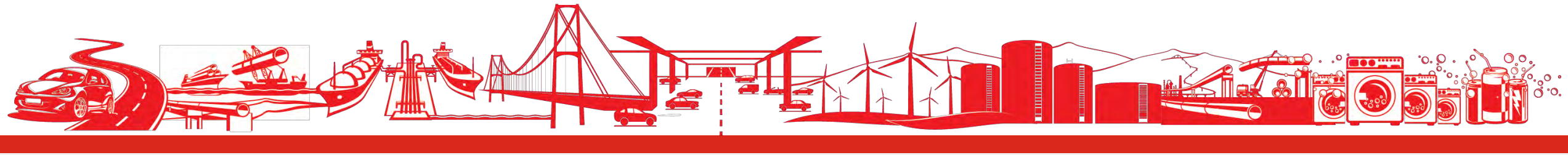
CHEMICAL RESISTANCE WITH OLIN D.E.H.™ CURING AGENTS - FOR CIVIL ENGINEERING & PROTECTIVE COATINGS



Introduction

- Epoxy coatings are known to provide good resistance to various chemicals such as acids, bases, organic solvents and various synthetic fluids. To achieve the desired performance, the selection of the hardener plays a critical role.
- The commonly used types of amine hardeners that provide good chemical resistance for ambient cured epoxy coatings include:
  - Aliphatic amines (modified/ adducts)
  - Cycloaliphatic amines (modified/adducts)
  - Mannich bases

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Olin D.E.H. Offerings for Chemical Resistance

Product	Product Description	AHEW (g/eq.)[1]	Viscosity at 25°C (mPa·s) [1]	Gel Time (min)[2]
D.E.H.™ 488	Modified cycloaliphatic amine, good early water spot resistance.	93	280-380	25
D.E.H. 502	Modified aliphatic amine. Good resistance to solvents and alcohols.	44	2500-4000	14
D.E.H. 530	Modified cycloaliphatic amine, low color, good color stability and blush resistance.	112	300-400	43
D.E.H. 546	Modified cycloaliphatic amine. Fast set.	95	200-400	25
D.E.H. 589	Modified cycloaliphatic amine. Low blush and good water spot resistance.	83	50-100	32
D.E.H. 590	Modified aliphatic amine. Excellent resistance to 98% sulfuric acid when used with epoxy novolacs.	83	1600-1800	38 (3)
D.E.H. 591	Excellent acid resistance similar to D.E.H. 590 but with lower viscosity.	65	60-80	33 (3)
D.E.H. 613	Mannich base, fast curing, low temperature cure.	90	900-1300	10
D.E.H. 615	Mannich base, similar to D.E.H. 613 but with lower viscosity.	75	400-600	15

(1) Typical properties, not to be construed as specifications.
(2) Formulated with standard D.E.R.™ 331 Epoxy Resin at 1:1 equivalent ratio unless noted.
(3) Formulated with D.E.R 354 Epoxy Resin.

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Chemical Resistant Ratings Based on 28 Days Immersion at Ambient Temperature1

D.E.H.™	10% Acetic acid	36% Hydrochloric acid	Oleic acid	MIBK	Ethanol	Xylene	Toluene
488	++			+++	+	+++	+++
502	x		+	+++	++	+++	+
530	++	++	+++	+++	+	+++	++
530+353	++			+	+		
546	++			+++	+	+++	+++
589	++	++		+++	+	+++	+++
590*	+	+++	+++	+++	++	+++	+++
590+324	+		+++	++	+	+	x
591*	+	+++	+++	+++	++	+++	+++
591+324	+		++	+++	++	+++	++
613	++	+++		+++	+	+++	+++
615	+++	+++	+++	x	+	+	x
615+324	+++			x	x	x	x

[1] Procedure based on ASTM D 543-06.
Samples made with D.E.R. 331 unless indicated otherwise in first column (e.g. 530 + 353 means D.E.H. 530 tested with D.E.R. 353).
Epoxy resin and hardener were mixed at 1:1 equivalent ratio.
Cure Proflie: Ambient temperature for seven days, then specimens were immersed into chemicals for 28 days.
The chemical resistance was evaluated by the weight change after the immersion test

All the hardeners have +++ rating for DI water, 10 % NaOH, 10% HCl, and 10% H2SO4.

