

**EPODIL® LV5 Hydrocarbon Resin****DESCRIPTION**

Epodil® LV5 is a chemically inert, low viscosity liquid hydrocarbon resin. It is soluble in and compatible with a wide variety of epoxy resins as well as most curing agents. Epodil LV5 is a specialized additive enhancing the performance properties of a formulated system and should be added at relatively low loadings, in the order of 5 to 15 phr, Epodil LV5 acts as a surface tension reducer, as a pigment wetting aid, and as an adhesion promoter. In the formulation of trowellable epoxy mortars, the addition of Epodil LV5 improves trowelability by reducing/eliminating the tendency for drag or sticking to occur, so that it is not necessary to keep wetting the trowel with solvent to obtain a smooth surface. In epoxy mastic coatings for application to poorly prepared surfaces it aids penetration of surface rust and oil leading to improved adhesion.

The optimum level of Epodil LV5 addition for any particular application will depend upon a variety of factors including types of resin, curing agents, fillers, substrates etc.

**ADVANTAGES**

- Improved chemical resistance
- Improved adhesion
- Improved water resistance
- Low volatility
- Maintains high level of corrosion resistance

**APPLICATIONS**

- Solvent based marine and protective coatings
- Solvent-free coatings
- Solvent-free flooring and concrete primers
- Grouts

**SHELF LIFE**

At least 24 months from the date of manufacture in the original sealed container at ambient temperature. Store away from excessive heat and humidity in tightly closed containers. Do not freeze.

**STORAGE AND HANDLING**

Refer to the Safety Data Sheet for Epodil LV5 hydrocarbon resin.

**TYPICAL PROPERTIES**

<b>Appearance</b>	Clear amber liquid
<b>Colour<sup>1</sup> (Gardner)</b>	2 max
<b>Viscosity<sup>2</sup> @ 25°C, [mPa.s]</b>	50
<b>Specific Gravity @ 21°C</b>	1.019
<b>Recommended use Level, [phr]</b>	5-15
<b>Solids Content, [%]</b>	100

**TYPICAL HANDLING PROPERTIES**

<b>Pot-life<sup>3</sup> (21°C)</b>	Increased by 15-60% <sup>5</sup>
<b>Thin Film Set Time<sup>4,5</sup> 21°C</b>	Increased by 35-200% <sup>5</sup>

Footnotes:

- (1) ASTM D 1544-80
- (2) Brookfield RVTD, Spindle 4
- (3) 150 g mixed mass
- (4) BK Drying Recorder Phase II
- (5) Depending upon the curing agent and addition level

## SUPPLEMENTARY INFORMATION

Epodil® LV5 is a chemically inert, low viscosity liquid hydrocarbon resin. It is soluble in and compatible with a wide variety of epoxy resins as well as most curing agents. Epodil® LV5 is a specialized additive used at relatively low loadings, in the order of 5 to 15 phr. Epodil® LV5 acts as a surface tension reducer, as a pigment wetting aid, and as an adhesion promoter.

The optimum level of Epodil® LV5 addition for any particular application will depend upon a variety of factors including types of resin, curing agents, fillers, substrates etc.

## PERFORMANCE EVALUATION

Epodil® LV5 was evaluated for its compatibility with liquid epoxy resin, impact on liquid epoxy resin viscosity, influence on reactivity, adhesion over sandblasted steel, influence on chemical resistance and 5% salt spray, following a 10 days ambient cure of applied coatings

To perform the tests liquid epoxy resin with EEW=190 was modified with Epodil® LV5 at the addition level of 5 and 15 phr and was compared with Epodil® L at the same addition levels. Unmodified liquid epoxy resin was used as a control.

Many different curing agents were used to cure the modified and unmodified liquid epoxy resin and in all tests and the stoichiometry was 1 EEW to 1 AHEW.

## COMPATIBILITY OF EPODIL LV5 WITH EPOXY RESIN AND CURING AGENTS

Epodil® LV5 is compatible with most curing agents and with a variety of epoxy resins, making it a viable additive for most epoxy systems. Compatibility with epoxy resin and curing agents were evaluated by mixing Epodil® LV5 with the liquid epoxy resin or with the curing agent up to the proportion of 1 part by weight of Epodil® LV5 to 1 part by weight of liquid epoxy resin or curing agent. Blends were observed immediately and after 24 hours. The same was made to evaluate Epodil® L. Table 1 shows the compatibility results.

