

STYRENE FREE CIPP RESINS – A MANAGABLE ALTERNATIVE

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INTERPLASTIC CORPORATION
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DEFINITION “STYRENE FREE”

- CONTAINS REACTIVE DILUENTS
- REACTIVE DILUENTS CLASSIFIED AS
 - NO VOC
 - NO HAP
- MEETS THE REQUIREMENTS FOUND IN ASTM F1216
- PROCESSES SIMILAR TO STANDARD CIPP RESINS
- COST EFFECTIVE

RESINS DISCUSSED

NEAT STYRENE FREE RESIN "A"

- DESIGNED FOR PRESSURE PIPE APPLICATION
- TYPICALLY USED WITH REINFORCED OR HYBRID BAGS
- USED WITH UV INITIATED SYSTEMS
- VE RESIN BASE

ENHANCED STYRENE FREE RESIN "B"

- MORE ECONOMICAL ALTERNATIVE
- DESIGNED FOR GRAVITY PIPELINES
- FOR USE IN FELT OR HYBRID BAGS
- HIGHER MODULUS NUMBERS IN FELT BAG SYSTEMS
- VE RESIN BASE

COMPARISON

STYRENATED RESINS

- MEETS ASTM F1216 CORROSION REQUIREMENTS
- MEETS ASTM F1216 PHYSICAL PROPERTY REQUIREMENTS
- MEETS ASTM D2990 “CREEP” REQUIREMENTS
- MAY BE PROCESSED WITH HOT AIR, HOT WATER, UV LIGHT, OR CURED AMBIENTLY

STYRENE FREE RESINS

- MEETS ASTM F1216 CORROSION REQUIREMENTS
- MEETS ASTM F1216 PHYSICAL PROPERTY REQUIREMENTS
- MEETS ASTM D2990 “CREEP” REQUIREMENTS
- MAY BE PROCESSED WITH HOT AIR, HOT WATER, UV LIGHT, OR CURED AMBIENTLY
- SLIGHTLY LONGER CURE TIME AT SIMILAR TEMPERATURES

MECHANICAL PROPERTIES

6.4mm THICK FELT LAMINATE

TEST	ASTM	RESIN A		RESIN B	
FLEXURAL STRENGTH	D790	70 MPa	10,064 PSI	76 MPa	11,000 PSI
FLEXURAL MODULUS	D790	3,556 MPa	5.12 X 10 ⁵ PSI	3,500 MPa	5.10 X 10 ⁵ PSI
TENSILE STRENGTH	D638	25 MPa	3,603 PSI	47 MPa	6,800 PSI
TENSILE MODULUS	D638	3,945 MPa	5.72 X 10 ⁵ PSI	3,700 MPa	5.30 X 10 ⁵ PSI
TENSILE ELONGATION	D638	1.5%	1.5%	2.0%	2.0%

MECHANICAL PROPERTIES

3.2mm THICK CLEAR CASTING

TEST	ASTM	RESIN A		RESIN B	
FLEXURAL STRENGTH	D790	109 MPa	14,431 PSI	132 MPa	19,100 PSI
FLEXURAL MODULUS	D790	3,786 MPa	5.49 X 10 ⁵ PSI	3,241MPa	4.7 X 10 ⁵ PSI
TENSILE STRENGTH	D638	72 MPa	10,505 PSI	76 MPa	11,000 PSI
TENSILE MODULUS	D638	3,731 MPa	5.41 X 10 ⁵ PSI	3,172 MPa	4.6 X 10 ⁵ PSI
TENSILE ELONGATION	D638	2.39%	2.39%	4.2%	4.2%
BARCOL HARDNESS, 934-1 gauge	D2583	52	52	36	36
HEAT DISTORTION TEMPERATURE	D648	118 °C	244 °F	102 °C	215 °F

CORROSION RESISTANCE

PRODUCT

VE8290

ASTM D5813

Flexural Modulus % Retention

Initial Modulus: 531,135 psi

Months →

1% Nitric Acid

5% Sulfuric Acid

Fuel C

0.1% Detergent

0.1% Soap Solution

100% Vegetable Oil

	1	12
1% Nitric Acid	95.49	100.00
5% Sulfuric Acid	97.20	100.00
Fuel C	98.86	99.00
0.1% Detergent	98.33	99.00
0.1% Soap Solution	96.38	98.00
100% Vegetable Oil	101.66	100.00