* D.E.H. 590 and D.E.H. 591 are especially good for for resistance to concentrated sulfuric acid (98%).
Epoxy novolac resins (D.E.R. 354, D.E.N. 425, or D.E.N. 431) need to be used for 98% sulfuric acid resistance.

Chemical Resistance Rating Definitions:

+++	< 2.5 wt % gain
++	2.5 to 5 wt % gain
+	5 -10 wt % gain
x	> 10 wt %
No entry	Means not tested

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DEH 590 and DEH 591: Excellent Resistance to 98% Sulfuric Acid

Sample Cure Schedule:	98% Sulfuric Acid, Immersion Temperature	Hardener	Weight Change After: (1) 7 Days	28 Days
Ambient Temperature 7-days	25 °C	D.E.H. 590	0.5 % gain	1 % gain
		Competitor Hardener 1	0.6 % gain	1 % loss
		Competitor Hardener 2	0.5 % gain	1 % gain
	45 °C	D.E.H. 590	0.3 % gain	0.5 % loss
		Competitor Hardener 1	9 % gain	x
		Competitor Hardener 2	3 % loss	1.9 % loss
Ambient Temperature 1-day + 50 °C 1-day	60 °C	D.E.H. 590	0.7 % loss	2.5 % loss
		Competitor Hardener 1	x	x
		Competitor Hardener 2	x	x

X - disintegrated

*Epoxy novolac resins (D.E.R. 354, D.E.N. 425, or D.E.N. 431) need to be used for 98% sulfuric acid resistance.
(1) Typical properties, not to be construed as specifications.

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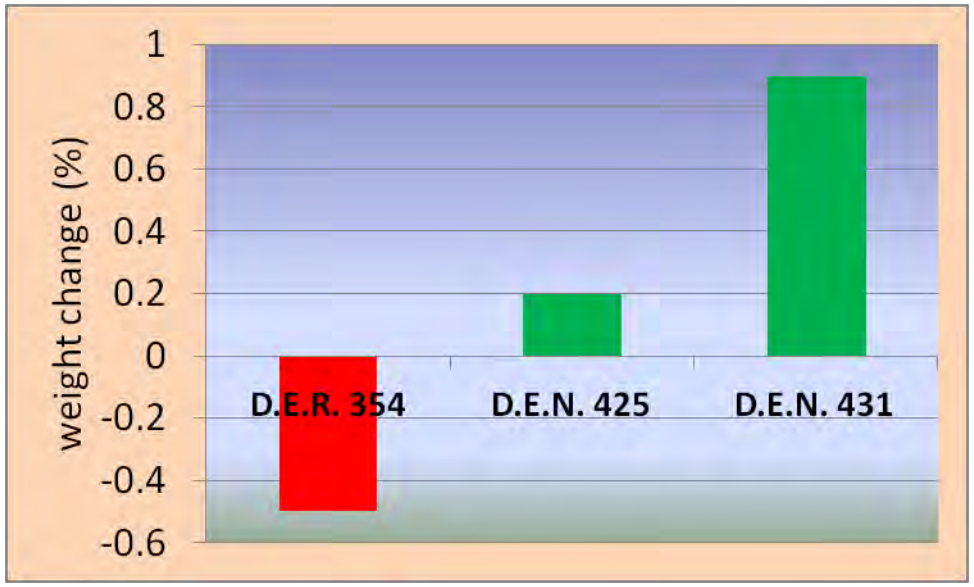
Role of Novolac Resins:
Chemical Resistance in 98 % Sulfuric Acid

D.E.H. 590, 28 days 45°c



QUESTIONS?

THANK YOU!