and does not contain or require any solvents in the formulation to deliver excellent performance. Its good compatibility with standard liquid epoxy and solid epoxy dispersions, and easy reducibility in water, broadens its use and allows for cost effective industrial coatings.



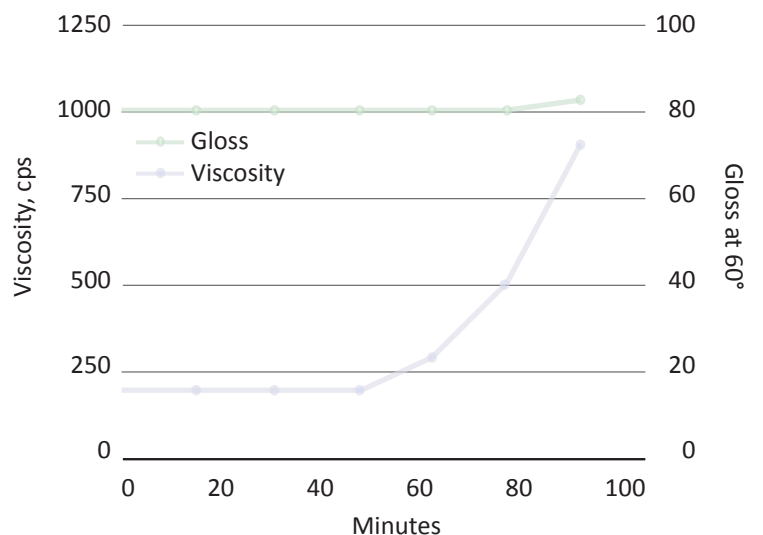
## Advantages:

- Completely solvent-free!
  - Fast cure and hardness development even at 10°C and 80% relative humidity
  - Excellent adhesion over dry and damp concrete
  - Compatible with standard liquid epoxy and solid epoxy dispersions
  - Good formulation latitude:
    - Do not demand emulsifiers
    - Wide compatibility
    - Systems easily reducible in water
  - Excellent self-leveling properties
  - Visible end of pot life
  - Good stain resistance
- (household and industrial products)
- Low color, good film appearance
  - Cost effective!