Flexural Strength, % Retention

Initial Strength: 9,368 psi

	1	12
1% Nitric Acid	101.68	99.00
5% Sulfuric Acid	104.36	96.00
Fuel C	104.14	100.00
0.1% Detergent	99.07	97.00
0.1% Soap Solution	98.75	96.00
100% Vegetable Oil	96.22	95.00

ASTM F1216

Flexural Modulus % Retention

Initial Modulus: 531,135 psi

Months →

100% Tap Water (pH 6 - 9)

5% Nitric Acid

10% Phosphoric Acid

10% Sulfuric Acid

Fuel C

0.1% Detergent

0.1% Soap Solution

100% Vegetable Oil

	1	12
100% Tap Water (pH 6 - 9)	95.20	100.00
5% Nitric Acid	95.49	100.00
10% Phosphoric Acid	95.33	100.00
10% Sulfuric Acid	97.20	100.00
Fuel C	98.86	99.00
0.1% Detergent	98.33	99.00
0.1% Soap Solution	96.38	98.00
100% Vegetable Oil	101.66	100.00

Flexural Strength, % Retention

Initial Strength: 9,368 psi

	1	12
100% Tap Water (pH 6 - 9)	101.09	99.00
5% Nitric Acid	101.68	99.00
10% Phosphoric Acid	99.19	97.00
10% Sulfuric Acid	104.36	96.00
Fuel C	104.14	100.00
0.1% Detergent	99.07	97.00
0.1% Soap Solution	98.75	96.00
100% Vegetable Oil	96.22	95.00

CORROSION RESISTANCE

PRODUCT

VE8295

ASTM D5813

Flexural Modulus % Retention

Initial Modulus: 672,616 psi

Months →

1% Nitric Acid
5% Sulfuric Acid
Fuel C
0.1% Detergent
0.1% Soap Solution
100% Vegetable Oil

	1	12
1% Nitric Acid	104.60	90.66
5% Sulfuric Acid	103.38	93.44
Fuel C	100.89	95.61
0.1% Detergent	95.70	99.79
0.1% Soap Solution	94.50	99.80
100% Vegetable Oil	99.97	106.02

Flexural Strength, % Retention

Initial Strength: 9,033 psi

	1	12
1% Nitric Acid	96.98	95.78
5% Sulfuric Acid	96.58	94.96
Fuel C	98.79	99.34
0.1% Detergent	101.87	94.42
0.1% Soap Solution	99.65	93.09
100% Vegetable Oil	101.87	95.16

ASTM F1216

Flexural Modulus % Retention

Initial Modulus: 672,616 psi

Months →

100% Tap Water (pH 6 - 9)
5% Nitric Acid
10% Phosphoric Acid
10% Sulfuric Acid
Fuel C
0.1% Detergent
0.1% Soap Solution
100% Vegetable Oil

