Technical Overview

Concrete Structural Repairs

SYNTHO-GLASS® XT

VIPER-SKIN™

TITAN™-XT

2008 Plant Engineering PRODUCT of the YEAR WINNER

NRI®

Innovative Composite Solutions

1346 S. KILLIAN DRIVE ◊ LAKE PARK, FL 33403 USA

561.683.6992 phone ◊ 561.683.8366 fax

NEPTUNERESEARCH.COM

Innovative Composite Solutions

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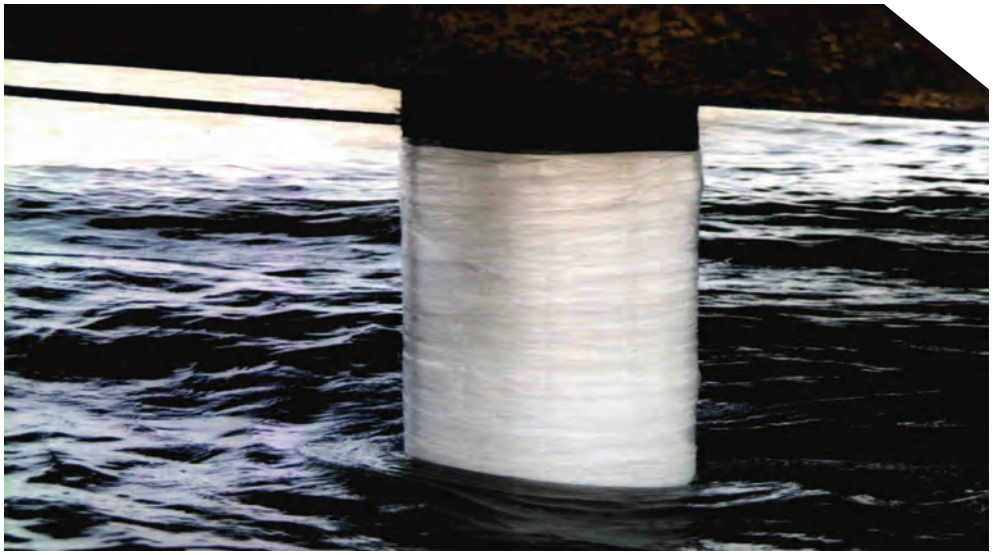
SYNTHO-GLASS® XT

EXTREME STRENGTH FIBERGLASS COMPOSITE SYSTEM



Description

Syntho-Glass®XT system is a unique pre-impregnated, bidirectional composite used to repair and reinforce concrete structures without expensive and time-consuming rebuilding cost. The initial development of this system was designed to conform to ACI440 standards for composite nonmetallic reinforcing solutions of concrete. This extreme strength design minimizes the time and cost of refurbishment by reducing the time to repair, as well as the replacement cost of the concrete structure.

The Syntho-Glass XT system provides a cost-effective solution by:

- Eliminating field mixing and wetting of the composite system to ensure proper fiber-to-resin content ratios that are crucial to reliable performance.
- Combining simplicity with flexibility to permit application to irregular shapes and geometries, thereby reducing parts inventory.
- Incorporating proprietary load transfer and bonding technology results in a high-tensile wrap capable of repairing concrete.

Mechanical Properties

Test	Method	Result
Tensile Strength	ASTM D3039	0 °: 54,000 psi (3724.0 bar) 90 °: 34,000 psi (2344.8 bar)
Hardness, Shore D @ 75°F (24°C)	ASTM D2240	24 Hours: 83
Flexural Strength	ASTM D790	58,680 psi (4046.8 bar)
In-Plane Shear Strength	ASTM D5379	7,520 psi (518.6 bar)
CTE	ASTM D648	1.06E-05 inches/inches/°F

Typical Applications

- Concrete pipe supports
- Piers and pilings
- Bridge columns
- Concrete columns, beams, slabs

Benefits

- Water-activated urethane resin reduces composite preparation time by over 50%
- Installation in wet, rainy, or submerged environments ensures ease of application in virtually any situation
- Full factory engineering consultation and support, ensuring safe and successful repairs

Physical Properties

VOCs: None

Service Temperature:
-50° to 173°F (-46° to 78°C)

Application Temperature:
50° to 150°F (10° to 65°C)

Resin Type: Water-activated polyurethane

Resin Application:
Micro-controlled, Pre-impregnated

Working Time: 30 Minutes @ 75°F (24°C)

Initial Cure Time: 2 Hours @ 75°F (24°C)

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VIPER•SKIN™
CARBON FIBER
COMPOSITE REINFORCEMENT SYSTEM

Description

Viper-Skin™ is the first biaxially, hybrid carbon and glass fiber polyurethane prepreg system that blends the unsurpassed strength and stiffness of carbon with the ease of use of a moisture-cured prepreg. This carbon fiber reinforcement composite system uses a micro-controlled, wet-out process. As a result, nearly perfect resin content and maximum, repeatable strength properties are attainable. The time and cost associated with field wetting of the composite is removed from the equation altogether and the moisture-curing properties allow for underwater and wet environment applications.

The Viper Skin system provides a cost-effective solution by:

- Eliminating field mixing and wetting of the composite system to ensure proper fiber-to-resin content ratios that are crucial to reliable performance.
- Combining simplicity with flexibility to permit application to irregular shapes and geometries, thereby reducing parts inventory.
- Incorporating proprietary load transfer and bonding technology results in a high-tensile wrap capable of repairing concrete structures.