Shore D Hardness at 10°C and 80%RH

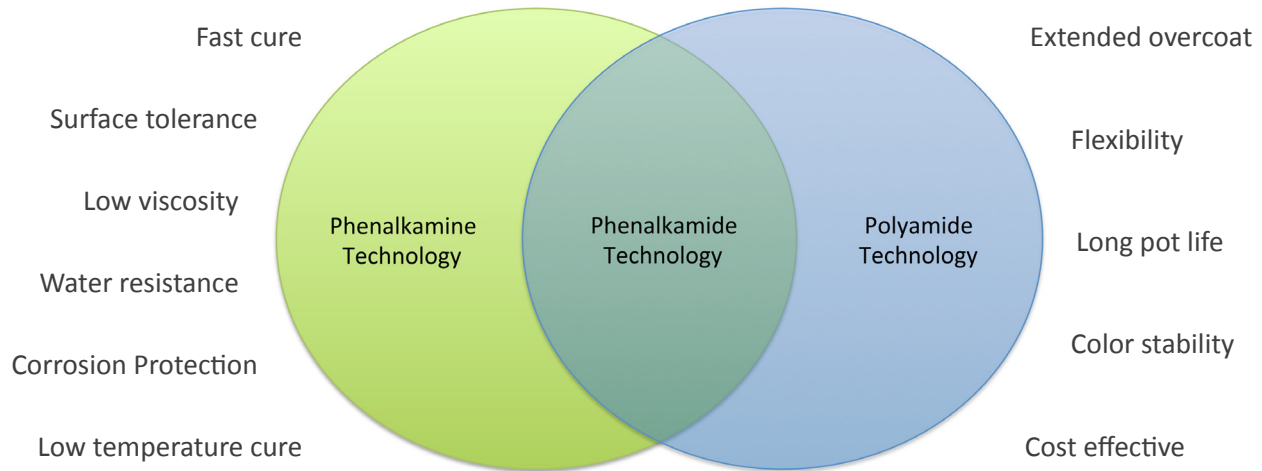


NX-8101 End of Pot Life



# Phenalkamide Technology

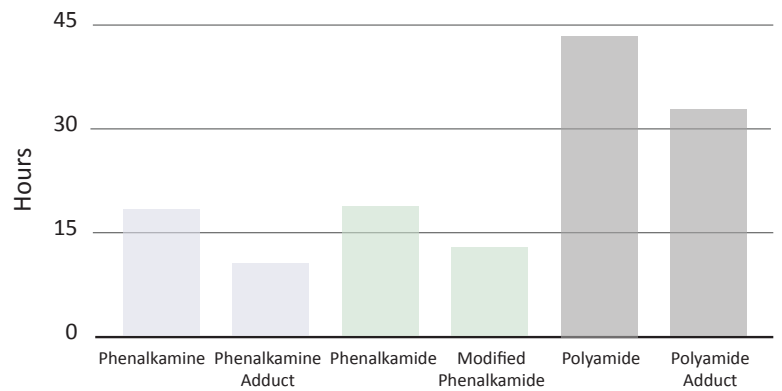
Cardolite phenalkamide technology is a new category of epoxy curing agent that fills a gap between polyamide and phenalkamine technology. By chemically combining the two technologies, phenalkamide curing agents offer the benefits of both while mitigating their limitations.



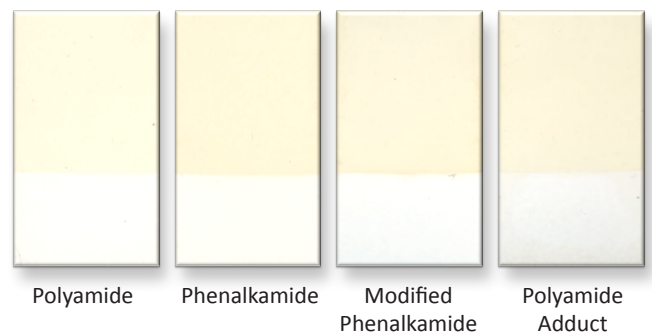
Phenalkamide technology can be used in many applications where polyamide technology currently prevails to bring a new level of performance, reliability, application latitude, and cost savings. General protective coatings, for example, that require good color stability and long overcoatability can avoid having separate summer and winter versions by using a phenalkamide based converter package. The overall system will have fast cure, low temperature cure, and excellent corrosion protection without the need for tertiary amines or anticorrosive pigments. A single formula's broader application latitude gives coating manufacturers protection from summer converter packages being used erroneously in low temperature conditions, and simplifies finished product and raw material inventory management.

- Universal coatings
- Formulation latitude
- No need for accelerators
- Remove or reduce anticorrosive pigments
- Cost savings!

**Thin Film Dry Hard Time Comparison**  
(5°C with Liquid Epoxy Resin, EEW=191)



**Color Stability after 72 hours QUVB**  
(8 hours light @ 50°C / 2 hours condensation @ 45°C )



## Phenalkamine Curing Agents Typical Properties

Product	Type	Color <sup>1</sup> (Gardner)	Viscosity <sup>2</sup> @ 25°C (cPs)	Solids <sup>3</sup> (%)	Amine Value <sup>4</sup> (mg KOH/g)	AHEW	Thin Film* Dry Hard Times (hours)		
							25°C	5°C	0°C
NC-541	Unmodified	16	28,000	Solvent-free	330	130	5	15.5	23
NC-641	Unmodified	16	25,000	Solvent-free	304	130	4	13.5	21
NX-2047	Unmodified	18+	25,000	Solvent-free	315	190	6.2	25	n/a
LITE 2001	Unmodified	10	28,000	Solvent-free	330	132	3	12.5	19
NC-541X90	Solvent cut	16	4,000	90	300	144	5	13	21
LITE 2001X90	Solvent cut	10	3,800	90	300	144	9	17	31
NC-541LV	Unmodified	15	2,300	Solvent-free	340	125	7	24+	36
LITE 2001LV	Unmodified	10	2,500	Solvent-free	340	125	7	17	29
LITE 2010LV	Unmodified	10	4,100	Solvent-free	247	125	3	13.5	19
NC-562	Adduct	14	1,300	65	185	174	3	9	11
LITE 2562	Adduct	9	1,500	65	180	174	2.5	7.5	11.5
NC-556X80	Adduct	14	4,500	80	330	135	3.5	12	19.5
NX-2016	Adduct	15	12,000	75	208	151	2	6.5	11
NX-2018	Adduct	16	8,400	75	218	151	3	9	14
NX-5459	Adduct	15	1,650	70	205	164	4	12	18
NX-5050	Adduct	18	770	80	165	190	2	7.5	11
NX-5556M	Adduct	15	2,500	80	245	165	2	11	16
NX-5110	Adduct	8	2,500	80	245	165	3.1	9.6	23.5
GX-5135	Adduct	8	2,500	80	245	165	3	8	11
NX-5444	Adduct	8	4,300	80	218	190	1.5	6	6
NX-5445	Adduct	18	1,800	78	155	256	2	6.5	14.5