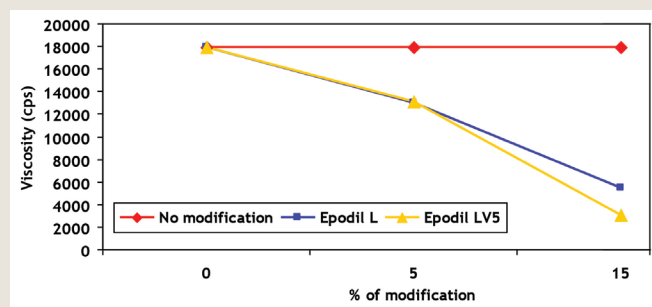
**TABLE 1: COMPATIBILITY WITH LIQUID EPOXY RESIN AND CURING AGENTS**

	Epodil LV5	Epodil L
Ancamide® 260A	Hazy	Hazy
Ancamide® 350A	Hazy	Hazy
Ancamide® 500	Compatible	Compatible
Ancamine® K54	Compatible	Compatible
Ancamine® 2089M	Compatible	Compatible
Ancamine® 1618	Compatible	Compatible
Ancamine® 2489	Compatible	Compatible
Ancamine® 2280	Compatible	Compatible
Ancamine® 2432	Compatible	Compatible
Liquid Epoxy Resin (EEW=190)	Compatible	Compatible
Solid epoxy resin supplied at 75% in xylene (EEW= 450 – 650)	Compatible	Compatible

## IMPACT OF EPODIL® LV5 ON LIQUID EPOXY RESIN VISCOSITY

Epodil LV5 reduces the viscosity of liquid epoxy resin, allowing the formulators to increase the fillers and or pigments concentration, or simply having a system with lower viscosity. Impact on liquid epoxy resin viscosity was evaluated by modifying the liquid epoxy resin with Epodil® LV5 at 5 and 15 phr. The viscosity for each mixture was determined using a Brookfield viscosimeter after 24 hours. The same was made to evaluate Epodil® L. Figure 1 shows the impact of Epodil® LV5 on resin viscosity.

**FIGURE 1: IMPACT ON LIQUID EPOXY RESIN VISCOSITY**



## INFLUENCE OF EPODIL® LV5 ON CURING AGENT REACTIVITY

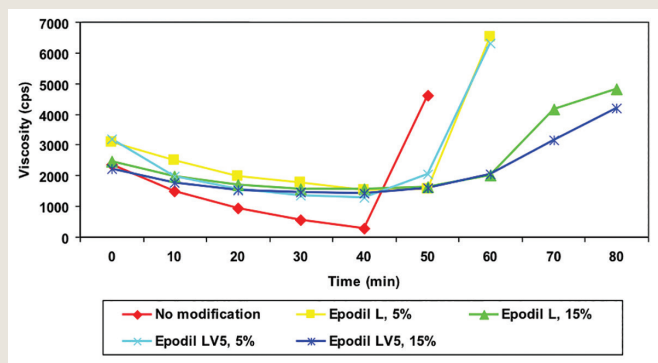
Epodil® LV5 increases the pot-life of ambient cured epoxy systems from 15 to 60%, depending on the curing agent and addition level of Epodil® LV5. Influence on curing agent reactivity was determined by modifying the liquid epoxy resin with Epodil® LV5 at 5 and 15 phr.

The reactivity was measured by viscosity increase during the pot-life; the viscosity was determined using a Brookfield

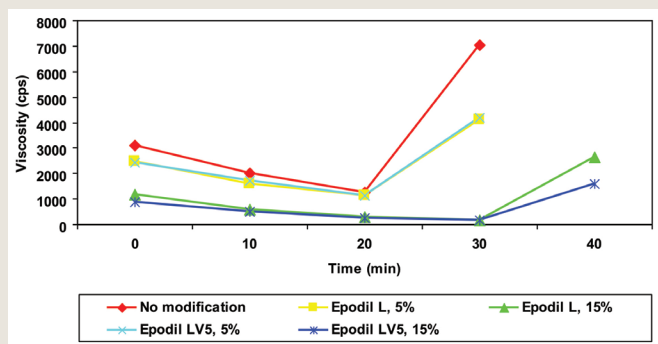
viscosimeter. The same was made to evaluate Epodil® L and unmodified liquid epoxy resin was used as a control.

