

# NX-8101 Waterborne Phenalkamine for Corrosion Resistant Primers

May 2016



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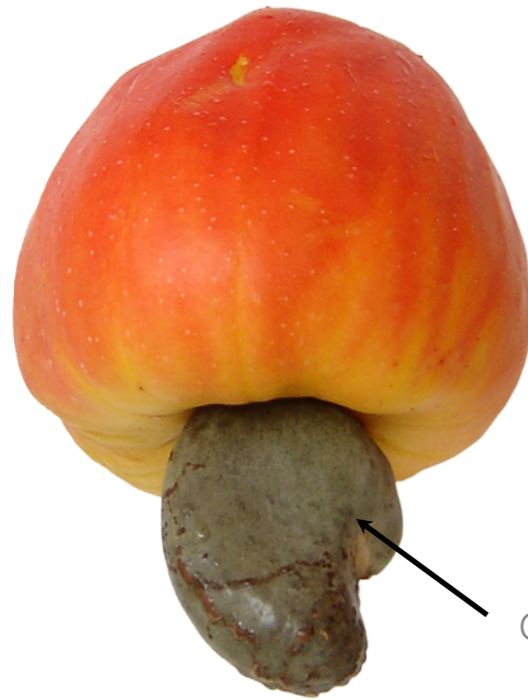
# Content

- CNSL (Cashew nutshell liquid) technology
- Benefits of Phenalkamine Chemistry
- Retaining Benefits
- NX-8101 –  
waterborne phenalkamine curing agent
- Performance over metal
- Formulation latitude and guidelines
- Conclusion



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# Cashew Nutshell Liquid Technology



Cashew Nut

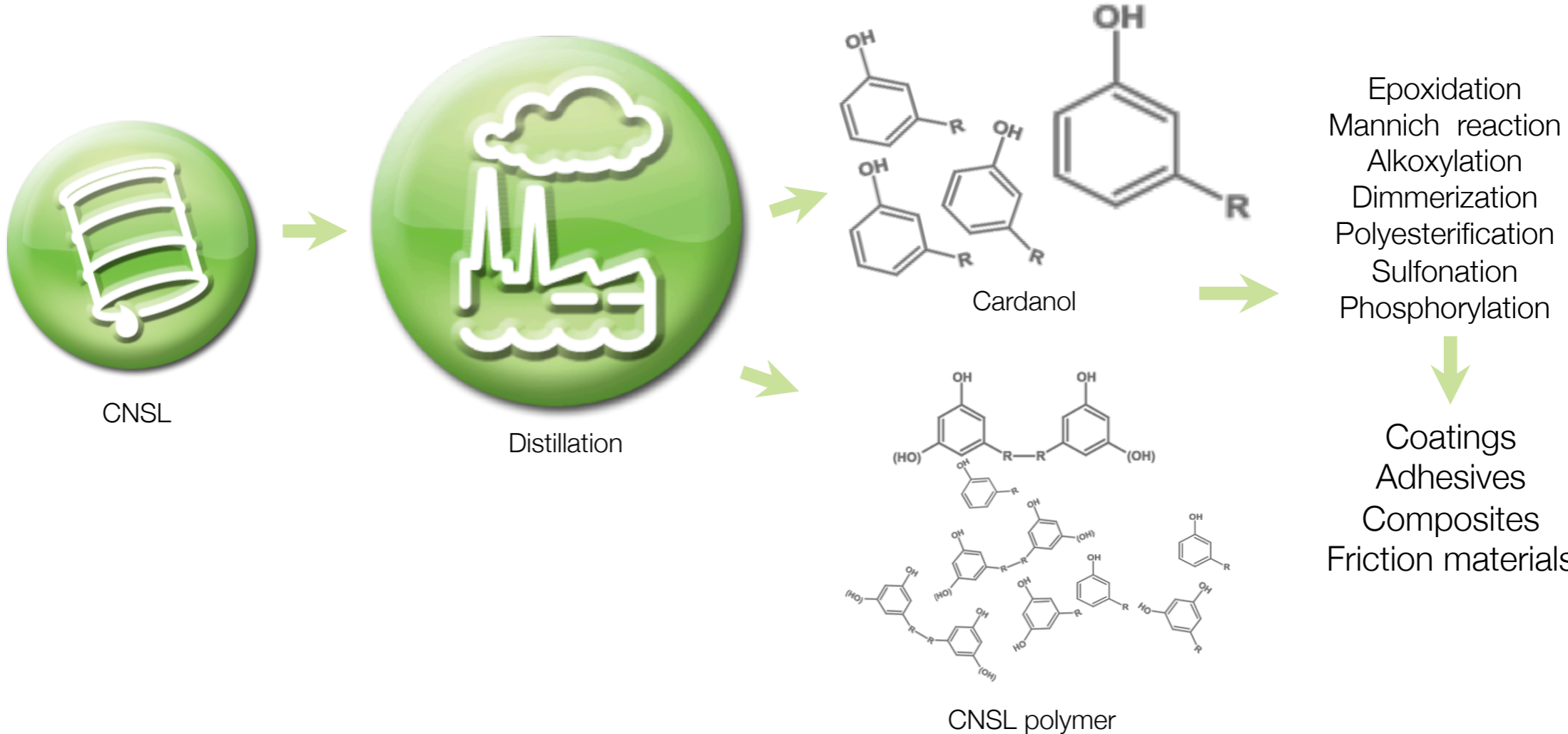
## Cashew Nutshell Liquid (CNSL)

A naturally occurring, non-food chain, renewable oil from the shell of the cashew nut. CNSL is obtained as by-product of the cashew nut industry