\*200 micron with liquid epoxy (EEW 190), <sup>1</sup> ASTM D1544, <sup>2</sup> ASTM D2196, <sup>3</sup> ASTM D2369-98, <sup>4</sup> ASTM D2074



Key Properties	Marine & Protective (immersed)	Transportation Primers	Industrial Coatings	Solvent-free Concrete Floors	Top coats	FDA 175.300
Low temperature cure, surface tolerant, excellent anticorrosion	XX		X			X
Lower free amine version of NC-541, with better film appearance and slightly faster cure	XX		X			
Very cost effective phenalkamine	X		X			
Light color	XX		X			
Solvent cut for good handling	XX		X			X
Light color, solvent cut for good handling	XX		X			
Low viscosity for high solids	XX		X			X
Low viscosity, light color	XX		X			
Low viscosity, light color, excellent film at extreme conditions	XX		X			
Fast cure, good blush resistance and adhesion	XX	XX	XX			
Light color, fast cure, good blush resistance and adhesion	XX	XX	XX			
Fast cure and hardness development, high solids		XX	X			X
Fast cure, higher viscosity	XX	X	X			
Fast cure, cost effective	XX	X	X			
Fast cure, high solids	XX		X			X
Very fast cure, high solids, low viscosity	X	X				
Excellent corrosion protection, similar properties to NC-562, high solids	XX	XX	XX			
Light color version of NX-5556M	XX	XX	XX			
Faster version of NX-5110, high solids	XX	XX	XX			
Fast hardness development, good flexibility, high solids	X	XX	X			
Very fast cure, high solids, low viscosity	XX					

X - recommended, XX - highly recommended

## Phenalkamine Curing Agents Typical Properties

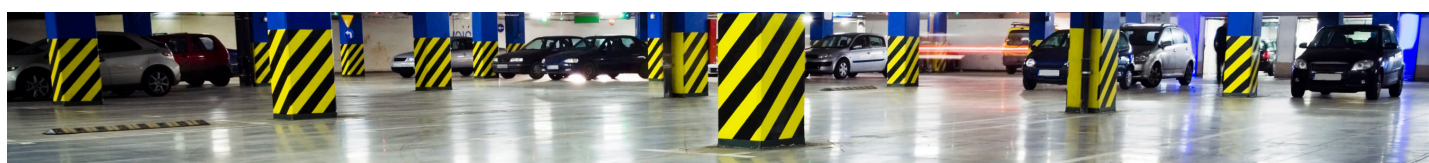
Product	Type	Color <sup>1</sup> (Gardner)	Viscosity <sup>2</sup> @ 25°C (cPs)	Solids <sup>3</sup> (%)	Amine Value <sup>4</sup> (mg KOH/g)	AHEW	Thin Film* Dry Hard Times (hours)		
							25°C	5°C	0°C
NC-540	Unmodified	15	2,000	Solvent-free	535	81	3.5	13	19
NC-558	Unmodified	17	900	Solvent-free	340	95	10	27	32
NC-557	Unmodified	14	1,100	Solvent-free	355	95	7	16.5	27.5
NX-2003	Unmodified	10	620	Solvent-free	360	95	4.5	18.5	22
NX-2003D	Unmodified	13	700	Solvent-free	357	95	4.5	15	24
NX-5454	Unmodified	11	1,080	Solvent-free	275	133	2	7.5	10
NX-6019	Unmodified	11	1,100	Solvent-free	275	133	2.5	10	11.5
NX-5198	Unmodified	11	140	95	300	179	2.4	13	n/a
LITE 2002	Unmodified	10	450	Solvent-free	360	104	6	20	30.5
LITE 2002LP	Unmodified	10	700	Solvent-free	360	104	7	21	39
NX-2007	Unmodified	4	265	≥ 97.5 <sup>5</sup>	310	113	2	16	23.5
NX-2009	Unmodified	7	370	≥ 97 <sup>5</sup>	310	95	4	12	20.5
Ultra LITE 2009	Unmodified	1	330	≥ 97 <sup>5</sup>	277	95	6	19	27
NX-4943	Unmodified	14	1,800	Solvent-free	488	82	4	14	23
NX-5567	Specially modified	15	770	85	561	66	3	10	15
NX-5594	Unmodified	14	950	Solvent-free	395	76	2.5	8	11
GX-6027	Unmodified	7	950	Solvent-free	395	76	3	8.8	10
NX-8101	Waterborne	8	35,000	Solvent-free	160	270	3	9	n/a

