REICHHOLD

PRODUCT BULLETIN

Revision Date (July 2012)

DION® 9100 Series

Bisphenol-Epoxy Vinyl Ester Resins

DESCRIPTION

The DION® 9100 Series are bisphenol-epoxy vinyl ester resins that provide corrosion-resistance in a wide variety of acidic and alkaline environments. These tough, high-strength resins can be used to produce glass-reinforced laminates with excellent impact and stress-fatigue resistance.

APPLICATION

DION® 9100 Series resins are ideal for filament winding operations and applications that require resistance to corrosive environments and thermal cycling.

FEATURES	BENEFITS
• Premium epoxy vinyl ester polymer	• Very Good high temperature stability • Resistance to a wide variety of corrosive environments • Tough, crack and stress-fatigue resistant laminates
• Stabilized resin system	• Extended Shelf Life
• Manufactured using statistical process controls	• Consistent batch-to-batch performance
• Chemical components listed under FDA 177.2520 Title 21	• Can be used in food and beverage contact applications • Can be used in many potable water applications
• Laminates based on DION® 9100 resins can meet BS6920 requirements	
• Extendable gel time technology	• Allows additional time for thick lay-ups, large diameter winding and prolonged pot life

The information herein is general information designed to assist customers in determining whether our products are suitable for their applications. Our products are intended for sale to industrial and commercial customers. We require customers to inspect and test our products before use and to satisfy themselves as to contents and suitability for their specific applications. We warrant that our products will meet our written specifications. **Nothing herein shall constitute any other warranty express or implied, including any warranty of merchantability or fitness for a particular purpose**, nor is any protection from any law or patent to be inferred. All patent rights are reserved. The exclusive remedy for all proven claims is limited to replacement of our materials and in no event shall we be liable for special, incidental or consequential damages.

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TYPICAL PROPERTIES

TYPICAL LIQUID PROPERTIES @ 25ºC					
Version	**Viscosity, cps**	**Gel Time, Minutes[2]**	**Wt. % N.V.**	**Specific Gravity**	**Shelf Life, Min.[3]**
DION® 9100-00	500	Unpromoted	56.0	1.05	3 months
DION® 9100-48	500	20	55.0	1.05	3 months
DION® 9100-50	500	Unpromoted	56.0	1.05	3 months
DION® 9100-55	400	Unpromoted/thixotropic	50.0	1.125	3 months
Flash point [1]	31.6 c (89F) all versions				

1. Seta Closed Cup Flash Point of all DION® 9100 resins is 31.6ºC (89ºF)
2. 1.25 wt.% Hi Point 90, 50 gram mass
3. Minimum shelf life performance refers to product in the original, unopened container. Shelf stabily is affected by storage conditions. See the "Storage" section of this bulletin for further details.

TYPICAL MECHANICAL PROPERTIES[1]		
	ASTM TEST METHOD	**CLEAR CASTING**
Barcol Hardness	D-2583	35
Heat Deflection Temperature, ºF	D-648	220
Tensile Strength, psi	D-638	11,600
Tensile Modulus, x 10^6 psi	D-638	0.46
Tensile Elongation @ Break, %	D-638	5.2
Flexural Strength, psi	D-790	23,000
Flexural Modulus, x 10^6 psi	D-790	0.50

TYPICAL LAMINATE PROPERTIES AT ELEVATED TEMPERATURES[1]				
Temp., ºF	**Tensile Strength, psi**	**Tensile Modulus x10^6, psi**	**Flexural Strength, psi**	**Flexural Modulus x10^6, psi**
77	19,200	1.70	32,800	1.17
150	22,100	1.70	33,100	1.12
200	22,700	1.39	25,700	0.83
250	14,600	0.80	3,000	0.37
300	9,900	0.80	--	--

Laminate Construction: V/M/M/WR/M/WR/M/M

Glass Content: 42%
Thickness: 0.250 inches

V = 10 mil C-Glass Veil
M = 1.5 oz./sq.ft Chopped Strand Mat
WR = 24 oz./sq.yd. Woven Roving

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[1] Properties reported in this bulletin are typical of those obtained in controlled laboratory tests and will vary in production conditions.