The modified liquid epoxy resin and unmodified liquid epoxy resin were cured with Ancamine® 1618 and Ancamine® 2432. Figure 2 and 3 shows the impact of Epodil® LV5 on curing agent reactivity.

**FIGURE 2: IMPACT ON CURING AGENT REACTIVITY USING ANCAMINE® 1618**



**FIGURE 3: IMPACT ON CURING AGENT REACTIVITY USING ANCAMINE® 2432**



### INFLUENCE OF EPODIL® LV5 ON ADHESION

Epodil® LV5 reduces the surface tension of epoxy systems and as a consequence it helps to improve the adhesion of systems that does not have a good substrate wetting characteristic. Adhesion improvement is dependable of the curing agent being used as well as the addition level of Epodil® LV5. For maximum performance tests varying the concentration of Epodil® LV5 are recommended.

To determine the influence of Epodil® LV5 on adhesion the liquid epoxy resin was modified with 5 and 15 phr of Epodil® LV5. The curing agents selected to run this evaluation were: Ancamine 1618, Ancamine 2280 and Ancamine 2432. The clear coatings were brush applied at a dry film thickness of 100 to 125µm over steel panels sandblasted to white metal (Sa3) and adhesion was measured following a 10 days of cure

at room temperature. Adhesion was measured according to ASTM 3359 (tape adhesion) and ASTM 4541 (pull-off test). The same was made to evaluate Epodil® L and unmodified liquid epoxy resin was used as a control. Table 2 shows the adhesion of modified and unmodified systems.

**TABLE 2: ADHESION OVER SANDBLASTED STEEL**

		ASTM 3359	ASTM 4541 (KPa)
<b>Ancamine® 1618</b>	Unmodified liquid epoxy resin	5B	14
	Epodil® LV5	5 phr	25
		15 phr	17
	Epodil® L	5 phr	23
15 phr		14	
<b>Ancamine® 2280</b>	Unmodified liquid epoxy resin	5B	20
	Epodil® LV5	5 phr	21
		15 phr	20
	Epodil® L	5 phr	20
15 phr		15	
<b>Ancamine® 2432</b>	Unmodified liquid epoxy resin	5B	14
	Epodil® LV5	5 phr	23
		15 phr	27
	Epodil® L	5 phr	19
15 phr		22	

### INFLUENCE OF EPODIL® LV5 ON CHEMICAL RESISTANCE

Epodil® LV5 improves the resistance of epoxy systems to diluted chemicals and water. A special improvement was observed on 10% solution of Acetic Acid. The impact of Epodil® LV5 on chemical resistance is dependable on the curing agent as well the addition level of Epodil® LV5.

The influence of Epodil® LV5 on the chemical resistance was determined by modifying the liquid epoxy resin (LER) with 5 and 15 phr. The modified epoxy resin was cured with Ancamide 350A, Ancamine 1618, Ancamine 2280 and Ancamine 2432. To perform the chemical resistance the samples were cast and immersed in many different chemical after a 10 days cure at room temperature. The chemical resistance was checked by weight gain or loss after 7 and 28 days. The same was made to evaluate Epodil® L and unmodified liquid epoxy resin was used as a control. The results obtained are expressed on Table 3, 4, 5 and 6.

**TABLE 3: CHEMICAL RESISTANCE OF LER CURED WITH ANCAMIDE 350**

	Unmodified system		Epodil LV5				Epodil L			
			5 phr		15 phr		5 phr		15 phr	
	7 days	28 days	7 days	28 days	7 days	28 days	7 days	28 days	7 days	28 days
Water	0.21	0.92	0.22	0.63	0.24	0.80	0.23	0.64	0.25	0.59
NaCl 3.5%	0.24	0.71	0.23	0.78	0.22	0.87	0.20	0.76	0.22	0.87
NaOH 10%	0.24	0.68	0.26	0.69	0.24	0.78	0.22	0.76	0.25	0.69
H2SO4 10%	1.43	2.98	0.74	1.73	0.60	1.10	0.77	1.51	0.41	0.86
MIBK	3.98	5.84	4.98	8.22	6.78	11.16	4.96	7.75	6.10	10.20
PM Solvent	5.49	8.51	5.53	8.42	5.88	9.62	5.69	9.04	6.11	9.71
Xylene	9.61	15.28	10.80	18.44	11.60	21.52	10.60	17.49	13.20	21.63
Acetic Acid 10%	7.83	17.17	3.44	7.62	2.63	5.58	4.48	9.34	2.45	4.94