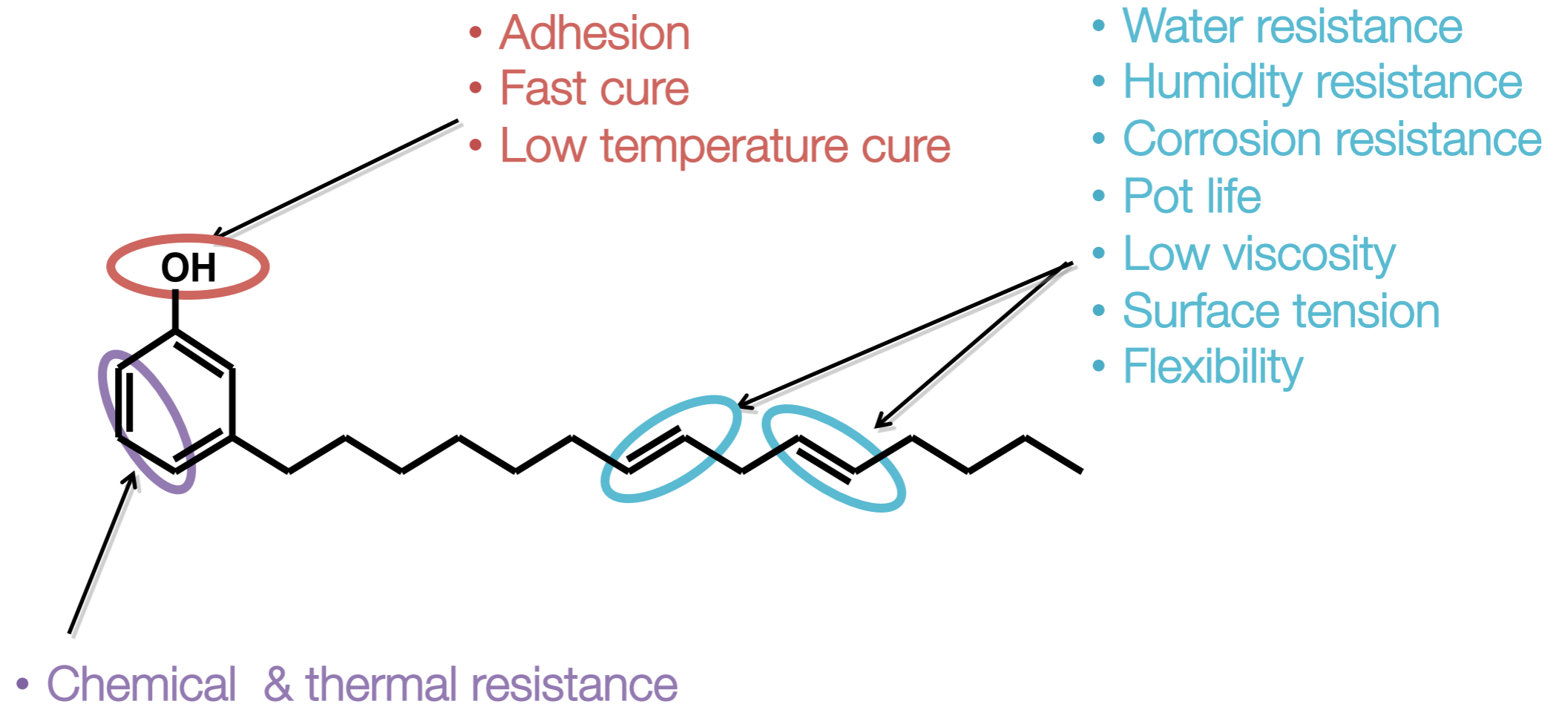
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# Distillation Components



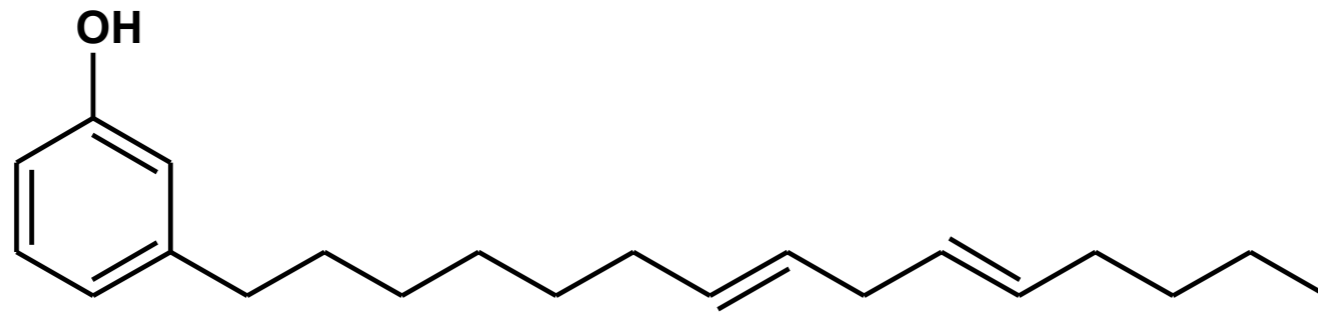
CNSL is distilled to produce purified cardanol and a CNSL polymer  
Cardanol is then used as a chemical building block for use in various applications