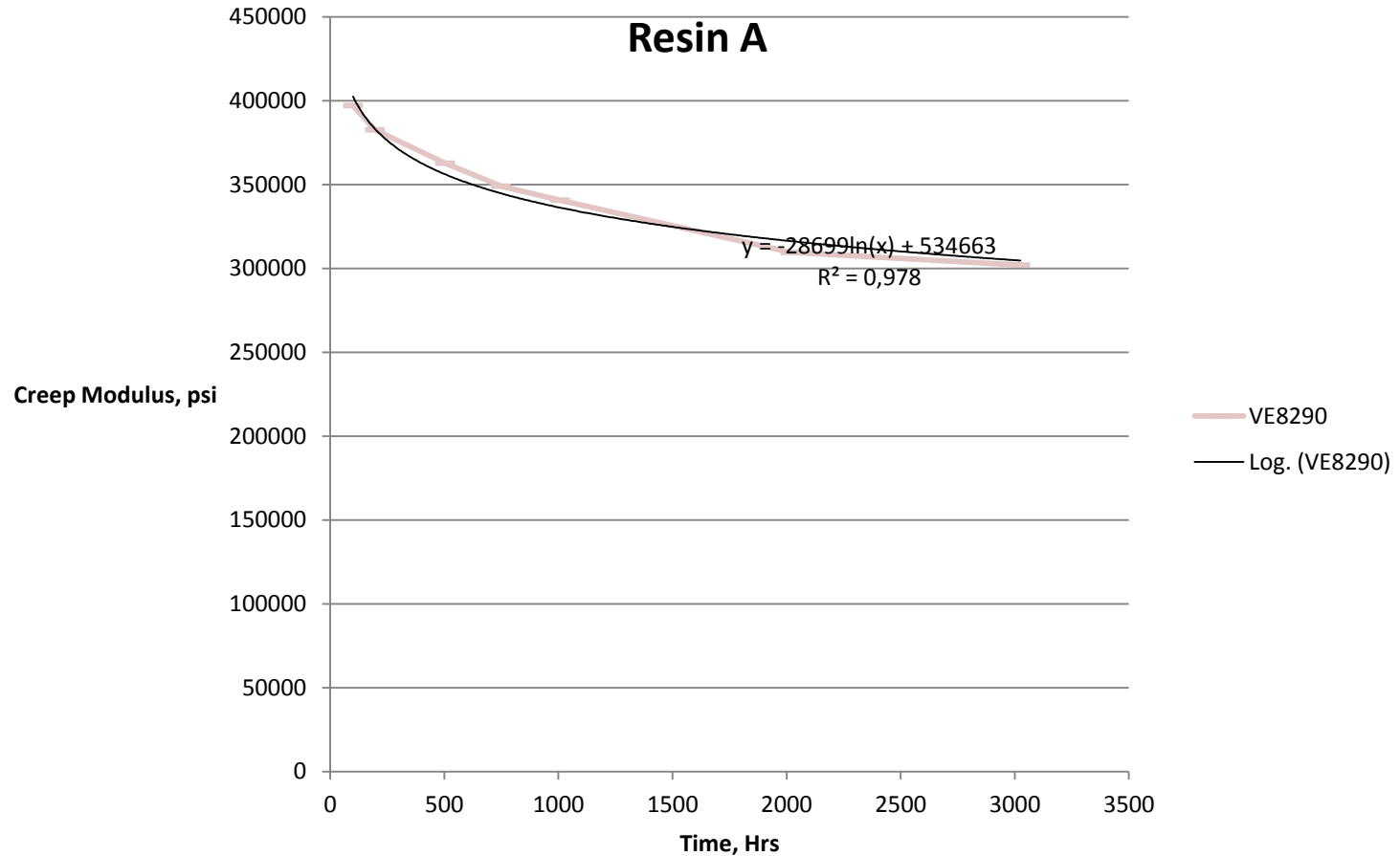
	1	12
100% Tap Water (pH 6 - 9)	98.90	93.98
5% Nitric Acid	104.60	90.66
10% Phosphoric Acid	105.81	94.28
10% Sulfuric Acid	103.38	93.44
Fuel C	100.89	95.61
0.1% Detergent	95.70	99.79
0.1% Soap Solution	94.50	99.80
100% Vegetable Oil	99.97	106.02