\*200 micron with liquid epoxy (EEW 190), <sup>1</sup> ASTM D1544, <sup>2</sup> ASTM D2196, <sup>3</sup> ASTM D2369-98, <sup>4</sup> ASTM D2074, <sup>5</sup> ASTM D2369-98 at 85°C



Key Properties	Marine & Protective (immersed)	Transportation Primers	Industrial Coatings	Solvent-free Concrete Floors	Top coats	FDA 175.300
Low viscosity, surface tolerant, solvent free				X		
Good film, excellent adhesion, potable water safe, solvent free	X		X	XX		
Fast cure, excellent adhesion, solvent free				XX		
Fast cure, excellent adhesion, light color, solvent free	XX		X	XX		
Fast cure, excellent adhesion, solvent free	XX		X	XX		
Very fast cure, excellent film appearance, solvent free	X		XX	XX		
Better labeling version of NX-5454	X		XX	XX		
Fast cure, very low viscosity, cost effective			X			
Low viscosity, light color, excellent anticorrosion	XX		X			
LITE 2002 with Improved pot life	XX		X			
Fast cure and hardness, good flow and yellowing resistance			X		XX	
Good film appearance, yellowing resistance, fast cure, cost effective			X		XX	
Excellent film appearance, yellowing resistance, cost effective			X		XX	
Excellent chemical resistance, solvent free	XX					
Excellent chemical resistance, fast cure	XX					
Very fast cure, excellent cathodic disbondment and chemical resistance properties.	XX		X			
Light color version of NX-5594	XX		X			
Fast hardness development, excellent adhesion to concrete and stain resistance			X	XX		

X - recommended, XX - highly recommended



## Phenalkamide Curing Agents Typical Properties

Product*	Type	Color <sup>1</sup> (Gardner)	Viscosity <sup>2</sup> @ 25°C (cPs)	Solids <sup>3</sup> (%)	Amine Value <sup>4</sup> (mg KOH/g)	AHEW	Thin Film* Dry Hard Times (hours)	
							25°C	5°C
LITE 3000	Unmodified	8	2,400	70	180	256	5	17
LITE 3000NH	Unmodified	8	1,800	70	185	256	3.5	17
LITE 3005	Unmodified	11	1,700	70	160	256	8	18
LITE 3025	Unmodified	8	34,000	Solvent-free	345	103	8.5	n/a
LITE 3040	Unmodified	8	5,000	Solvent-free	380	118	7.3	29
LITE 3060	Unmodified	8	850	Solvent-free	455	104	5	17.5
LITE 3100	Modified	8	4,500	80	260	150	4	13
LITE 3100NH	Modified	8	4,200	80	265	150	4	8
LITE 3117	Modified	8	4,500	80	270	150	3.5	16

\*Phenalkamides are available in different solvent cuts and in benzyl alcohol.

## Polyamide Curing Agents Typical Properties

Product	Type	Color <sup>1</sup> (Gardner)	Viscosity <sup>2</sup> @ 25°C (cPs)	Solids <sup>3</sup> (%)	Amine Value <sup>4</sup> (mg KOH/g)	AHEW	Thin Film* Dry Hard Times @ 25°C (hours)
NT-1500	Unmodified	16	6,000 @ 75°C	Solvent-free	215	198	n/a
NT-1500X70	Solvent cut	15	1,800	70	150	283	10
NT-1500I73	Solvent cut	15	1,900	73	157	271.5	10
NT-1541	Unmodified	9	5,000 @ 75°C	Solvent-free	215	198	n/a
NT-1541X70	Solvent cut	8	1,600	70	150	283	10
NT-1541I73	Solvent cut	8	1,800	73	157	271.5	10

\*200 micron with liquid epoxy (EEW 190), <sup>1</sup>ASTM D1544, <sup>2</sup>ASTM D2196, <sup>3</sup>ASTM D2369-98, <sup>4</sup>ASTM D2074