**TABLE 4: CHEMICAL RESISTANCE OF LER CURED WITH ANCAMINE 1618**

	Unmodified system		Epodil LV5				Epodil L			
			5 phr		15 phr		5 phr		15 phr	
	7 days	28 days	7 days	28 days	7 days	28 days	7 days	28 days	7 days	28 days
Water	0.21	0.48	0.21	0.46	0.18	0.40	0.20	0.45	0.17	0.40
NaCl 3.5%	0.20	0.44	0.19	0.43	0.18	0.41	0.18	0.42	0.15	0.36
NaOH 10%	0.18	0.41	0.19	0.40	0.15	0.33	0.15	0.35	0.13	0.30
H2SO4 10%	0.39	0.81	0.30	0.68	0.20	0.48	0.27	0.64	0.21	0.43
MIBK	0.32	1.07	0.41	1.32	1.15	2.82	0.26	1.20	0.92	2.26
PM Solvent	3.55	6.33	3.48	6.34	3.51	6.84	3.15	6.19	3.38	6.75
Xylene	-0.31	-0.20	-0.27	0.09	0.64	2.29	-0.21	0.19	0.42	1.64
Acetic Acid 10%	1.01	2.08	0.68	1.45	0.51	1.10	0.64	1.47	0.43	0.99

**TABLE 5: CHEMICAL RESISTANCE OF LER CURED WITH ANCAMINE 2280**

	Unmodified system		Epodil LV5				Epodil L			
			5 phr		15 phr		5 phr		15 phr	
	7 days	28 days	7 days	28 days	7 days	28 days	7 days	28 days	7 days	28 days
Water	0.19	0.44	0.20	0.43	0.20	0.45	0.17	0.41	0.16	0.36
NaCl 3.5%	0.17	0.39	0.18	0.41	0.21	0.40	0.17	0.41	0.18	0.39
NaOH 10%	0.17	0.38	0.14	0.35	0.18	0.40	0.15	0.34	0.16	0.34
H2SO4 10%	0.23	0.54	0.22	0.52	0.24	0.91	0.22	0.49	0.20	0.42
MIBK	0.04	0.44	0.10	0.64	1.15	2.09	0.26	0.43	1.10	2.03
PM Solvent	2.14	4.58	2.33	4.45	3.06	6.34	2.83	4.18	3.34	6.07
Xylene	-0.16	-0.01	-0.10	0.29	1.00	2.09	-0.20	0.01	0.89	1.67
Acetic Acid 10%	0.87	1.98	0.73	1.65	0.54	1.34	0.78	1.66	0.76	1.49

Note: Results are expressed in %.

**TABLE 6: CHEMICAL RESISTANCE OF LER CURED WITH ANCAMINE 2432**

	Unmodified system		Epodil LV5				Epodil L			
			5 phr		15 phr		5 phr		15 phr	
	7 days	28 days	7 days	28 days	7 days	28 days	7 days	28 days	7 days	28 days
Water	0.17	0.43	0.17	0.40	0.16	0.38	0.15	0.37	0.14	0.34
NaCl 3.5%	0.14	0.36	0.20	0.38	0.13	0.33	0.13	0.33	0.14	0.31
NaOH 10%	0.15	0.36	0.17	0.38	0.18	0.37	0.13	0.33	0.14	0.33
H2SO4 10%	0.27	0.62	0.27	0.59	0.24	0.51	0.23	0.54	0.24	0.48
MIBK	-0.26	-0.22	-0.22	-0.12	-0.26	0.02	-0.12	0.03	-0.08	0.10
PM Solvent	0.55	1.35	0.82	1.73	1.21	2.42	0.74	1.61	1.16	2.18
Xylene	-0.21	-0.13	-0.13	-0.05	-0.19	0.08	-0.22	-0.15	-0.20	-0.04
Acetic Acid 10%	0.62	1.32	0.54	1.10	0.42	0.88	0.59	1.18	0.48	0.91

