REICHHOLD

PRODUCT BULLETIN

May 2007

DION® 9102 SERIES

Bisphenol-Epoxy Vinyl Ester Resins

DESCRIPTION

The DION® 9102 series are special versions of the DION 9100 series of bisphenol-epoxy vinyl ester resin. They provide a reduced viscosity and improved curing at low promoter levels for enhanced performance in filament winding operations, while maintaining the mechanical properties and corrosion-resistance of the DION 9100 series.

DION 9102-00 is unique, because it is Certified to NSF/ANSI 61 for use in domestic and commercial potable water applications in both piping and tanks.

APPLICATION

- Can be used in hand lay-up, spray-up and filament winding applications. Adapts to most other methods of fabrication with no additional modifications.

FEATURES	BENEFITS
• Premium epoxy vinyl ester polymer • DION® 9102-00 version is Certified by NSF International to NSF/ANSI Standard 61, Drinking Water System Components • Stabilized resin system	• Very good high-temperature stability • Resistance to a wide variety of corrosive environments • Tough, crack and stress-fatigue resistant laminates
• Low Viscosity	• Can be used in potable (drinking) water applications
• Manufactured using statistical process control in ISO-9002 certified plants	• Extended shelf life • Improved glass fiber wet-out
• Compositional components listed under FDA 177.2420, Title 21	• Consistent batch-to-batch performance
• Extendible gel time to several hours at ambient temperature without affecting the cure	• Excellent for use in vacuum infusion and Cured-In-Place Pipe (CIPP) applications that require extended working time at ambient temperatures (Lateral Lining & Point Repair)

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TYPICAL PROPERTIES

PHYSICAL DATA IN LIQUID FORM AT 77°F

Version	Viscosity, CPS	Gel Time, minutes*	Specific Gravity	Shelf Life, Min.
DION 9102-00** NSF/ANSI 61 Certified	230	unpromoted	1.04	6 months
DION 9102-05	190	unpromoted	1.05	6 months
DION 9102-10	230	unpromoted	1.05	3 months
DION 9102-20	230	unpromoted	1.05	6 months
DION 9102-30	700	unpromoted	---	3 months
DION 9102-40	180	unpromoted	1.05	6 months

Seta Closed Cup Flash Point of all DION 9102 resins is 31.6°C (89°F)

* **See Page 3 for specific initiator and promotion addition tables for NSF/ANSI 61 applications.** See Page 4 for initiator and promoter addition tables for all other applications.

** **DION 9102-00 is the only version in this series Certified by NSF International to the NSF/ANSI 61 Standard for use in potable water.** It can also be used for non-NSF applications.

TYPICAL MECHANICAL PROPERTIES

Properties at 77°F	Unit	1/8" Clear Casting	Test Method
Barcol Hardness, Model 934-1	-	35	ASTM D 2583
Flexural Strength	psi	23000	ASTM D 790
Flexural Modulus, $x10^6$	psi	0.50	ASTM D 790
Tensile Strength	psi	11600	ASTM D 638
Tensile Modulus, $x10^6$	psi	0.46	ASTM D 638
Tensile Elongation (at break)	%	5.2	ASTM D 638
Heat Deflection Temperature (HDT)	°F	220	ASTM D 648

TYPICAL LAMINATE PROPERTIES AT ELEVATED TEMPERATURES

Temp (°F)	Tensile Strength (psi)	Tensile Modulus ($x10^6$, psi)	Flexural Strength (psi)	Flexural Modulus ($x10^6$, psi)
77	19200	1.70	32800	1.17
150	22100	1.70	33100	1.12
200	22700	1.39	25700	0.83
250	14600	0.80	3000	0.37
300	9900	0.80		

Laminate Construction: V-M-M-WR-M-WR-M-M
Glass Content: 42%
Thickness: 0.250 inches

V = 1 ply of 10 mil C-glass veil
M = 1 ply of 1.5 $oz/ft.^2$ of chopped strand mat
WR = 1 ply of 24 $oz/yd.^2$ of woven roving

DION9102-00 COATING SYSTEM CERTIFIED BY NSF INTERNATIONAL

REQUIREMENTS FOR USE OF DION 9102-00 IN A COATING SYSTEM CERTIFIED BY NSF TO ANSI/NSF STANDARD 61, DRINKING WATER SYSTEM COMPONENTS.

