

# Technical Datasheet

Ashland Performance Materials



## DERAKANE® 411-350 Epoxy Vinyl Ester Resin

DERAKANE 411-350 epoxy vinyl ester resin is based on bisphenol-A epoxy resin and has become the "industry standard" due to its wide range of end-use applications and ability to be used in a wide range of fabrication techniques. The raw materials used in the manufacture of this resin are listed as acceptable in FDA regulation Title 21 CFR 177.2420 for repeated use in contact with food, subject to user's compliance with the prescribed limitations of that regulation.

Equipment fabricated with DERAKANE 411-350 resin has superior elongation and toughness and better impact resistance and less cracking due to cyclic temperature, pressure fluctuations and mechanical shocks providing a safety factor against damage during process upsets or during shipping installation. Composites fabricated with DERAKANE 411-350 resin provide resistance to a wide range of acids, alkalis, bleaches and solvents. This resin holds up well in corrosive environments, postponing the need for replacements. Equipment fabricated with DERAKANE 411-350 resin tolerates heavy design loads without causing failure due to resin damage. This facilitates working with large weight-bearing equipment with confidence.

### APPLICATIONS AND USE

-DERAKANE 411-350 resin is designed for use in fabricating FRP storage tanks, vessels, ducts and on-site maintenance projects, particularly in chemical processing and pulp and paper operations.

- The resin is designed for ease of fabrication using hand lay-up, spray-up, filament winding, compression molding and resin transfer molding techniques, pultrusion and molded grating applications.

- An alternate viscosity, optimized for some vacuum infusion processes is available as DERAKANE MOMENTUM 411-200 resin.

- An alternate for low styrene content (HAP) is available as DERAKANE 441-400 resin.

- Recommendations for specific services and environments can be provided by contacting us at [derakane@ashland.com](mailto:derakane@ashland.com).

### TYPICAL LIQUID RESIN PROPERTIES

Property <sup>(1)</sup> at 25°C (77°F)	Value	Unit
Dynamic Viscosity	370	mPas (cps)
Kinematic Viscosity	350	cSt
Styrene Content	45	%
Density	1.046	g/ml



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(1) Properties are typical values, based on material tested in our laboratories, but varies from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specification items.

### TYPICAL CURING CHARACTERISTICS

The following tables provide typical gelltimes for MEKP. "Starting point" formulations for MEKP, non-foaming MEKP alternatives and BPO peroxides are available in separate product bulletins. These and other information are available at [www.derakane.com](http://www.derakane.com).

### MEKP Cure System

Typical gelltimes<sup>(2)</sup> using NOROX<sup>(3)</sup> MEKP-925H<sup>(4)</sup> catalyst (MEKP) and Cobalt Naphthenate-6%<sup>(5)</sup> (Co-nap6%), Diethylaniline (DEA) and 2,4-Pentanedione (2,4-P).

Geltime at 15 °C (59 °F)	MEKP (phr) <sup>(6)</sup>	Co-nap6% (phr)	DMA (phr)	2,4-P (phr)
15 +/- 5 minutes	1.50	0.30	0.20	-
30 +/- 10 minutes	1.50	0.30	0.05	-
60 +/- 15 minutes	1.25	0.30	0.05	0.04

  

Geltime at 20°C (68°F)	MEKP (phr)	Co-nap6% (phr)	DMA (phr)	2,4-P (phr)
15 +/- 5 minutes	1.50	0.30	0.10	-
30 +/- 10 minutes	1.50	0.30	0.05	0.03
60 +/- 15 minutes	1.50	0.30	0.05	0.06

  

Geltime at 25°C (77°F)	MEKP (phr)	Co-nap6% (phr)	DMA (phr)	2,4-P (phr)
15 +/- 5 minutes	1.25	0.20	0.05	-
30 +/- 10 minutes	1.25	0.20	-	0.02
60 +/- 15 minutes	1.50	0.20	-	0.05

  

Geltime at 30°C (86°F)	MEKP (phr)	Co-nap6% (phr)	DMA (phr)	2,4-P (phr)
15 +/- 5 minutes	1.00	0.20	0.02	-
30 +/- 10 minutes	1.25	0.20	-	0.04
60 +/- 15 minutes	1.25	0.20	-	0.06



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Geltime at 35°C (95°F)	MEKP (phr)	Co-nap6% (phr)	DMA (phr)	2,4-P (phr)
15 +/- 5 minutes	1.00	0.20	-	0.02
30 +/- 10 minutes	1.00	0.20	-	0.05
60 +/- 15 minutes	1.00	0.20	-	0.08

- (2) Thoroughly test any other materials in your applications before full-scale use. Geltimes may vary due to the reactive nature of these materials. Always test a small quantity before formulating large quantities.
- (3) Registered trademark of Norac Inc.
- (4) Norox MEKP-925H or equivalent low hydrogen peroxide content MEKP. Use of other MEKP catalysts or additives may result in different geltimes.
- (5) Use of cobalt octoate, especially in combination with 2,4-P can result in 20-30% slower geltimes.
- (6) phr = parts per hundred resin molding compound

#### Typical<sup>(1)</sup> Mechanical Properties

The properties in the table below are measured from a postcured<sup>(7)</sup> clear resin casting.