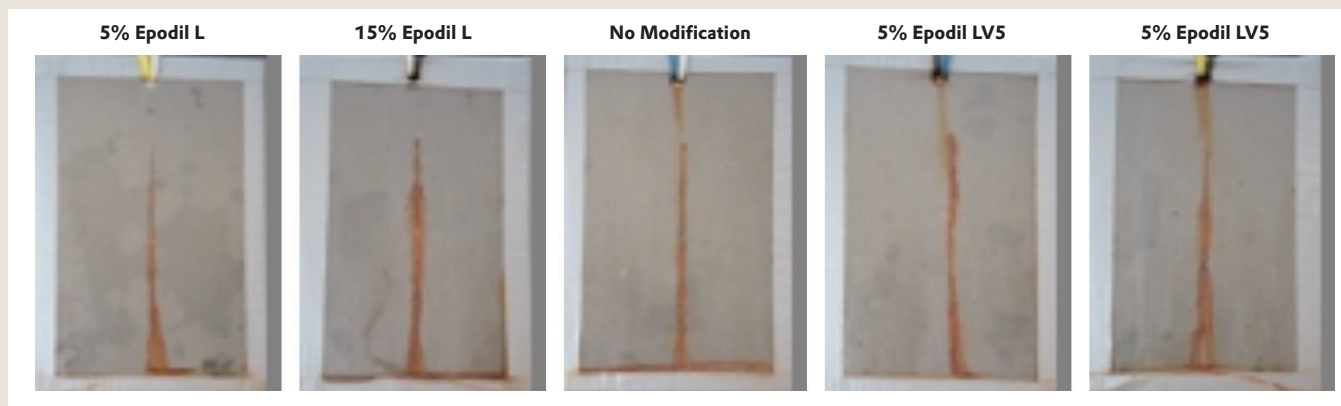
Note: Results are expressed in %.

**INFLUENCE OF EPODIL® LV5 ON CORROSION RESISTANCE**

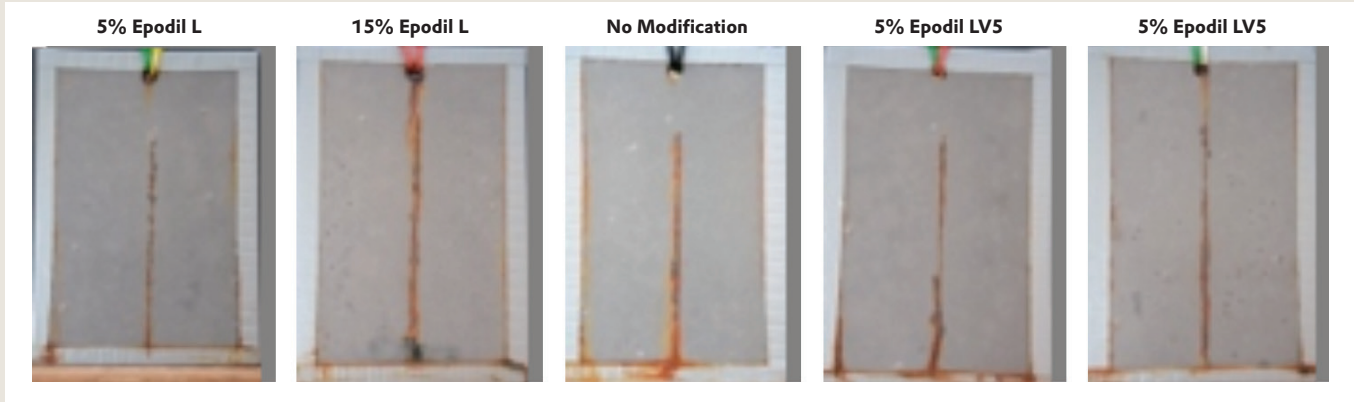
Epodil® LV5 when added to a coating formulation maintains the high levels of corrosion resistance observed with 2 component epoxy systems. This is demonstrated by the excellent data obtained following exposure to salt spray resistance weather testing.

To determine the influence of Epodil® LV5 on salt spray the liquid epoxy resin (LER) was modified with 5 and 15 phr of Epodil® LV5. The curing agents selected to run this evaluation were: Ancamide 350A/Ancamine 1618, Ancamine 2280 and Ancamine 2432. The clear coatings were brush applied at a dry film thickness of 100 to 125µm over steel panels sandblasted to white metal (Sa3). Salt spray test was performed according to ASTM B-117 after 10 days of cure at room temperature. The same was made to evaluate Epodil® L and unmodified liquid epoxy resin was used as a control. Results obtained after 1,000 hours of exposure to salt spray cabined are showed on pictures 1, 2, 3 and 4.