DION 9102-00 is recommended as a coating system in potable water tanks (>=150 gal) and piping (>=1/2" diameter) at ambient temperature

In potable water applications, the following are required of the coating system. ***Additional, non-specified chemical components or designated components that are utilized outside the percentage limitations specified below, constitutes non-compliance with the NSF Certified DION ® 9102-00 Coating System. Strict adherence to components and percentages is required.***

NSF®

Certified to NSF/ANSI 61

COMPONENT	***Percentage***
DION 9102-00	97.9% - 98.85%
MEKP by Norac (Norox MEKP-925) or Witco (HiPoint 90)	1% - 1.5%
Cobalt Napthenate 6% by OMG Americas, Inc.	0.1% - 0.4%
Dimethylaniline (DMA) by Aceto Corporation or Aarti Industries Ltd.	0.05% - 0.2%
50/50 Blend of Styrene & Paraffin Wax (for topcoating of air inhibited regions only). Paraffin Wax by Amoco Oil Company Eskar Wax R-35 Styrene by Amoco, Arco, Chevron, GE, Shell Chemical, Sterling Chemicals, Lyondell Chemical, Huntsman Chemical Corp.	0.0 -1.0%
Amorphous Fumed Silica (for topcoating) by Cabot Corp.(Cab-O-Sil TS-720) or Nippon Aerosil Co., Ltd. (Aerosil R-972)	0.0 -2.0%
Owens Corning Fiberglass C-veil	1 Ply (Veil Thickness – Nominal 10 mils)
Cure time shall be 2 – 100 hours at ambient temperature with a postcure of 4 hours at 160°F, followed by 2 hours at 180°F. Equipment must be washed with a non-ionic detergent solution after postcure and rinsed with potable water.	
The DION 9102-00 Coating System is Certified by NSF International to the requirements of NSF/ANSI Standard 61: Drinking Water System Components-Health Effects. This certification is non-transferable. Certain jurisdictions may require certain end products to be coated with an NSF Certified coating system, while other jurisdictions may require certain end products to be Certified to NSF 61. If you would like information regarding NSF Certification, please contact NSF International at info@nsf.org; www.nsf.org; or at 1-800-NSF-MARK.	

DION 9102 CURING

The DION 9102 products are unpromoted vinyl ester resins for use with cobalt naphthenate, or octoate, and an aniline accelerator which responds well to MEKP catalyst systems. Other catalysts work as well, but should be thoroughly evaluated prior to use. These resins however, are sensitive to low temperatures and care must be taken to avoid less than minimum stated quantities of MEKP type catalysts.

At temperatures below 60°F, it may be necessary to add dimethylaniline in incremental amounts of 0.05 phr to increase gel and cure profiles. For applications at high ambient temperatures (80-90°F) the MEKP catalyst levels must still be maintained above the minimum recommendation to achieve optimum cure. In order to lengthen gel times at these temperatures, it is suggested that the MEKP catalyst be maintained at 1.25 phr and the gel time be adjusted with additions of tert-butyl catechol solution (TBC-10) or low levels of 2,4 pentanedione (PDO).

The DION 9102 products can also be effectively cured using a benzyl peroxide (BPO) / dimethylaniline (DMA) system. **Note: BPO/DMA systems are not authorized for use in NSF/ANSI 61 situations.**

GUIDELINES FOR DION 9102 SERIES RESINS ● INITIATOR AND PROMOTER ADDITIONS (NOT TO BE USED IN NSF/ANSI 61 APPLICATIONS – REFER TO PAGE 3 FOR REQUIREMENTS IN THESE APPLICATIONS)

Add cobalt naphthenate and dimethyl aniline in quantities shown to achieve working life at the temperature indicated. Resin gel time will drift slightly if allowed to stand overnight. Readjust with additional DMA.

Guidelines for catalyst and promoter additions at various ambient temperatures:

Ambient Temperature (°F)	Additive (phr)[1]	Gel Time, minutes			
		10	20	30	60
55-65	6% cobalt[2]	-	0.4	0.3	0.2
	DMA	-	0.10	0.05	0.05
	HiPoint 90[3]	-	1.5	1.25	1.25
70-80	6% cobalt	0.4	0.3	0.2	0.1
	DMA	0.10	0.05	0.05	0.05
	HiPoint 90	1.5	1.25	1.25	1.00
85-95	6% cobalt	0.3	0.2	0.1	0.1
	DMA	0.05	0.05	0.05	0.00
	HiPoint 90	1.25	1.25	1.00	1.00

[1] phr = Parts per hundred resin.