DION 9100 CURE DATA

The DION® 9100 Series of resins are most commonly formulated for use with initiator systems that employ cobalt promoters and dimethyl aniline (DMA), or diethyl aniline (DEA) accelerators. The most common initiator is methyl ethyl ketone peroxide (MEKP), but among the others that can be used are straight cumene hydroperoxide (CHP), MEKP/CHP blends at various ratios, and commercially available, non-foaming CHP/MEKP modified blends. Unpromoted versions of the DION® 9100 Series can be utilized with benzyl peroxide (BPO) pastes when used with DMA or DEA accelerators. This is sometimes required for certain chemical environments. Prepromoted versions require the addition of initiator only, or in some cases, gel time extender additives. Vinyl ester resins are acutely sensitive to cobalt. If the gel time must be adjusted, use DMA to accelerate it or a 10% solution of tertiary-butyl catechol (TBC-10) to slow it down. Maintain initiator levels at 1.25-2.5 wt. %.

The curing performance of DION® 9100 Series resins is also sensitive to changes in temperature. For best results, use of less than 1.25% initiators is not recommended. When long gel times at high ambient temperatures are required, the initiator level should be maintained at 1.25% and gel time adjusted by adding TBC-10 or 2,4 pentandione. At ambient temperatures below 60ºF, it may be necessary to add additional aniline to increase gel and cure rates.

GUIDELINES FOR DION INITIATOR AND PROMOTER ADDITIONS 9100-00, 9100-50, 9100-55

Blend in 6% cobalt naphthenate and dimethyl aniline (DMA) in the quantities listed below to achieve the appropriate working time at the indicated temperatures. Thorough mixing after the addition of each component is essential. Resin gel time may drift if allowed to stand overnight or longer. Adjust with additional DMA.

		Gel Time, Minutes		
Ambient Temperature, ºF	Additive, phr[1]	20	30	60
55-65	6% Cobalt[2] DMA MEKP[3]	0.5 0.3 2.0	0.5 0.15 2.5	0.4 0.15 2.0
70-80	6% Cobalt DMA MEKP	0.5 0.3 2.5	0.5 0.1 2.5	0.2 0.1 1.25
80-90	6% Cobalt DMA MEKP	0.4 0.02 2.0	0.3 0.01 1.5	-- -- --

[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 naphthenate (6%) or 0.25% of cobalt octoate (12%). If using cobalt ocotate (12%), use half of the amount indicated in the chart for cobalt naphthenate 6%.
[3]MEKP (9% oxygen) initiators, such as HiPoint 90, DHD 9, MEKP 925, or equivalents.

Trigonox™ 239A has been shown to reduce or eliminate foaming upon initiator addition. Other brands of commercially available non-foaming initiators have also been used successfully. A thorough evaluation of any initiator response is suggested prior to fabrication.

Cumene Hydroperoxide (CHP) alone and CHP/MEKP blends can be used in promoted and accelerated DION® 9100 Series resins. Foaming is eliminated in vinyl ester resins with the use of straight CHP. This is a useful initiator for thick parts that yields lower composite exotherms, which reduces shrinkage and warpage in the composite where dimensional deviations cannot be tolerated. CHP also moderately extends gel times and pot life when fabricating in higher ambient temperatures.

[4]2,4-Pentanedione (aka, Acetylacetone) gel time retarder.

DION® 9100 Series PARAFFINATED TOPCOATS

Even fully cured resin can retain a tacky surface. Surface cure may be improved by incorporating a paraffin wax into the resin used in the final ply. Alternatively, a wax modified resin can be added as a topcoat once the laminate has hardened.