# Unique Structure Based Properties

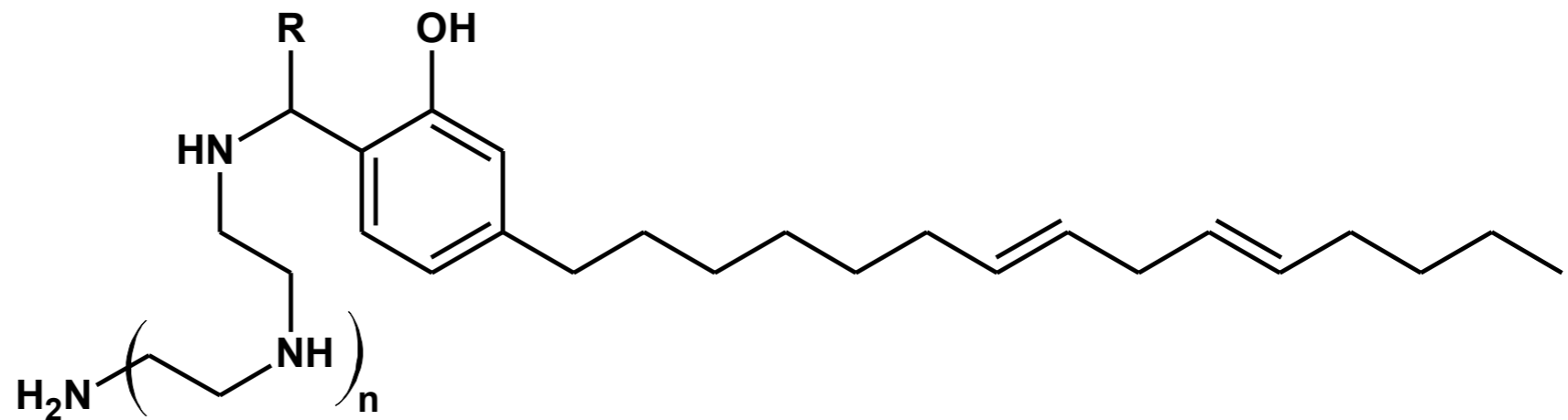
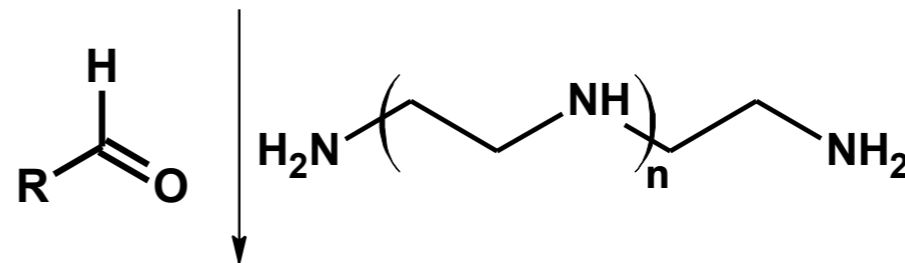


*Cardanol structure*

# Unique Structure Based Properties



Mannich Reaction



Phenalkamines

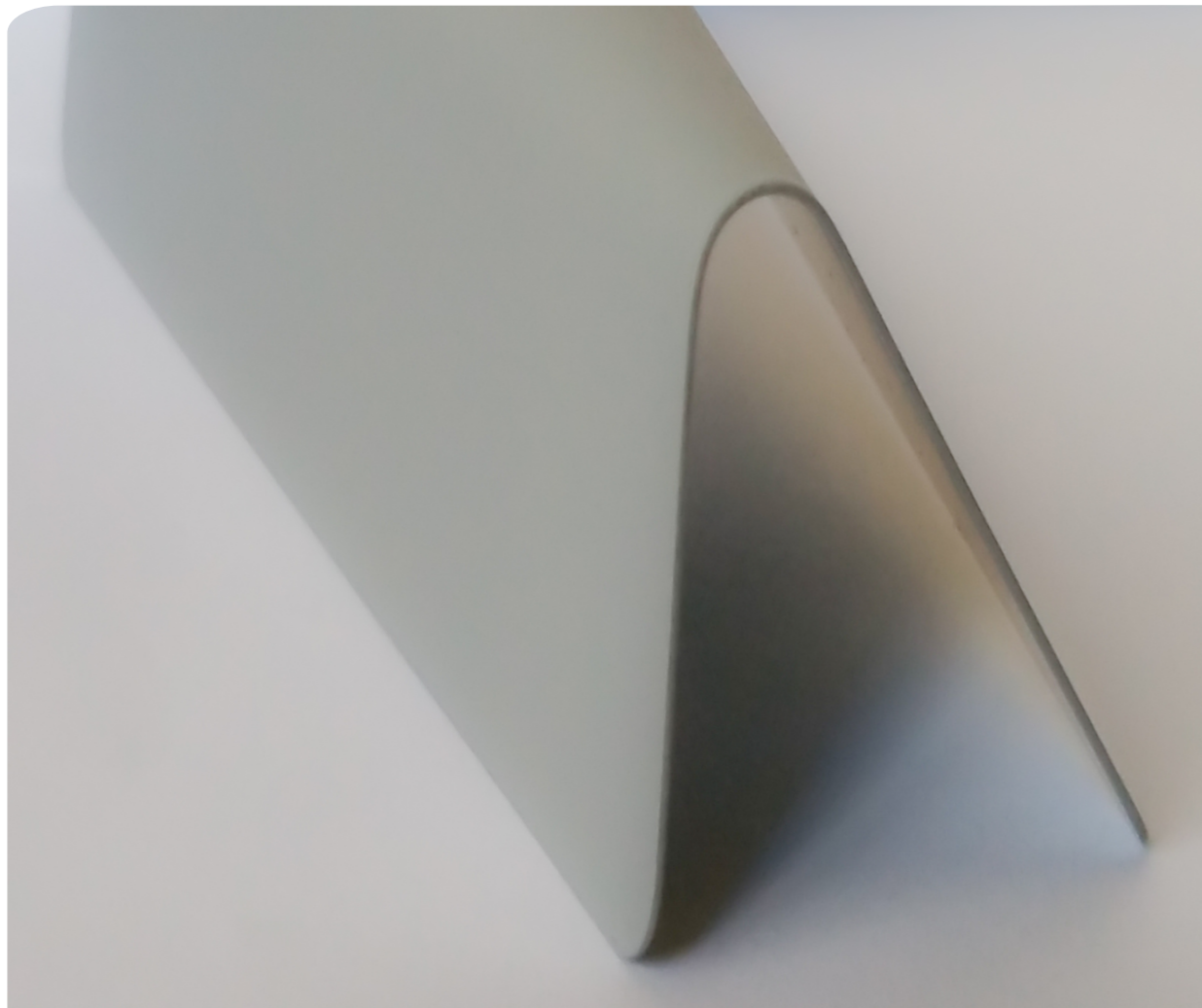
$n = 0, 1, 2, 3, \dots$

Polyamine Epoxy Curing Agents

*Phenalkamine structure*

# NX-8101

- Waterborne phenalkamine curing agent for use over metal substrates
  - Compatible with solid epoxy dispersions
  - Corrosion resistance
  - Water resistance
  - Adhesion over metal substrates
  - Wet-on-wet appearance with 2k polyurethane topcoats
  - Wide formulating latitude
    - Compatible with standard liquid epoxy
    - Non V.O.C. viscosity control