Key Properties	Marine & Protective (immersed)	Transportation Primers	Industrial Coatings	Solvent-free Concrete Floors	Top coats
First generation phenalkamide combining and balancing the benefits of phenalkamine and polyamide technologies.	X		XX		XX
LITE 3000 cut in non-HAPs solvent.	X		XX		XX
Cost effective and direct replacement of standard high molecular weight polyamide curing agents. NX-5052 is the undiluted version of LITE 3005.	X		XX		XX
Direct replacement of standard medium molecular weight polyamides with faster dry time and hardness development and better UV resistance.	X		XX		XX
Low viscosity, excellent flexibility and overcoatability, and good dry color stability and corrosion protection. Suitable for high solids coatings.	X	XX	XX		XX
Solvent free, very low viscosity, good color stability, excellent cathodic disbondment protection and adhesion to metal and concrete.	X	X	XX	XX	XX
Modified LITE 3000 with increased cure speed, higher solids, and lower use level.	X	X	XX		XX
LITE 3100 cut in non-HAPs solvent.	X	X	XX		XX
Modified LITE 3100 with excellent intercoat adhesion at low temperatures and high humidity.	X	X	XX		XX

Key Properties	Marine & Protective (immersed)	Transportation Primers	Industrial Coatings	Solvent-free Concrete Floors	Top coats
Similar to standard high molecular weight polyamides	X		XX		X
NT-1500 in xylene	X		XX		X
NT-1500 in isopropanol	X		XX		X
Light color version of NT-1500	X		XX		XX
NT-1541 in xylene	X		XX		XX
NT-1541 in isopropanol	X		XX		XX

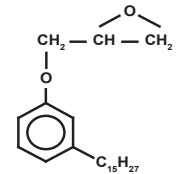
X - recommended, XX - highly recommended

# Epoxy Resins, Diluents, and Modifiers



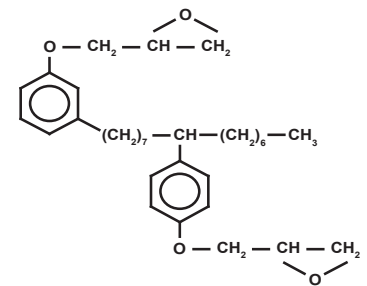
## Cardolite NC-513/Ultra LITE 513

Cardolite NC-513 and Ultra LITE 513 are monofunctional reactive epoxy diluents that can be used to increase the flexibility and impact, and chemical and water resistance of epoxy coatings. These reactive diluents have very low viscosity, which make them ideal for helping formulate high solids and solvent free coatings. Good reactivity means these diluents react completely into the coating network. Ultra LITE 513 is a lower viscosity, higher purity, and very low color version of NC-513; they are both identical in chemical make-up and excellent alternatives to traditional glycidyl ethers.



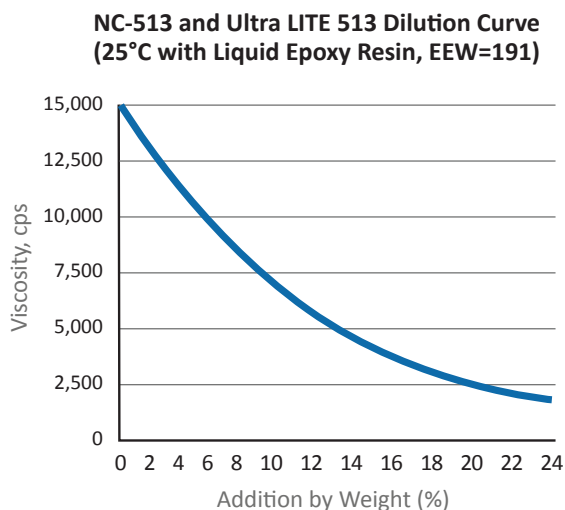
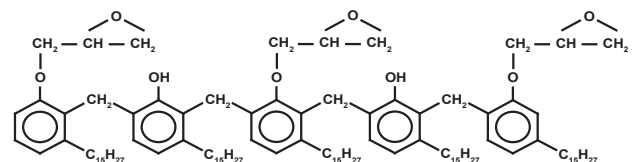
## Cardolite NC-514/NC-514S

Cardolite NC-514 and NC-514S are flexible difunctional glycidyl ether epoxy resins. NC-514S is lower in viscosity. The chain of 8 carbons separating the aromatic groups allows this resin to be used in conjunction with traditional epoxy resins or as a sole resin to increase coating flexibility, abrasion resistance, and water and chemical resistance without adversely affecting other properties.