Flexural Strength, % Retention

Initial Strength: 9,033 psi

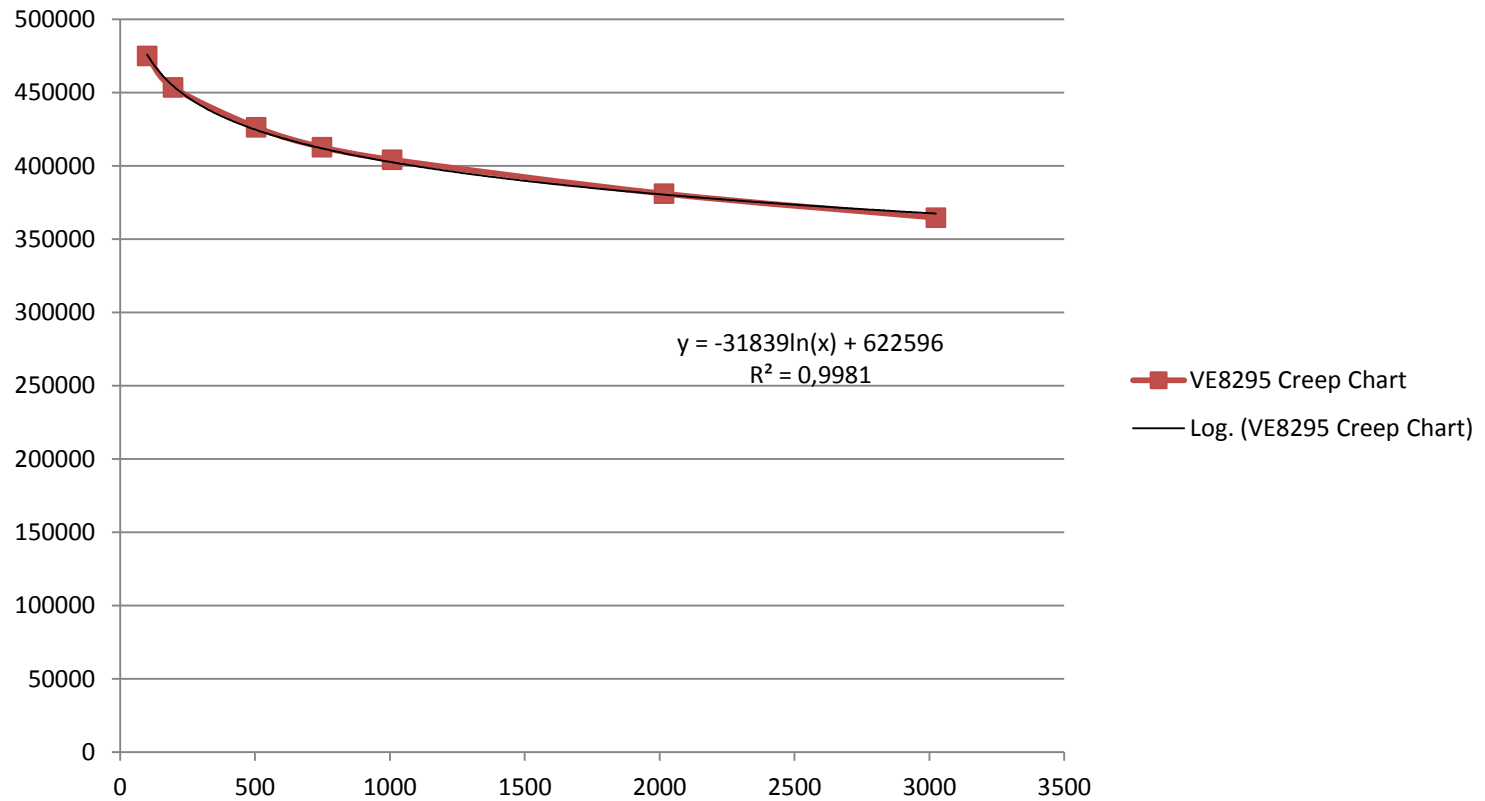
	1	12
100% Tap Water (pH 6 - 9)	101.09	86.24
5% Nitric Acid	96.98	95.78
10% Phosphoric Acid	98.68	95.03
10% Sulfuric Acid	96.58	94.96
Fuel C	98.79	99.34
0.1% Detergent	101.87	94.42
0.1% Soap Solution	99.65	93.09
100% Vegetable Oil	101.87	95.16

CREEP TESTING – ASTM D2990



CREEP TESTING – ASTM D2990

Resin B



The Economics of Styrene Free Resins

- Styrene Free Resins process as easily as styrenated resins
- Styrene Free Resins can achieve the necessary mechanical properties and corrosion resistance
- Styrene Free resins can achieve the same design life as styrenated resins
- Styrene Free Resin liners , installed, may be 10 – 30% more expensive than liners using styrenated resins

CONCLUSIONS

- STYRENE FREE RESIN SYSTEMS ARE AVAILABLE FOR CIPP PROCESSING THAT WILL ACHIEVE COMPARABLE MECHANICAL PROPERTIES, CORROSION RESISTANCE AND LONG LIFE AS CURRENTLY AVAILABLE STYRENE CONTAINING SYSTEMS
- THE DISCUSSED SYSTEMS ARE VOC AND HAP FREE AND ARE BEING EVALUATED AS NSF APPROVED RESINS FOR DRINKING WATER

THANK YOU!

QUESTIONS OR COMMENTS?



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