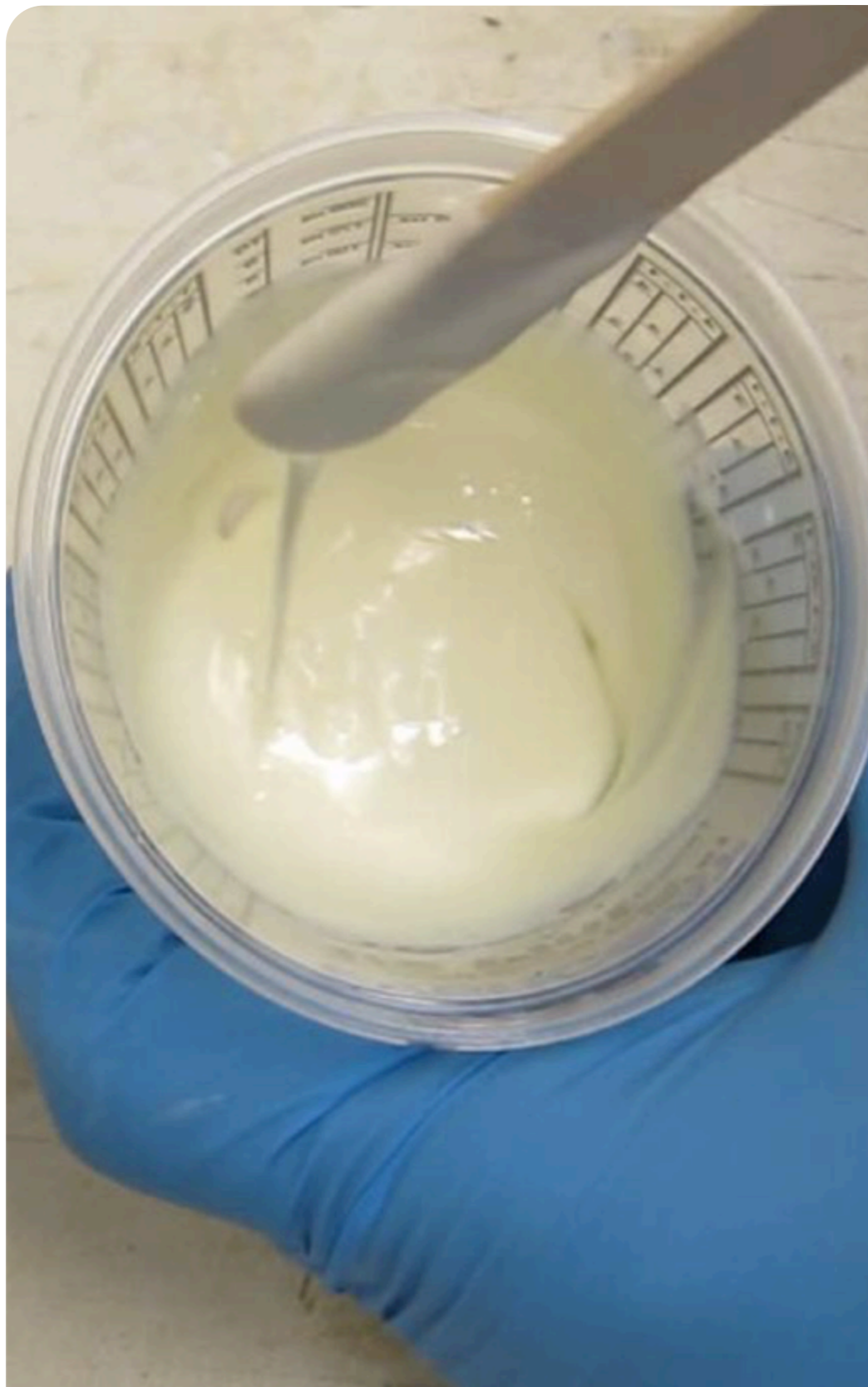
# Typical Properties

Properties	NX-8101	Competitive WBCA
Viscosity @ 25°C (cPs)	20000-55000	6000-14000
Amine value (mg KOH/g)	140-180	130-140
Solids	50	55
AHEW	270	390
Color (Gardner)	7	8
Recommended, (phr, EEW 190)	105-130	103-155





# Admix Reduction With Water



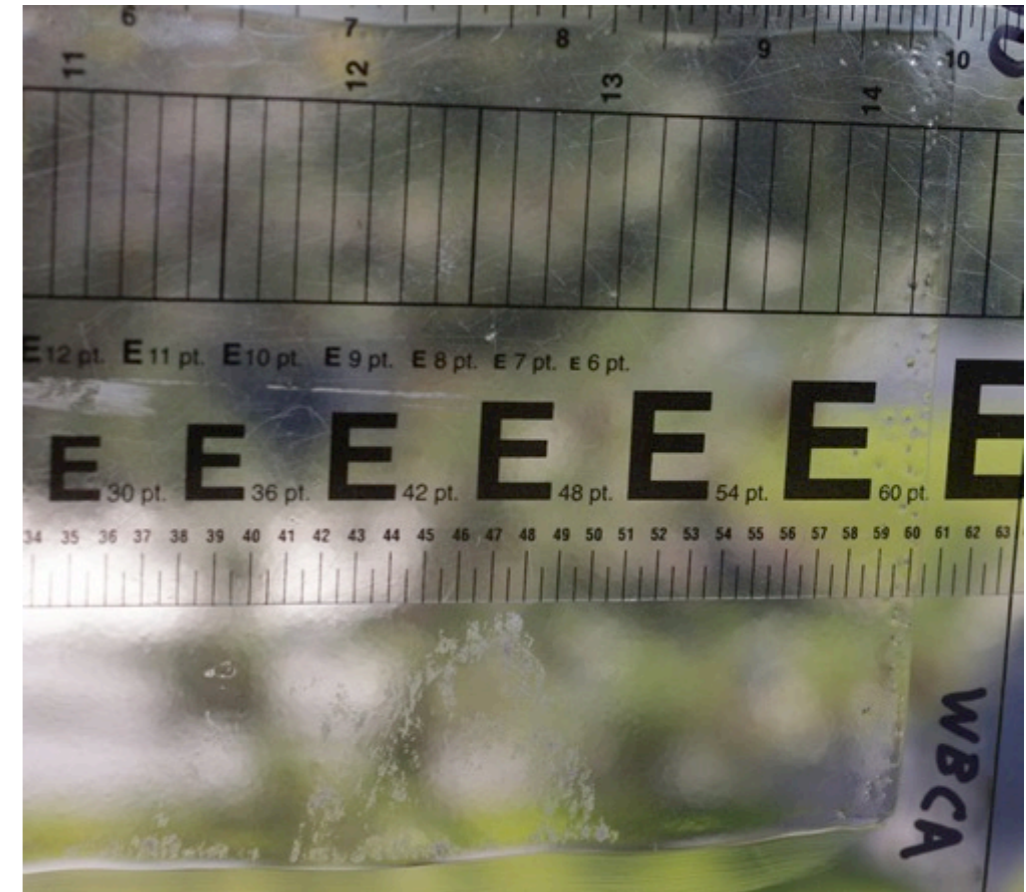
Curing Agent	Effort Required to Lower Admix Viscosity With Water
NX-8101	Very easy to reduce with water
Competitive WBCA	Initial resistance for water acceptance