## Cardolite NC-547

Cardolite NC-547 is a polyglycidyl ether epoxy novolac resin derived from cardanol. This resin can be used in conjunction with standard epoxy resins to bring additional flexibility and longer pot life to coatings without adversely affecting chemical and water resistance.



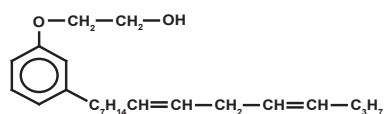
## Epoxy Resin, Diluent, and Modifier Typical Properties

Product	Type	Color <sup>1</sup> (Gardner)	Viscosity <sup>2</sup> (cPs)	EEW <sup>3</sup>	HyCl <sup>4</sup> (%)
NC-513	Reactive diluent	9	40-70	425-575	≤ 2
Ultra LITE 513	Reactive diluent	1	20-35	350-425	≤ 0.5
NC-514	Epoxy resin	17	25,000	350-500	≤ 2
NC-514S	Epoxy resin	12	2,000	320-420	≤ 0.5
NC-547	Epoxy novolac resin	18	28,000	550-850	≤ 2.5

<sup>1</sup> ASTM D1544, <sup>2</sup> ASTM D2196 at 25°C, <sup>3</sup> ASTM D1652,

<sup>4</sup> ASTM D1726 Hydrolyzable chlorine

## Cardolite LITE 2020\*

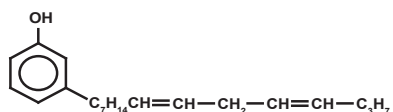


Cardolite LITE 2020 is a low viscosity multi-purpose resin modifier.

This resin is ideal for

formulating environmentally friendly high solids or solvent free coatings. Due to its unique chemical structure, LITE 2020 is more efficient than traditional hydrocarbon resins in reducing viscosity despite being higher in viscosity. Its hydrophobic nature allows for good corrosion resistance and early water resistance.

## Cardolite NX-202x Product Family



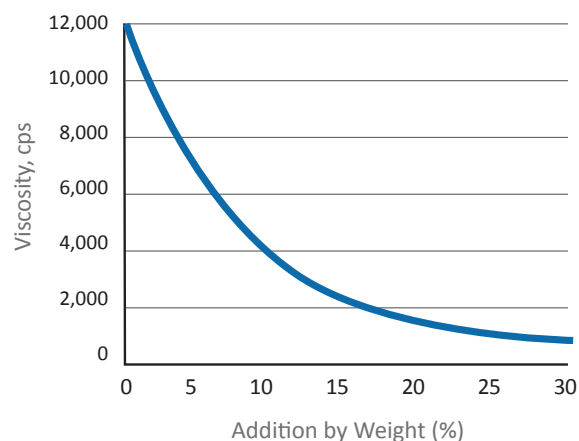
Cardolite NX-202x products are low viscosity multipurpose

resin modifiers. The long hydrophobic aliphatic side chain of the cardanol gives these products a very low viscosity and provides excellent early water resistance and corrosion protection. Used as epoxy diluents and accelerators, high viscosity solvent or solvent free formulations can achieve higher solids, and faster cure without sacrificing other performance properties. NX-2021 is the standard modifier grade while NX-2022 is higher in purity. NX-2024 and NX-2025 are the lower odor and lighter initial color versions of NX-2021 and NX-2022 respectively. Ultra LITE 2023, NX-2023(D), and NX-2026 are the wet color stable versions of the NX-202x product family.

## Cardolite LITE 2100\*/LITE 2100R\*\*

Cardolite LITE 2100(R) are low color and low viscosity CNSL modified hydrocarbon resins. They are designed to enable high solids and solvent free formulations by lowering the viscosity of epoxy resins more efficiently than typical phenol based hydrocarbon resins and by improving overall system compatibility for better film formation. These products show good hardness development while providing improved flexibility and impact resistance. Their high hydrophobicity results in excellent water resistance, and more importantly, excellent corrosion protection on immersed and vapor exposed surfaces. Both products show very good UV resistance with excellent gloss retention for use in lighter color coatings.