Mechanical Properties

Test	Method	Result
Tensile Strength	ASTM D3039	0 °: 100,000 psi (6894.7 bar) 90 °: 20,000 psi (1378.95 bar)
Hardness, Shore D @ 75°F (24°C)	ASTM D2240	24 Hours: 83
Flexural Strength	ASTM D790	61,600 psi (4,247 bar)
In-Plane Shear Strength	ASTM D5379	6,145 psi (423 bar)
CTE	ASTM E831	3.218 µm/m°C

Typical Applications

- Concrete pipe supports
- Piers and pilings
- Bridge columns
- Concrete columns, beams, slabs

Benefits

- Water-activated urethane resin reduces composite preparation time by over 50%
- Installation in wet, rainy, or submerged environments ensures ease of application in virtually any situation
- Full factory engineering consultation and support, ensuring safe and successful repairs

Physical Properties

VOCs: None

Working Time: 30 Minutes @ 75°F (24°C)

Initial Cure Time: 2 Hours @ 75°F (24°C)

Resin Type: Water-activated polyurethane

Resin Application:

Micro-controlled, Pre-impregnated

Service Temperature:

-50° to 173°F (-46° to 78°C)

Application Temperature:

32° to 150°F (18° to 65°C)

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TITAN™ XT

FIBERGLASS/EPOXY COMPOSITE SYSTEM FOR INFRASTRUCTURE REPAIR

Description

NRI's epoxy based infrastructure repair system is a custom engineered composite system that utilizes a high strength bidirectional (0°/90°), woven fiberglass tape in combination with NRI's proprietary epoxy resin formulation. This unique composite is used to repair and reinforce concrete structures without expensive and time-consuming rebuilding cost. The development of this system was designed to conform to ACI440 standards for nonmetallic composite reinforcing solutions of concrete. The superior performance values of the epoxy based system give you the tensile strength of a carbon fiber composite at a price of a fiberglass composite solution. By incorporating proprietary load transfer and bonding technologies developed by NRI, this results in a highly effective system capable of repairing concrete in the toughest conditions.

Mechanical Properties

Test		Method	Result
Tensile Properties	Strength	ASTM D638	0°: 101,500 psi (6,998 bar) 90°: 35,700 psi (2461 bar)
	Modulus	ASTM D638	0°: 4.48 msi (308,885 bar) 90°: 2.32 msi (159,958 bar)
Flexural Properties	Strength	ASTM D790	0°: 121,700 psi (8,390 bar) 90°: 54,500 psi (3,757 bar)
	Modulus	ASTM D790	0°: 4.18 msi (288,200 bar) 90°: 2.35 msi (162,026 bar)
Shear Properties	Strength	ASTM D5379	0°: 13,000 psi (2,896 bar) 90°: 10,000 psi (690 bar)
	Chord Modulus	ASTM D5379	0°: 629 ksi (43,368 bar) 90°: 683 ksi (162,026 bar)
Hardness, Shore D		ASTM D2240	74
Lap Shear Strength		ASTM D5379	3,150 psi (217 bar)

Typical Applications

- Concrete pipe supports
- Piers and pilings
- Bridge columns
- Concrete/Steel columns, beams, slabs

Benefits

- No VOCs minimizes potential safety hazards while making the entire installation user-friendly
- Full factory engineering consultation and support, ensuring safe and successful repairs
- Eliminate field saturation problems by using NRI's patented field impregnation machine
- Consistent resin-to-fiber ratios crucial to performance and reliability
- Application to irregular shapes and odd geometries

Physical Properties

VOCs: None

Service Temperature:
-50° to 300°F (-46° to 150°C)

Application Temperature:
50° to 200°F (10° to 93°C)

Working Time: 2 hours @ 75°F (24°C)

Cure Time: 18 Hours @ 75°F (24°C)

Resin Type:
Two-Part, 100% Solids, Proprietary Epoxy Resin Formulation

Resin Application: Field-Impregnated

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Bodycote TESTING GROUP
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Test Certificate

6/25/2008

Sample ID: 30004987 Tensile
Method: Poisson's Ratio

Test Date: 6/20/2008
Operator: Ahamed Shabeer

Sample Information:

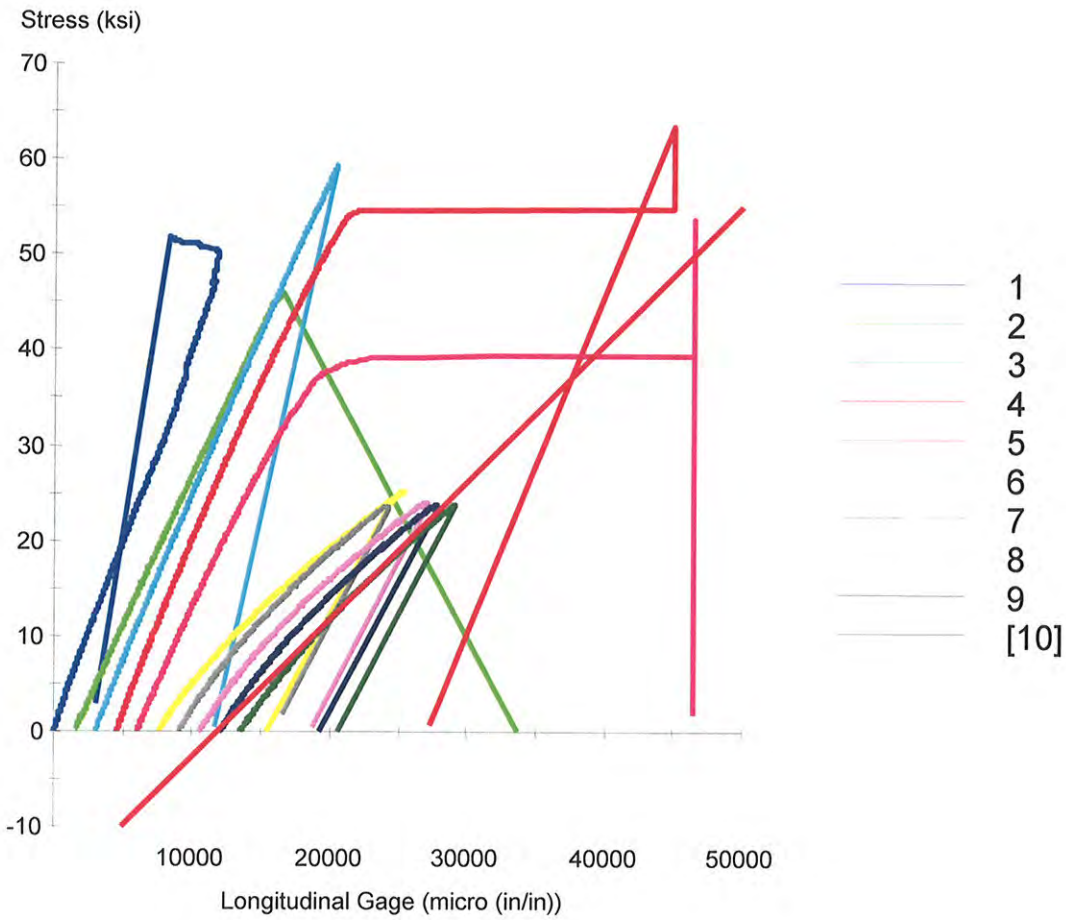
Name	Value
01) Customer:	Neptune Research
02) Job #:	30004987
03) Material:	Fiber Glass Composite
04) Specimen Type:	1" Strips
05) Conditioning:	40hr. @, 72F, & 50%rh.
06) Test Temperature, & Humidity:	74F, 52%rh
07) Method:	ASTM D3039

Specimen Results:

Test	Client ID	Specimen ID	Thickness (in)	Width (in)	Chord Modulus Strain (0.1% - 0.3%) (ksi)	Poisson's Ratio (0.1% - 0.3%)	Strain At Break (%)	Peak Stress (psi)
1	0 Degree	30004987-A1	0.0989	0.991	3974.86	0.1509	0.829	51891.3
2		30004987-A2	0.0982	0.994	3269.38	0.1160	1.508	45892.1
3		30004987-A3	0.0986	0.991	3670.98	0.1232	1.742	59273.9
4		30004987-A4	0.0979	0.992	3739.03	0.1486	1.723	63353.6
5		30004987-A5	0.0985	0.992	3321.91	0.1245	1.715	53622.3
Mean			0.0984	0.992	3595.23	0.1326	1.503	54806.6
Std.Dev			0.000	0.001	296.40	0.02	0.39	6752.3
6	90 Degree	30004987-B1	0.0945	0.995	1866.36	0.0535	1.782	25237.0
7		30004987-B2	0.0941	0.996	2068.05	0.0692	1.513	23617.8
8		30004987-B3	0.0943	0.999	1992.84	0.0775	1.654	24008.1
9		30004987-B4	0.0945	0.996	1939.81	0.0753	1.559	23857.1
10		30004987-B5	0.0940	0.995	1922.37	0.0680	1.565	23866.4
Mean			0.0942	0.996	1957.88	0.0687	1.6146	24117.2
Std. Dev.			0.000	0.002	76.36	0.01	0.11	641.4

Test Inputs:

Name	Value	Units
Break Sensitivity	90	%
Break Threshold	50.000	lbf
Data Acq. Rate	10.0	Hz
Test Speed	0.05	in/min



Sample ID: 30004987 Tensile

Method: Poisson's Ratio

Test performed by: Ahamed Shabeer

Signature:

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Test Certificate

6/25/2008

Sample ID: 30004987 Flexural
Method: ASTM D790- 3 Point Flex

Test Date: 6/23/2008
Operator: Ahamed Shabeer

Sample Information:

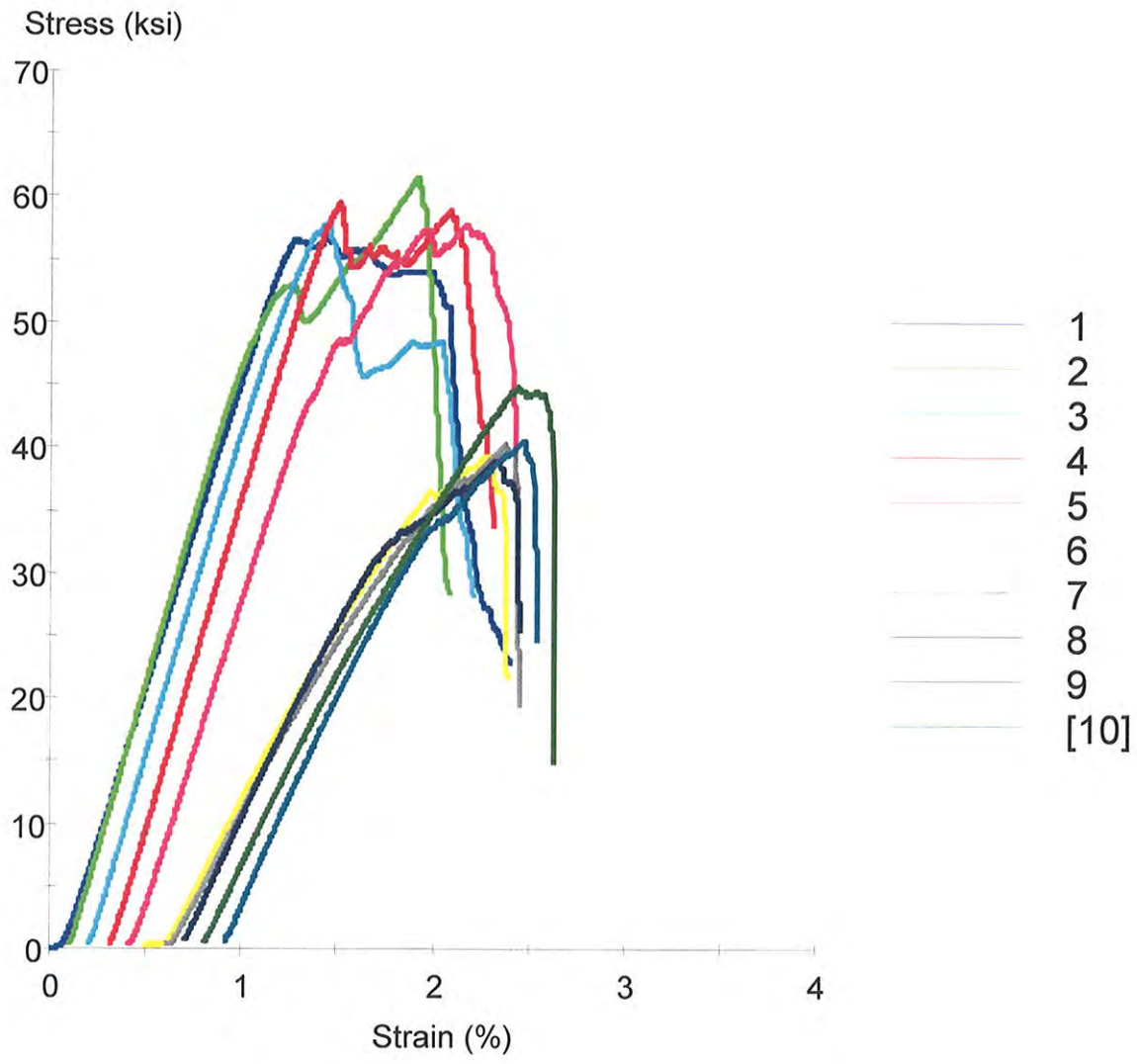
Name	Value
01) Customer:	Neptune Research
02) Job #:	30004987
03) Material:	Fiber Glass Composite
04) Specimen Type:	1/2" Strips
05) Conditioning:	40hr. @, 72F, & 50%rh.
06) Test Temperature, & Humidity:	74F, 52%rh
07) Method:	ASTM D790

Specimen Results:

Test	Client ID	Specimen ID	Width (in)	Thickness (in)	Peak Load (lbf)	Ultimate Flexural Strength (ksi)	Modulus (ksi)
1	0 Degree	30004987-D1	0.5020	0.0987	92.3	56.65	5191.8
2		30004987-D2	0.5010	0.0986	99.8	61.48	5638.9
3		30004987-D3	0.5030	0.0984	94.2	58.04	5530.7
4		30004987-D4	0.5010	0.0983	96.0	59.48	5541.1
5		30004987-D5	0.5030	0.0981	93.2	57.79	5131.9
Mean			0.502	0.0984	95.1	58.68	5406.8
Std.Dev			0.001	0.000	2.96	1.86	228.61
6	90 Degree	30004987-D6	0.5010	0.0942	58.3	39.36	3145.1
7		30004987-D7	0.5030	0.0945	60.2	40.19	3102.9
8		30004987-D8	0.5020	0.0940	57.5	38.88	3597.1
9		30004987-D9	0.5010	0.0942	66.3	44.75	3420.4
10		30004987-D10	0.5010	0.0942	60.1	40.53	3731.2
Mean			0.5016	0.0942	60.48	40.74	3399.3
Std. Dev.			0.001	0.000	3.45	2.33	274.8

Test Inputs:

Name	Value	Units
Break Sensitivity	100	%
Data Acquisition Rate	10.0	Hz
Strain Endpoint	5.200	%
Test Speed	0.050	in/min



Sample ID: 30004987 Flexural

Method: ASTM D790 3 Point Flex

Test performed by: Ahamed Shabeer

Signature:

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Test Certificate

6/25/2008

Sample ID: 30004987 Shear
Method: ASTM D5379

Test Date: 6/23/2008
Operator: Ahamed Shabeer

Sample Information:

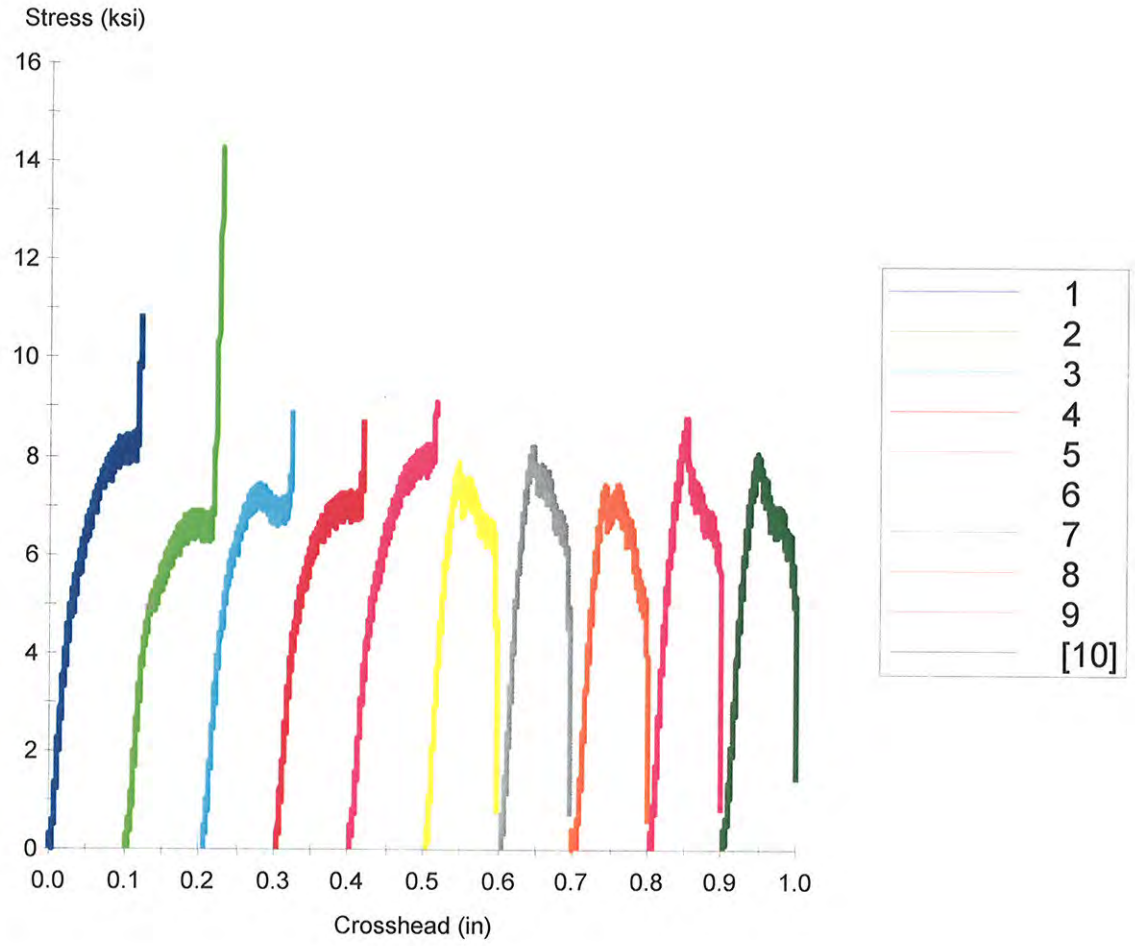
Name	Value
01) Customer:	Neptune Research
02) Job #:	30004987
03) Material:	Fiber Glass Composite
04) Specimen Type:	V Notch
05) Conditioning:	40hr. @, 72F, & 50%rh.
06) Test Temperature, & Humidity:	74F, 52%rh
07) Method:	ASTM D5379

Specimen Results:

Test	Client ID	Specimen ID	Thickness (in)	Width (in)	Shear Modulus (ksi)	Shear Strength (ksi)
1	0 Degree	30004987-C1	0.0987	0.4738	289.88	8.3
2		30004987-C2	0.0986	0.4740	212.67	6.8
3		30004987-C3	0.0985	0.4780	237.81	7.2
4		30004987-C4	0.0984	0.4760	271.10	7.1
5		30004987-C5	0.0985	0.4750	313.16	8.2
Mean			0.0985	0.4753	264.92	7.52
Std.Dev			0.000	0.002	40.17	0.68
6	90 Degree	30004987-C6	0.0941	0.4750	311.20	7.8
7		30004987-C7	0.0945	0.4760	343.12	7.9
8		30004987-C8	0.0943	0.4780	287.64	7.6
9		30004987-C9	0.0945	0.4760	283.31	8.4
10		30004987-C10	0.0941	0.4760	325.28	7.9
Mean			0.0943	0.4762	310.11	7.92
Std. Dev.			0.000	0.001	25.22	0.29

Test Inputs:

Name	Value	Units
Break Sensitivity	90	%
Break Threshold	200	lbf
Data Acq. Rate	10.0	Hz
Test Speed	0.05	in/min



Sample ID: 30004987 Shear

Method: ASTM D5379

Test performed by: Ahamed Shabeer

Signature:

Bodycote TESTING GROUP

Test Certificate

BBI#: 30004987

Customer: Neptune Research

Test: ASTM D648

Author: Bhavya Mehta

Bodycote Testing Group
1975 North Ruby Street • Melrose Park • Illinois • 60160 • USA • Tel: +1 (708) 236-5360 • Fax: +1 (708) 236-5363
Test Method: ASTM D648
Test Type: Method A - Using a stress of 264 psi and a heating rate of 120C/hr
Heat Transfer Medium: Silicone oil

BPBL Specimen ID	Depth (in)	Width (in)	Stress(psi)	Load (lbs)	Load (g)	Def. Temp. (C)
30004987 - A1	0.5002	0.0989	264.00	1.0888	493.86	**195.40**
30004987 - A2	0.5002	0.0985	264.00	1.0844	491.86	**195.50**
Mean	0.5002	0.0987	264.00	1.0866	492.86	195.45
Std. Deviation	0.0000	0.0003	0.00	0.0031	1.41	0.07

Tested By : BHAVYA MEHTA
Signature: B M Mehta
Reviewed by:
Date: 6/23/08

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Standard Test Methods for Linear Expansion of Solid Materials using Thermomechanical Analysis (E- 831)

Project Number: 30004987
Project Name: Neptune Research
Material Identification : Composite

Test Date: 6/16/2008

Client ID	Bodycote ID	Temp Range deg C	Length (mm) (Room Temp)	Length (1) mm	Length (2) mm	Length Change mm	CTLE
	Sample 1	27.2300	7.0174	7.0191	7.0213	0.0023	1.27E-05
0 degree	Sample 2	23.8800	7.0174	7.0296	7.0465	0.0169	1.06E-05
	Sample 1	40.4800	2.7321	2.7221	2.7279	0.0058	5.49E-05
90 degree	Sample 2	40.3200	2.7321	2.7246	2.7298	0.0052	4.95E-05

Signature : _____
Reviewed by : _____

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Standard Test Methods for Rubber Property-Durometer Hardness (ASTM D2240-04)

Project Number: 30004987
Project Name: Neptune Research
Material Identification : Composite

Test Date: 6/23/2008
Serial no. of Durometer: 287
Durometer Type: Shore-D

Bodycote ID	Client ID	Hardness	Mean	std
		76.5		
		77.0		
30004987-A	0 Degree	75.5	76.00	0.79
		75.0		
		76.0		
		78.0		
		79.5		
30004987-B	90 Degree	78.5	78.00	1.06
		77.0		
		77.0		

Signature : _____
Reviewed by : _____

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TEST REPORT

Testing. Advising. Assuring.

Neptune Research, Inc.
1346 South Killian Drive
Lake Park, Florida 33403

Attn: Muhammad Farooq
E-Mail: mfarooq@neptuneresearch.com
Revision:

Exova Report No.: 292085
Date of Report: June 7, 2010
Shipper No. / Quote No. E1001053
Purchase Order No: 00NR1042610
Phone: 561 683-6992
Fax: 561 683-8366

Type of Test:	**Tension Properties**	**0° Direction**	
Material Identification	Carbon Fiber Reinforced Polyurethane		
Specification / Revision:	n/a	*Test Procedure:*	ASTM D3039-08
Specimen Conditions:	73°F / 47% RH	*Test Temperature:*	73°F
Test Performed By:	Robert Thompson	*Date of Test:*	May 20, 2010

TEST RESULTS:

Test No.	Width (inch)	Thickness (inch)	Ultimate Load (lbs)	Ultimate Strength (psi)	Modulus (msi)	Poisson's Ratio	Ultimate Strain (micro-inch)	Mode of Failure
1	0.999	0.0703	6654	94746	11.66	0.150	9064	Angled, Gage, Middle
2	0.999	0.0685	6964	101765	10.21	0.332	14048	Angled, Gage, Middle
3	0.993	0.0695	6822	98850	10.71	0.253	11820	Angled, Gage, Middle
4	0.997	0.0687	7146	104330	13.69	0.028	9627	Angled, at Grip/Tab, Top
5	0.985	0.0698	7450	108358	10.36	0.327	12478	Angled, at Grip/Tab, Top
			Average	101609	11.32	0.218	11407	---
			Standard Deviation	5188	1.43	0.129	2058	---
			Coefficient of Variation	5.1	12.6	59.2	18.0	---

Note: *For Information Only.*

Equipment	Size or Type	Control No.	Calibration Due		Equipment	Size or Type	Control No.	Calibration Due
Load Frame	30 K	1307	01-27-11		Inspection Device	6" Caliper	1376	08-04-10
Load Cell	25 K	2153	07-30-10		Micrometer	1" Ball	2430	08-04-10
Test Speed	0.05 Inch/Minute		---					
Bi-Axial Strain Gage		CEA-06-125UT			A66AD945	---	GF=2.115 & 2.135	

This is to certify that the above tests were performed in accordance with the terms of the purchase order requirements.
Test equipment is calibrated with standards traceable to the NIST.