Property	Value (SI)	Method	Value (US)	Method
Tensile Strength	86 MPa	ISO 527	12000 psi	ASTM D638
Tensile Modulus	3200 MPa	ISO 527	460 kpsi	ASTM D638
Tensile Elongation at Yield	5-6%	ISO 527	5-6%	ASTM D638
Flexural Strength	150 MPa	ISO 178	22000 psi	ASTM D790
Flexural Modulus	3400 MPa	ISO 178	490 kpsi	ASTM D790
Heat Distortion Temperature <sup>(8)</sup>	105 °C	ISO 75	220 °F	ASTM D648
Glass Transition Temperature, T <sub>g</sub> <sup>2</sup>	120 °C	ISO 11359-2	250 °F	ASTMD3419
Volume Shrinkage	7.8 %		7.8 %	
Barcol Hardness	35	EN 59	35	ASTM D2583
Density	1.14 g/cm <sup>3</sup>	ISO 1183		ASTM D792

(7) Cure schedule: 24 hours at room temperature and 2 hours at 120°C (250 °F).

(8) Maximum stress: 1.8 MPa (264 psi)

#### Laminate Properties

Typical properties<sup>(1)</sup> of a postcured<sup>(9)</sup> 6 mm (1/4") laminate.<sup>(10)</sup>



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Property	Value (SI)	Method	Value (US)	Method
Tensile Strength	150 MPa	ISO 527	22000 psi	ASTMD3039
Tensile Modulus	12000 MPa	ISO 527	1700 kpsi	ASTMD3039
Flexural Strength	210 MPa	ISO 178	30000 psi	ASTM D790
Flexural Modulus	8100 MPa	ISO 178	1200 kpsi	ASTM D790
Glass Content	40%	ISO 1172	40%	ASTMD2584

(9) Cure schedule: 24 hours at room temperature and 6 hours at 80 °C (175 °F).

(10) Laminate construction of 6mm (1/4") is V/M/M/Wr/M/Wr/M where V=Continuous veil glass, M=Chopped strand mat 450 g/m<sup>2</sup> (1.5 oz/ft<sup>2</sup>) and Wr=Woven roving 800 g/m<sup>2</sup> (24 oz/yd<sup>2</sup>).

### CERTIFICATES AND APPROVALS

The manufacturing, quality control and distribution of products, by Ashland Performance Materials, comply with one or more of the following programs or standards: Responsible Care, ISO 9001, ISO 14001 and OHSAS 18001.

### HANDLING AND STORAGE

Standard Package: 55-Gallon (208 liter) Drum, Non-Returnable, Net Wt. 205 kgs (452 Lbs.)  
Dot Label Required: Flammable Liquid

Drums - It is highly recommended that all material is stored at stable temperatures below 25°C (77 °F). Avoid exposure to heat sources such as direct sunlight or steam pipes. To avoid contamination of product with water, do not store outdoors. Keep sealed to prevent moisture pick-up and monomer loss. Rotate stock.

Bulk - See Ashland's Bulk Storage and Handling Manual for Polyesters and Vinyl Esters. A copy of this may be obtained from Ashland at +1.614.790.3333 or 800.523.6963.

When stored in accordance with the above conditions, Ashland warrants this product to remain within specifications for six (6) months from date of manufacture. All things being equal, higher storage temperature will reduce product stability and lower storage temperature will extend product stability.

### Notice

All information presented herein is believed to be accurate and reliable, and is solely for the user's consideration, investigation and verification. The information is not to be taken as an express or implied representation or warranty for which Ashland assumes legal responsibility. Any warranties, including warranties of merchantability or non-infringement of intellectual property rights of third parties, are herewith expressly excluded.



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Since the user's product formulations, specific use applications and conditions of use are beyond the control of Ashland, Ashland makes no warranty or representation regarding the results which may be obtained by the user. It shall be the responsibility of the user to determine the suitability of any of the products mentioned for the user's specific application.

Ashland requests that the user reads, understands and complies with the information contained herein and the current Material Safety Data Sheet.

#### More information

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