SUGGESTED TOPCOAT FORMULATION

Component	Parts
DION® 9100[1] Series, Parts	100.0
10% Paraffin wax solution in styrene	5.0
DMA	0.2
6% cobalt naphthenate	0.4
Tween® 20 or 80	0.3
Fumed silica thixotrope[2]	1.5
MEKP initiator	1.3
Approximate gel time, minutes	20

1. Does not include DION® 9100-48
2. Use in sodium hypochlorite environments will result in decreased chemical resistance. Hydrophobic grades of fumed silica are suggested for vinyl ester resins.

STORAGE

To ensure maximum stability and maintain optimum resin properties, resins should be stored in the original closed container at temperature below 24°C/75°F and away from heat ignition sources and sunlight. Resin should be warmed to at least 18°C/65°F prior to use in order to assure proper curing and handling. All storage areas and containers should conform to local fire and building codes. Copper or copper containing alloys should be avoided as containers. Store separate from oxidizing materials, peroxides and metal salts. Keep containers closed when not in use. Inventory levels should be kept to a reasonable minimum with first-in, first-out stock rotation.

Additional information on handling and storing unsaturated polyesters is available in Reichhold's Application Bulletin "Bulk Storage and Handling of Unsaturated Polyester Resins." For information on other Reichhold resins, additives or initiators, contact your Sales Representative or authorized Reichhold Distributor.

SHELF LIFE

Shelf life is three months from date of shipment. Minimum shelf life performance refers to product in the original, unopened container.

STANDARD PACKAGE

This product is available in non-returnable 55-gallon metal drums (**452 lb. net**) or 42,000 – 44,000-lb. tank truck.

SAFETY

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

Obtain a copy of the Material Safety Data Sheet on this product or contact the Reichhold service center prior to use. Material Safety Data Sheets are available from your Reichhold Sales Representative. Such information should be requested from suppliers of all products and understood prior to working with their materials.

DIRECTLY MIXING ANY ORGANIC PEROXIDE WITH A METAL SOAP, AMINE, OR OTHER POLYMERIZATION ACCELERATOR OR PROMOTER WILL RESULT IN VIOLENT DECOMPOSTION. WHEN ADDING ORGANIC PEROXIDES TO A RESIN SOLUTION, PROMPTLY AND THOROUGHLY MIX THE RESULTING PRODUCT. NEVER ADD ORGANIC PEROXIDES TO A HOT DILUENT OR PROCESS. PREVENT CONTAMINATION WITH FOREIGN MATERIALS, INCLUDING WITHOUT LIMITATION, ACCELERATORS (SUCH AS DIMETHYL ANILINE, OTHER AMINES, OR COBALT COMPOUNDS), HEAVY-METAL OXIDES OR SALTS (PARTICULARLY THOSE OF COBALT, IRON AND COPPER), STRONG ACIDS AND SANDING DUSTS. USE CLEAN CONTAINERS MADE OF GLASS, POLYPROPYLENE, TEFLON, POLYETHYLENE, OR CERAMIC TO PREVENT CONTAMINATION OF ORGANIC PEROXIDES DURING ITS HANDLING.

TECHNICAL SUPPORT

Reichhold's Technical Support Staff has extensive practical experience with various composites resins, end use performance and manufacturing techniques. Please do not hesitate to request our assistance through your Reichhold Sales or Technical Representative.

Copies of test methods used to determine reported properties are available through your Reichhold Representative.

Each user must determine the suitability of this product to his/her particular mode of operation and intended end use application. A Reichhold representative will be available to assist in the proper selection of all Reichhold products available for commercial use.

Properties reported in this bulletin are typical of those obtained in controlled laboratory tests and may vary in actual production; therefore, we require our customers to inspect and test our products before using them to satisfy themselves as to contents and suitability. We warrant that our products will meet our written specifications. **Nothing herein shall constitute any other warranty express or implied, including any warranty of merchantability or fitness for a particular purpose, nor is protection from any law or patent to be inferred.**

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