Exova OCM

Neptune Research, Inc.
1346 South Killian Drive
Lake Park, Florida 33403
Revision:

EXOVA REPORT NO.: 292085
DATE OF REPORT: June 7, 2010
PURCHASE ORDER NO: 00NR1042610

Type of Test:	**Tension Properties**	**0° Direction**	
Material Identification	Carbon Fiber Reinforced Polyurethane		
Specification / Revision:	n/a	*Test Procedure:*	ASTM D3039-08
Specimen Conditions:	73°F / 47% RH	*Test Temperature:*	160°F (10 minute soak)
Test Performed By:	Robert Thompson	*Date of Test:*	May 29, 2010

TEST RESULTS:

Test No.	Width (inch)	Thickness (inch)	Ultimate Load (lbs)	Ultimate Strength (psi)	Modulus (msi)	Poisson's Ratio	Ultimate Strain (micro-inch)	Mode of Failure
1	0.998	0.0690	4592	66684	8.88	0.693	7422	Angled, Gage, Top
2	0.999	0.0703	7427	105752	12.35	0.158	9512	Angled, Gage, Middle
3	0.993	0.0717	6792	95395	10.59	0.145	10943	Angled, Gage, Bottom
4	0.995	0.0689	6593	96170	10.63	0.289	10285	Angled, Gage, Bottom
5	0.995	0.0698	6193	89170	12.63	0.150	7769	Angled, Gage, Top
			Average	90634	11.01	0.287	9186	---
			Standard Deviation	14642	1.52	0.234	1542	---
			Coefficient of Variation	16.1	13.8	81.7	16.7	---

Note: *For Information Only.*

Equipment	Size or Type	Control No.	Calibration Due		Equipment	Size or Type	Control No.	Calibration Due
Load Frame	30 K	1307	01-27-11		Inspection Device	6" Caliper	1376	08-04-10
Load Cell	25 K	2153	07-30-10		Micrometer	1" Ball	2430	08-04-10
Controller	Temperature	1998	09-09-10		Thermocouple	Omega	2084	07-24-10
Test Speed	0.05 Inch/Minute		---		Timer	---	2282	10-20-10
Bi-Axial Strain Gage		CEA-06-125UT			A66AD945	---	GF=2.115 & 2.135	

This is to certify that the above tests were performed in accordance with the terms of the purchase order requirements.
Test equipment is calibrated with standards traceable to the NIST.

Exova OCM

Neptune Research, Inc.
1346 South Killian Drive
Lake Park, Florida 33403
Revision:

EXOVA REPORT NO.: 292085
DATE OF REPORT: June 7, 2010
PURCHASE ORDER NO: 00NR1042610

Type of Test:	**Tension Properties**	**90° Direction**	
Material Identification	Carbon Fiber Reinforced Polyurethane		
Specification / Revision:	n/a	*Test Procedure:*	ASTM D3039-08
Specimen Conditions:	73°F / 47% RH	*Test Temperature:*	73°F
Test Performed By:	Robert Thompson	*Date of Test:*	May 20, 2010

TEST RESULTS:

Test No.	Width (inch)	Thickness (inch)	Ultimate Load (lbs)	Ultimate Strength (psi)	Modulus (msi)	Poisson's Ratio	Ultimate Strain (micro-inch)	Mode of Failure
1	1.000	0.0723	1763	24384	1.99	0.052	16288	Lateral, Gage, Middle
2	0.999	0.0732	1897	25941	1.87	0.058	17246	Lateral, Gage, Middle
3	1.000	0.0715	1730	24195	1.93	0.047	19889	Lateral, Gage, Middle
4	0.998	0.0716	1752	24518	1.96	0.032	20224	Lateral, Gage, Middle
5	0.997	0.0698	1788	25698	2.05	0.059	23491	Lateral, Gage, Middle
			Average	24947	1.96	0.049	19427	---
			Standard Deviation	809	0.06	0.010	2827	---
			Coefficient of Variation	3.2	3.4	22.1	14.5	---

Note: *For Information Only.*

Equipment	Size or Type	Control No.	Calibration Due		Equipment	Size or Type	Control No.	Calibration Due
Load Frame	30 K	1307	01-27-11		Inspection Device	6" Caliper	1376	08-04-10
Load Cell	25 K	2153	07-30-10		Micrometer	1" Ball	2430	08-04-10
Test Speed	0.05 Inch/Minute		---					
Bi-Axial Strain Gage		CEA-06-125UT			A66AD945	---	GF=2.115 & 2.135	

This is to certify that the above tests were performed in accordance with the terms of the purchase order requirements.
Test equipment is calibrated with standards traceable to the NIST.

Exova OCM

Neptune Research, Inc.
1346 South Killian Drive
Lake Park, Florida 33403
Revision:

EXOVA REPORT NO.: 292085
DATE OF REPORT: June 7, 2010
PURCHASE ORDER NO: 00NR1042610

Type of Test:	**Flexural Properties**	**0° Direction**	
Material Identification	Carbon Fiber Reinforced Polyurethane Laminate		
Specification / Revision:	n/a	*Test Procedure:*	ASTM D790-07e1
Specimen Conditions:	72°F / 48% RH	*Test Temperature:*	72°F
Test Performed By:	Robert Fortner	*Date of Test:*	May 28, 2010

TEST RESULTS:

Test No.	Width inch)	Thickness (inch)	Ultimate Load (lb)	Ultimate Strength (psi)	Modulus (msi)	Mode of Failure
1	1.003	0.079	197.2	58747	4.15	Lateral, ClearThru, Top
2	1.004	0.076	192.2	61499	4.63	Lateral, ClearThru, Top
3	1.003	0.077	193.0	60701	4.72	Lateral, ClearThru, Top
4	1.003	0.078	202.8	62297	4.51	Lateral, ClearThru, Top
5	1.002	0.078	211.3	64985	4.34	Lateral, ClearThru, Top
			Average	61646	4.47	---
			Standard Deviation	2286	0.23	---
			Coefficient of Variation	3.71	5.12	---

Note: *For Information Only.*

Equipment	Size or Type	Control No.	Calibration Due		Equipment	Size or Type	Control No.	Calibration Due
Load Frame	30 K	1548	07-30-10		Deflectometer	1"	1324	03-15-11
Load Cell	1 K	2245	05-12-11		Span Ratio	16:1	Span	1.237"
Test Speed	0.05 Inch/Minute		---					

This is to certify that the above tests were performed in accordance with the terms of the purchase order requirements.
Test equipment is calibrated with standards traceable to the NIST.