[2] **Caution:** Excessive cobalt can inhibit cure and degrade corrosion resistance. Do not use more than 0.5% of cobalt 6% or 0.25% of cobalt 12%. If using cobalt octoate (12%), use half of the amount indicated in the chart for cobalt 6%.

[3] Witco HiPoint™90 or equivalent. HiPoint 90, Lucidol™ DHD-9 and Trigonox™ 239A have proven to be particularly well suited for curing DION vinyl ester resins. Trigonox 239A has been shown to reduce or eliminate foaming upon initiator addition, but may not adapt to the above cure grids. Other brands of MEKP have also been used successfully. A thorough evaluation of initiator characteristics is suggested prior to fabrication to satisfy user's expectations.

WARNING: CARE MUST BE TAKEN TO AVOID DIRECT MIXING OF ANY ORGANIC PEROXIDE WITH METAL SOAPS, AMINE OR ANY OTHER POLYMERIZATION ACCELERATOR OR PROMOTER, AS VIOLENT DECOMPOSITION WILL RESULT!

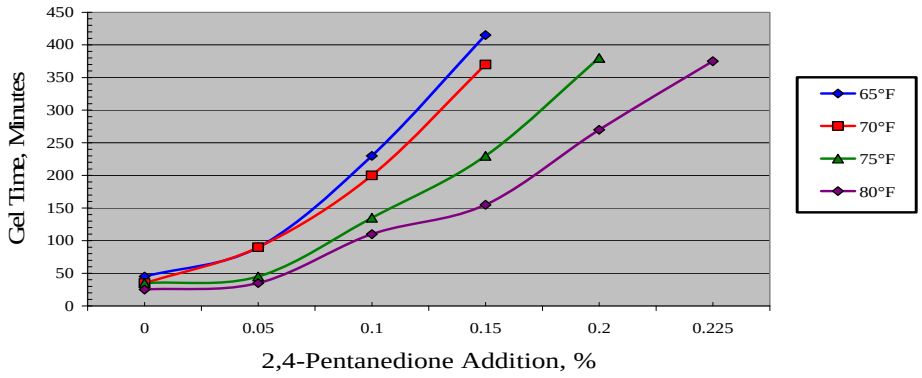
EXTENDED AMBIENT CURING TIME WITH DION 9102 USING 2,4 - PENTANEDIONE (PDO) (NOT FOR NSF/ANSI APPLICATIONS)

Due of the unique manner in which vinyl ester resins reacts when small amounts of 2,4-Pentanedione (PDO) are added, it is possible to extend the ambient temperature gel time of these resins without greatly affecting their peak exotherm and gel-to-peak profile. The following charts and graphs show ambient gel time data for various levels of 2,4-PDO at different temperatures.

Ambient Temperature (°F)	2,4- PDO Addition, phr[1]					
	0.0	0.05	0.1	0.15	0.2	0.225
65	00:45[2,3]	00:90	3:50	6:55	--	--
70	00:35	00:90	3:20	6:10	--	--
75	00:35	00:45	2:15	3:50	6:20	--
80	00:25	00:35	1:50	2:35	4:30	6:15

[1] phr = Parts per hundred resin
[2] Gel Times are listed in the format Hours:Minutes
[3] Resin was promoted using 0.4% cobalt 6% (by weight) and 0.05% DMA (by weight). The initiator used for this chart was Norac MEKP-925H at 1.25% (by weight).