**NX-202x and LITE 2020 Dilution Curve (25°C with Liquid Epoxy Resin, EEW=191)**



## Epoxy Diluent and Modifier Typical Properties

Product	Type	Color <sup>1</sup> (Gardner)	Viscosity <sup>2</sup> (cPs)
LITE 2020	Nonreactive resin modifier	≤ 14	30-115
LITE 2100	Hydrocarbon resin modifier	≤ 4	450-750
LITE 2100R	Hydrocarbon resin modifier	≤ 4	500-1,000
NX-2021	Nonreactive resin modifier	≤ 18	45-75
NX-2022	Nonreactive resin modifier	5 - 8	40-60
Ultra LITE 2023	Nonreactive resin modifier	1	40-100
NX-2023	Nonreactive resin modifier	≤ 6	40-100
NX-2023D	Nonreactive resin modifier	≤ 15	80-140
NX-2024	Nonreactive resin modifier	4 - 9	45-60
NX-2025	Nonreactive resin modifier	≤ 5	≤ 60
NX-2026	Nonreactive resin modifier	≤ 2	≤ 60

<sup>1</sup> ASTM D1544, <sup>2</sup> ASTM D2196 at 25°C

\* LITE 2020 and LITE 2100 not approved for sale in Europe.

\*\*LITE 2100R is the REACH version of LITE 2100.

# CNSL Polyol Resins



Cardolite CNSL-based polyols have unique qualities compared to widely known polyester and polyether polyols, and other natural oil based polyols. CNSL polyols are very hydrophobic because of the long aliphatic chain of cardanol, the absence of ester bonds (hydrolyzable), and fewer ether oxygen atoms compared to typical polyether polyols (less hydrophilic). This hydrophobicity provides excellent water resistance and less moisture sensitivity during cure with isocyanate for increased durability of the final polyurethane system. In addition, CNSL polyols show fast cure with isocyanates minimizing the amount of catalysts required and allowing for quick return-to-service.

Different from other renewable polyols obtained from soy and castor oil, CNSL polyols have an aromatic structure that translates into excellent thermal resistance and chemical resistance to acid and alkaline solutions. Moreover, the combination of aromaticity and long aliphatic chain delivers hydrolytic stability and mechanical strength to CNSL-based polyols.

## Advantages:

- Excellent water and moisture resistance
- Quick return-to-service
- Excellent acid and alkali resistance
- Can be tailored for different applications
- Available in low to high functionality
- Very good hydrolytic stability
- Suitable for a variety of coatings:
  - two-component ambient cured
  - one-component blocked or moisture cured
  - building block for prepolymers
- Cost effective!

## Polyols and Diols Typical Properties

Product	Type	Color <sup>1</sup> (Gardner)	Viscosity <sup>2</sup> (cPs)	Hydroxyl Value <sup>3</sup> (mg KOH/g)	Hydroxyl Eq. Weight (g/mole)
NX-9001	CNSL Polyol	18	2,000	175	320
NX-9001LV	Low Viscosity CNSL Polyol	18	1,000	175	320
LITE 9001	Low color CNSL Polyol	6	2,000	175	350
GX-9005	Non-CNSL Branched Polyol	5	3,000	170	330
GX-9007	CNSL Branched Polyol	14	2,900	175	320
GX-9201	CNSL Polyester Diol	14	1,400	75	748
GX-9203	CNSL Polyester Diol	14	3,000	85	660

<sup>1</sup> ASTM D1544, <sup>2</sup> ASTM D2196 at 25°C, <sup>3</sup> ASTM D4274



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<http://www.cardolite.com>

**Cardolite Corporation**

500 Doremus Avenue  
Newark, NJ 07105  
United States of America  
T: +1-800-322-7365  
F: +1-973-344-1197

11 Deer Park Drive  
Suite 124  
Monmouth Junction, NJ 08852  
United States of America  
T: +1-609-436-0902  
F: +1-732-823-1063

**Cardolite Specialty Chemicals Europe NV**

Wijmenstraat 21K / 2  
B-9030 Mariakerke (Gent)  
Belgium  
T: +32 (0) 92658826  
F: +32 (0) 92658824

**Cardolite Specialty Chemicals India LLP**

Plot No. IP-1 & IP-2, Mangalore Special Economic Zone  
Bajpe, Mangalore, 574 142  
India  
T: +91 (0) 824 2888 300

**Cardolite Chemical Zhuhai Ltd.**

Biyang Road  
Harbor Industrial Zone  
Zhuhai, Guangdong 519050  
P.R. China  
T: +86-756-726-9066  
F: +86-756-726-9067