When admixed with standard liquid epoxy, NX-8101 is easily reduced with water

# High Humidity Film Appearance with Liquid Epoxy



NX-8101



Competitive WBCA

NX-8101 exhibits good flow and film formation under LTC and high humidity (10°C / 80% R.H.)



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# Linear Dry Times (clear)

<b>Curing Agent / Epoxy Resin</b>	<b>10 °C / 80% R.H.</b>	<b>25 °C / 50% R.H.</b>
NX-8101 / Solid Epoxy Dispersion	1 ½ hrs	½ hrs
Competitive WBCA / Solid Epoxy Dispersion	2 hrs	½ hrs
NX-8101 / Liquid Epoxy	12.5 hrs	3.5 hrs
Competitive WBCA / Liquid Epoxy	14 hrs	3.5 hrs

All mixtures at 1:1 stoichiometry

# Early Hot Water Resistance (non-pigmented)

Curing Agent / Epoxy Resin	16 hour cure before immersion	5 day cure before immersion
<b>NX-8101</b> / Solid Epoxy Dispersion	<b>No blisters</b>	No blisters
Competitive WBCA / Solid Epoxy Dispersion	Medium dense #8 blisters	No blisters
<b>NX-8101</b> / Liquid Epoxy	<b>No blisters</b>	No blisters
Competitive WBCA / Liquid Epoxy	Medium dense #8 blisters	No blisters

*35 μ DFT (Q-Panel "S" surface cold rolled steel)*

48 hour immersion @ 50 °C



# Formulation Guidelines

- NX-8101 is compatible with solid epoxy dispersions and standard liquid epoxy resins
- No additional emulsifiers are required
- Reactive diluents (mono or di-functional) can be used without additional emulsifiers
- Best pigmentation method is resin-free dispersion with resin letdown
- Defoamers like BYK 045 and BYK 054 help with air release and surface appearance
- Temperature of NX-8101 should remain below 40°C during the pigment dispersion phase
- The most efficient solvent for the NX-8101, evaluated thus far, is diethylene glycol monohexyl ether



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# Solid Epoxy Dispersion w/ WBPCA

<b>Part A</b>	<b>Wt.</b>
EP 2384 w/57WA	58.85
Flash rust inhibitor	0.24
Part A sub-total	64.97
<b>Part B</b>	
D.I. Water	20.23
Disperbyk 192	0.82
Minex 7	9.81
Nicron 302 talc	16.47
Wollastocoat 10ES	24.52
TIPURE R-706	10.22
BYK 054	0.37
<b>NX-8101</b>	17.56
Part B sub-total	100.00
<b>Total Wt</b>	<b>16</b>