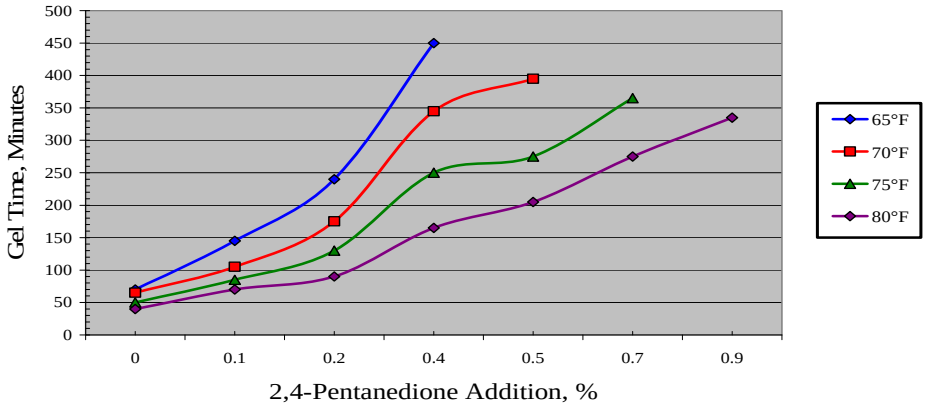
DION® 9102 Extended Ambient Temperature Gel Time with Norac MEKP-925H



Ambient Temperature (°F)	2,4- PDO Addition, phr[1]					
	0.0	0.2	0.4	0.5	0.7	0.9
65	1:10[2,3]	4:00	7:30	--	--	--
70	1:05	2:55	5:40	6:35	--	--
75	00:50	2:10	4:10	4:40	6:10	--
80	00:40	1:30	2:45	3:25	4:35	5:35[4]

[1] phr = Parts per hundred resin
[2] Gel Times are listed in the format Hours:Minutes
[3] Resin was promoted using 0.4% cobalt 6% (by weight) and 0.05% DMA (by weight). The initiator used for this chart was Norac 46727 CHP at 1.25% (by weight).
[4] Other gel tests were run using higher levels of 2,4-PDO. Results indicate that gel time will not lengthen significantly beyond the 0.9% level. The 2,4-PDO may actually begin to act as a promoter or plasticizer.

DION® 9102 Extended Ambient Temperature Gel Time with Norac 46727 CHP



DION 9102 PARAFFINATED TOPCOATS

Even fully cured resin of a non-mold sided surface can demonstrate some tackiness due to air inhibition. Surface cure may be improved by incorporating a paraffin wax into the resin to be used in the final ply. Alternatively, a wax modified resin can be added as a protective topcoat once the laminate has hardened. **These topcoated surfaces will negatively influence secondary bonding.** Grinding and additional surface preparation will become necessary to enhance the success of the bond.

SUGGESTED TOPCOAT FORMULATION (Not for NSF Applications)	
COMPONENT	***PARTS***
DION 9102-00	100.0
10% paraffin wax solution in styrene	5.0
DMA (dimethylaniline)	0.2
6% cobalt naphthenate	0.4
Tween® 20 or 80	0.3
Fumed silica thixotrope*	1.5
HiPoint 90 or DHD-9 initiator	1.3

Approximate gel time, minutes; 15

* Use in sodium hypochlorite environments will result in decreased chemical resistance. We suggest this be omitted from the formulation in those situations. Hydrophobic grades of fumed silica are suggested for vinyl ester resins.

STORAGE

These DION 9102 products are available in non-returnable 55-gallon metal drums (400 lb.net) or 40,000-44,000-lb. tank trucks.

To ensure maximum stability and maintain optimum resin properties, resins should be stored in closed containers at temperatures below 75°F (25°C) and away from heat sources and sunlight. All storage areas and containers should conform to local fire and building codes. Drum stock should be stored away from all sources of flame or combustion. Inventory levels should be kept to a reasonable minimum with first-in, first-out stock rotation.

Additional information on handling and storing unsaturated polyester resins is available in ***REICHHOLD***'s application bulletin **"Bulk Storage and Handling of Unsaturated Polyester Resins".** For information on other ***REICHHOLD*** resin products and systems, contact your local Sales Representative or Authorized ***REICHHOLD*** Distributor.

SAFETY

READ AND UNDERSTAND THE MATERIAL SAFETY DATA SHEET BEFORE WORKING WITH THIS PRODUCT

Obtain a copy of the Material Safety Data Sheet (MSDS) on this product prior to use. Material Safety Data Sheets are available from your local ***REICHHOLD*** Sales Representative or Authorized ***REICHHOLD*** Distributor. In addition, Material Safety Data Sheets can be obtained at www.reichhold.com .Such information should be requested from suppliers of all other products and components and understood prior to working with their materials.