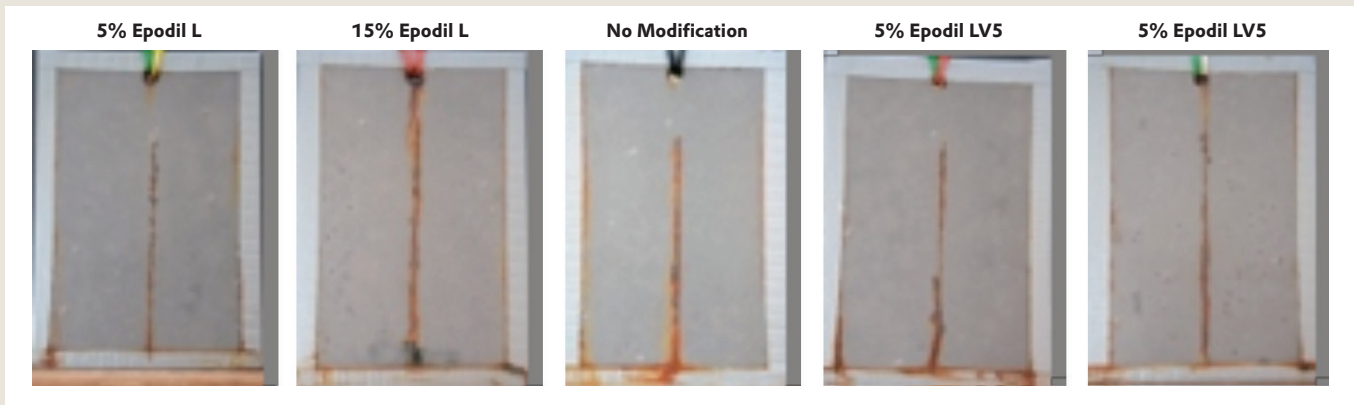
**PICTURE 1: 1,000 HOURS SALT SPRAY OF LER CURED WITH ANCAMIDE 350A**



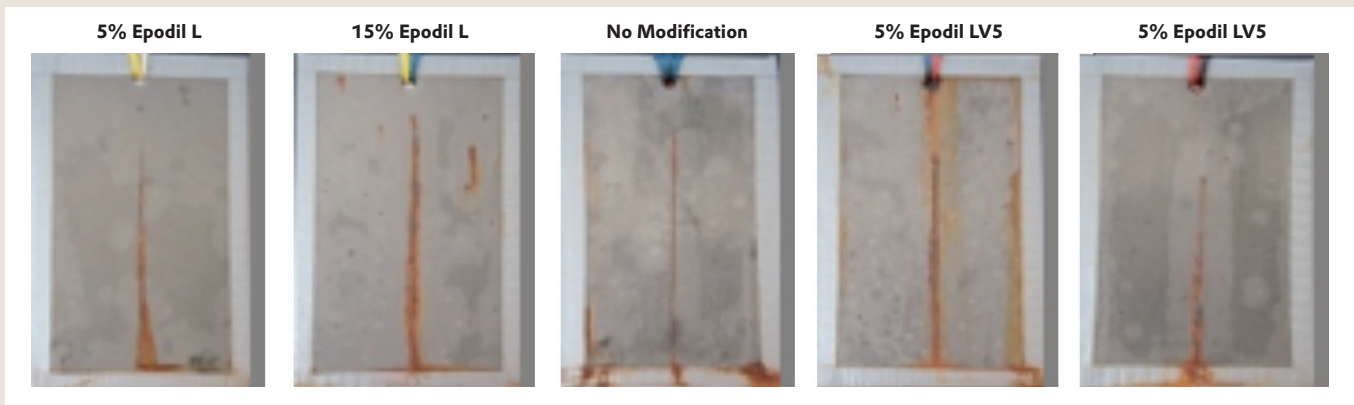
**PICTURE 2: 1,000 HOURS SALT SPRAY OF LER CURED WITH ANCAMINE 1618**



**PICTURE 3: 1,000 HOURS SALT SPRAY OF LER CURED WITH ANCAMINE 2280**



**PICTURE 4: 1,000 HOURS SALT SPRAY OF LER CURED WITH ANCAMINE 2432**



Epoxy Curing Agents and Modifiers

# EPODIL® LV5 Hydrocarbon Resin

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