1:1 by volume mix ratio

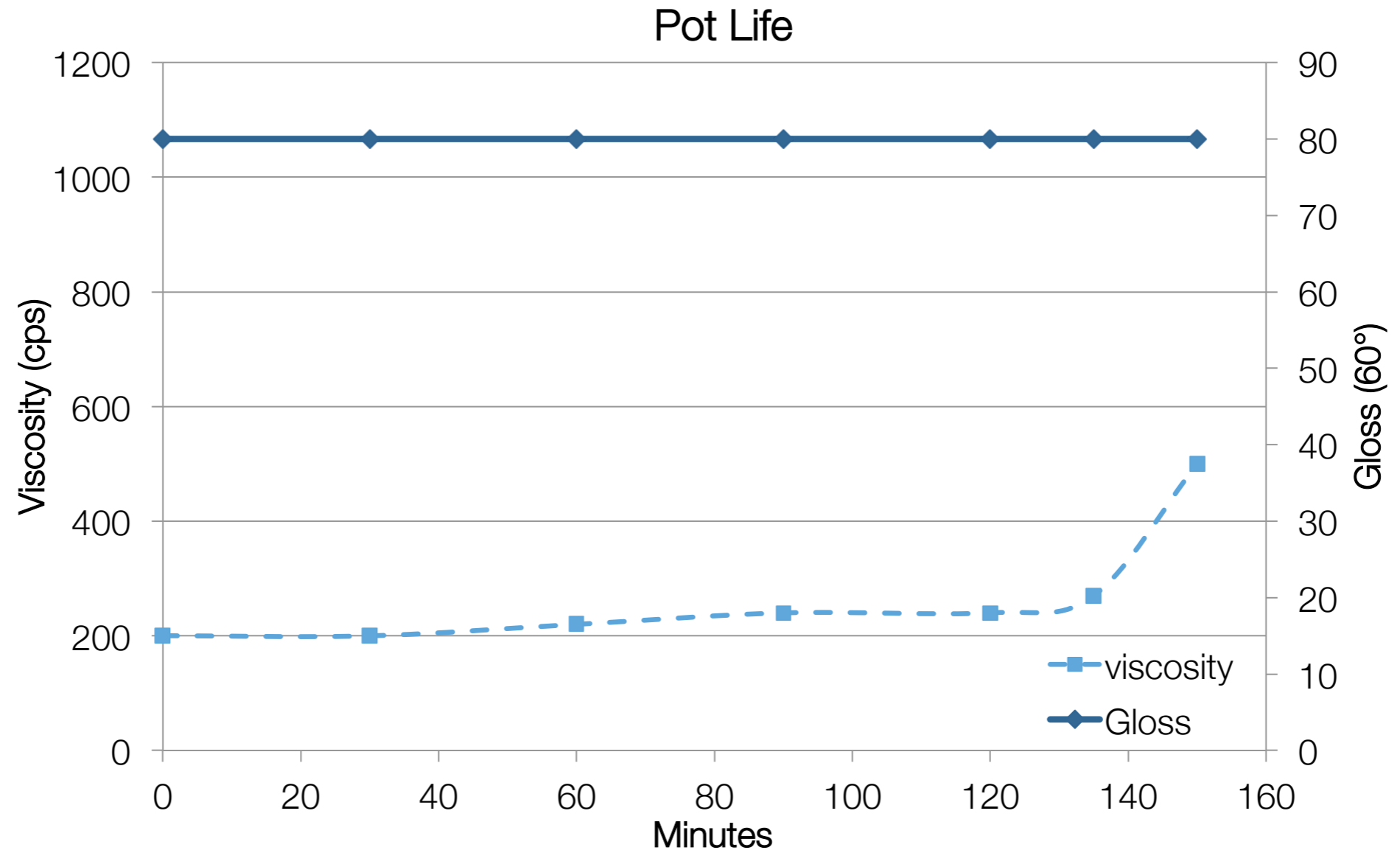
# Pigmented Formulations

Part A	Formula #1	Formula #2	Formula #3	Formula #C1	Formula #C3
	Wt.	Wt.	Wt.	Wt.	Wt.
EP 2384 w/57WA	58.85	45.00		50.69	
EPON™ 828		4.50	20.00		16.13
Ultra LITE 513			2.00		
Heloxy™ Modifier 8					1.61
Flash rust inhibitor	0.24	0.20		0.21	
D.I. Water	5.88	4.00		5.06	
<b>subtotal</b>	<b>64.97</b>	<b>53.70</b>	<b>22.00</b>	<b>55.96</b>	<b>17.74</b>

Part B	Wt.	Wt.	Wt.	Wt.	Wt.
<i>High Speed Disperse</i>					
Disperbyk™ 192	0.82	0.82	0.90	0.78	0.85
D.I. Water	20.23	21.00	21.93	19.19	20.70
MINEX™ 7	9.81	10.00	10.97	9.30	10.35
Nicron™302 Talc	16.47	20.00	16.45	15.62	15.52
WOLLASTOCOAT™ 10 ES	24.52	20.00	16.45	23.25	15.52
TIPURE™ R-706	10.22	8.00	8.77	9.69	8.28
BYK™ 054	0.37	0.37	0.41	0.35	0.38
<i>Letdown with</i>					
<b>NX-8101</b>	<b>17.56</b>	<b>19.81</b>	<b>24.13</b>		
Competitive WBCA				21.81	28.39
<b>subtotal</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>

Admixed Values	Formula #1	Formula #2	Formula #3	Formula #C1	Formula #C3
Volume Mix Ratio	1.0 to 1	0.8 to 1	0.3 to 1	0.9 to 1	0.2 to 1
V.O.C. (gm/l)*	4.66	4.87	6.00	4.71	6.06
%wt NVM	63.23	64.42	71.89	63.91	71.32
%wt Volatile	36.77	35.58	28.11	36.09	28.68
%wt Pigment	36.99	37.74	43.15	37.11	42.19
%vol NVM	50.57	51.81	59.31	51.10	58.63
%vol Volatile	49.43	48.19	40.69	48.90	41.37
%vol Pigment	17.15	17.75	21.08	17.42	20.84
%PVC	33.92	34.26	35.53	34.09	35.55
Pigment/Binder	1.41	1.41	1.50	1.38	1.45
Amine/Epoxy	0.83	0.88	0.81	0.83	0.80
Viscosity (cps)	230	260	300	260	310

# NX-8101 Pot Life @ 25°C



Admixed with solid epoxy dispersion reduced with water –  
total weight solids 50%

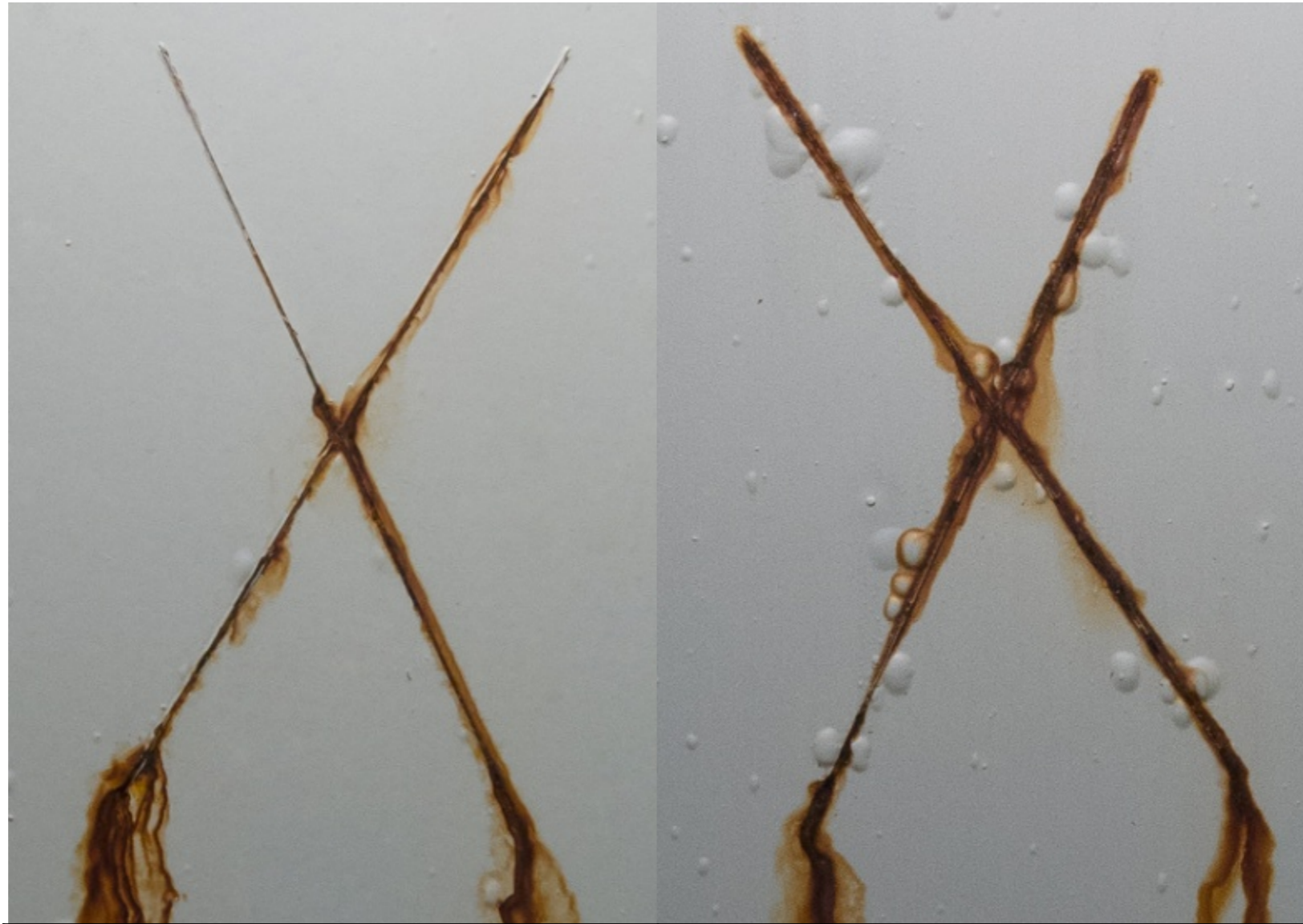


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# 500 Hour Salt Spay

Cold Rolled Steel  
Q-Panel S surface

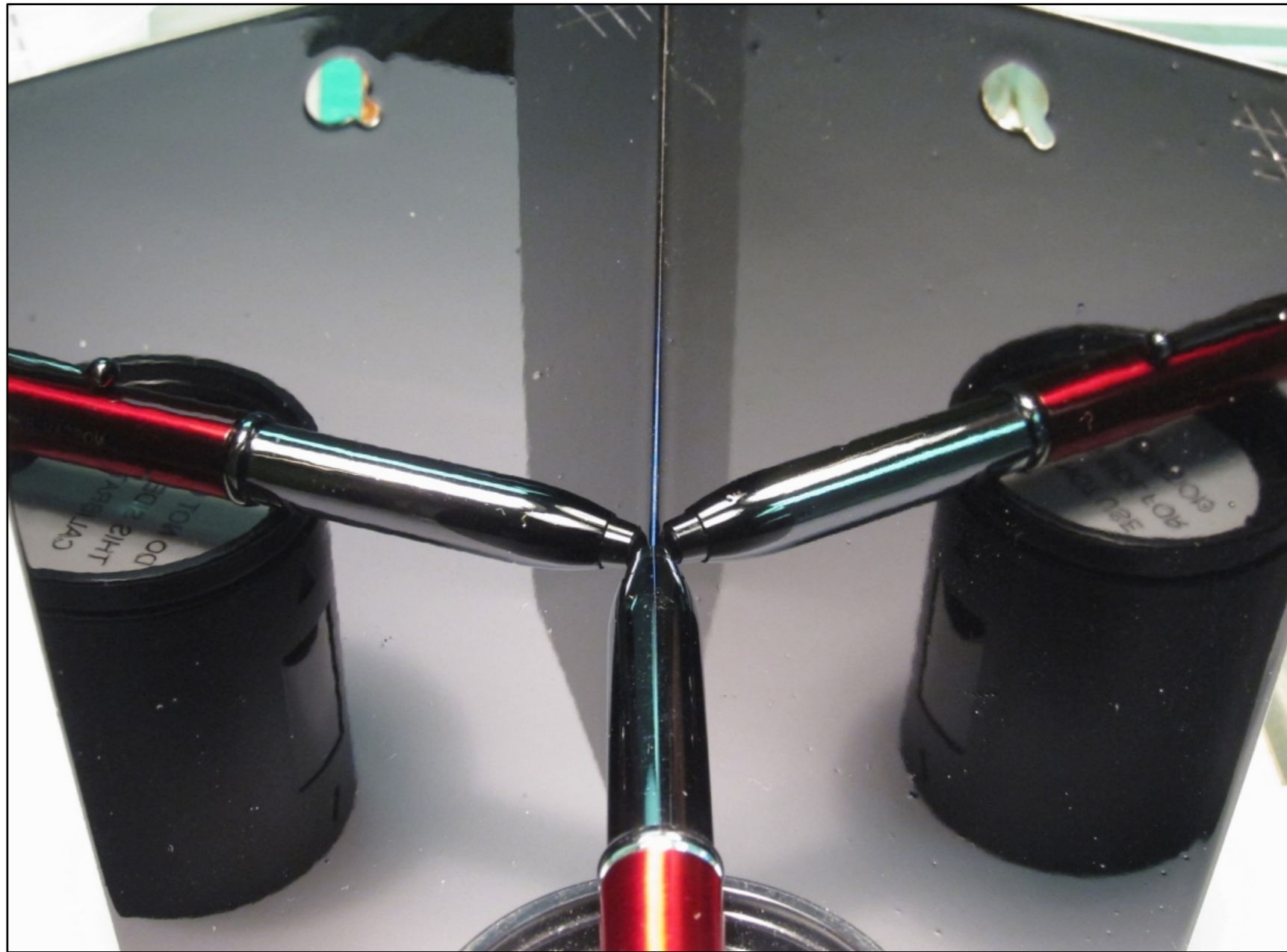


**NX-8101  
Formula #1**

**Competitive WBCA  
Formula #C1**

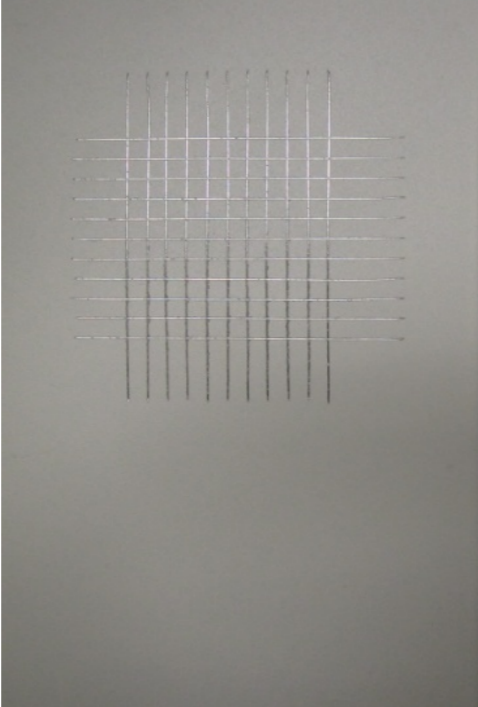
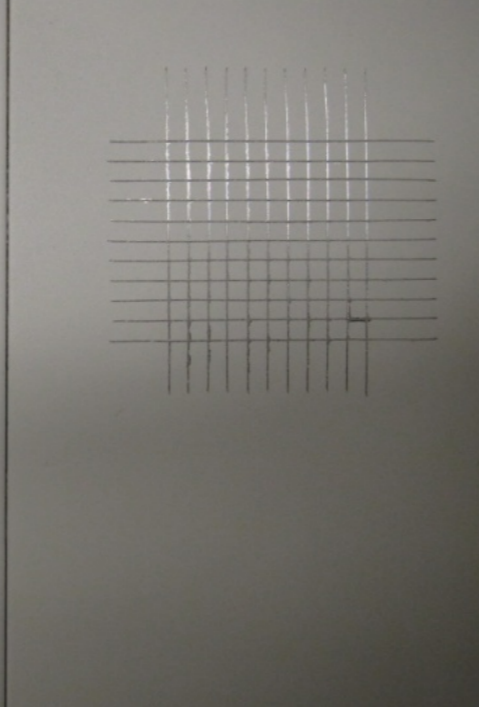
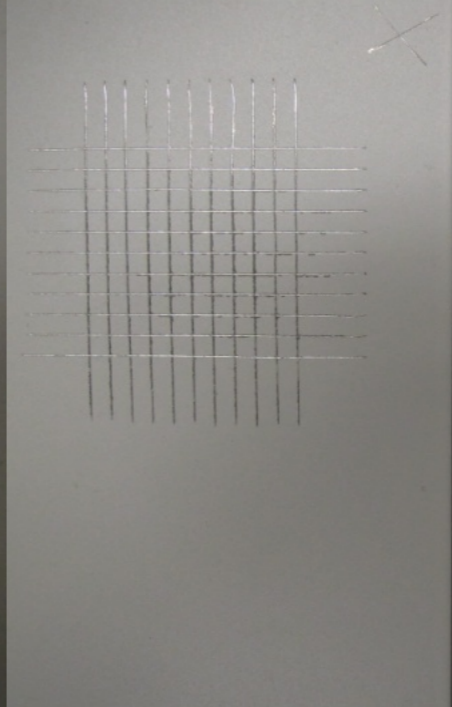
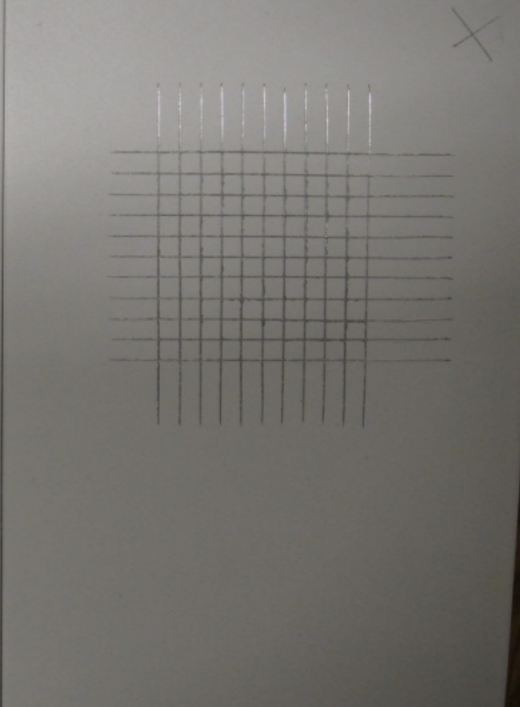
# Early Recoat

Wet-On-Wet Appearance



Bare CRS substrate		NX-8101 over CRS	
20° Gloss	60° Gloss	20° Gloss	60° Gloss
89.9	95.2	89.8	95.3

# Adhesion to Aluminum

			
<b>Alclad 2024 T3 abraded</b>	<b>Alclad 2024 T3 solvent only wiped</b>	<b>Bare 2024 T3 abraded</b>	<b>Bare 2024 T3 solvent only wiped</b>
<b>4B</b>	<b>4B</b>	<b>4B</b>	<b>4B</b>





# Conclusions

- NX-8101 is compatible with both solid epoxy dispersion and standard liquid epoxy resins
- No additional emulsifiers are required
- Outstanding spray characteristics and film formation when used with a wide range of epoxy resins (standard liquid, solid dispersions, separate and in blends)
- Excellent adhesion and blister resistance in salt spray testing without the use of inhibiting pigments
- The NX-8101 can be used to develop corrosion resistant primers for use over metal substrates



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