Exova OCM

Neptune Research, Inc.
1346 South Killian Drive
Lake Park, Florida 33403
Revision:

EXOVA REPORT NO.: 292085
DATE OF REPORT: June 7, 2010
PURCHASE ORDER NO: 00NR1042610

Type of Test:	**Flexural Properties**	**90° Direction**	
Material Identification	Carbon Fiber Reinforced Polyurethane Laminate		
Specification / Revision:	n/a	*Test Procedure:*	ASTM D790-07e1
Specimen Conditions:	72°F / 48% RH	*Test Temperature:*	72°F
Test Performed By:	Robert Fortner	*Date of Test:*	May 28, 2010

TEST RESULTS:

Test No.	Width inch)	Thickness (inch)	Ultimate Load (lb)	Ultimate Strength (psi)	Modulus (msi)	Mode of Failure
1	1.006	0.0789	89.9	27677	0.82	Lateral, ClearThru, Top
2	1.006	0.0803	110.6	32857	0.84	Lateral, ClearThru, Top
3	1.006	0.0823	97.7	27648	0.83	Lateral, ClearThru, Top
4	1.006	0.0796	94.0	28431	0.86	Lateral, ClearThru, Top
5	1.004	0.0805	88.0	26083	0.88	Lateral, ClearThru, Top
			Average	28539	0.85	---
			Standard Deviation	2560	0.02	---
			Coefficient of Variation	8.97	2.71	---

Note: *For Information Only.*

Equipment	Size or Type	Control No.	Calibration Due		Equipment	Size or Type	Control No.	Calibration Due
Load Frame	30 K	1548	07-30-10		Deflectometer	2"	1324	03-15-11
Load Cell	1 K	2245	05-12-11		Span Ratio	16:1	Span	1.285"
Micrometer	1"	2428	08-04-10		Caliper	6"	2268	10-01-10
Test Speed	0.03 Inch/Minute		---					

This is to certify that the above tests were performed in accordance with the terms of the purchase order requirements.
Test equipment is calibrated with standards traceable to the NIST.

Exova OCM

Neptune Research, Inc.
1346 South Killian Drive
Lake Park, Florida 33403
Revision:

EXOVA REPORT NO.: 292085
DATE OF REPORT: June 7, 2010
PURCHASE ORDER NO: 00NR1042610

Type of Test:	**V- Notch Properties**	**0° Direction**	
Material Identification	Carbon Fiber Reinforced Polyurethane Laminate		
Specification / Revision:	n/a	*Test Procedure:*	ASTM D5379-05
Specimen Conditions:	73°F / 47% RH	*Test Temperature:*	73°F
Test Performed By:	Robert Thompson	*Date of Test:*	06-02-2010

TEST RESULTS:

Test No.	Width (inch)	Thickness (inch)	Ultimate Load (lbs)	Load @ 2% Strain (lbs)	Load @ 5% Strain (lbs)	Shear Stress @ 2% Offset (psi)	Shear Stress @ 5% Offset (psi)	Ultimate Sear Strength (psi)	Chore Shear Modulus (msi)
1	0.451	0.0766	211	131	155	3801	4495	6102	0.232
2	0.452	0.0769	219	144	174	4154	5018	6289	0.295
3	0.452	0.0763	216	151	184	4379	5326	6249	0.287
4	0.451	0.0755	186	154	170	4525	5001	5461	0.278
5	0.452	0.0749	224	199	211	5865	6240	6624	0.268
					Average	4545	5216	6145	0.272
					Standard Deviation	787	645	427	0.025
					Coefficient of Variation	17.3	12.3	6.9	9.0

Note: *For Information Only.*

Equipment	Size or Type	Control No.	Calibration Due		Equipment	Size or Type	Control No.	Calibration Due
Load Frame	60 K	1279	11-02-10		Inspection Device	6" Caliper	1376	08-04-10
Load Cell	5 K	2020	11-02-10		Micrometer	1" Ball	2430	08-04-10
Test Speed	0.05 Inch/Minute		---					
Strain Device	CEA-06-062WT-350				A66AD409		---	GF=2.15

This is to certify that the above tests were performed in accordance with the terms of the purchase order requirements.
Test equipment is calibrated with standards traceable to the NIST.

Exova OCM

Neptune Research, Inc.
1346 South Killian Drive
Lake Park, Florida 33403
Revision:

EXOVA REPORT NO.: 292085
DATE OF REPORT: June 7, 2010
PURCHASE ORDER NO: 00NR1042610

Type of Test:	**V- Notch Properties**	**90° Direction**	
Material Identification	Carbon Fiber Reinforced Polyurethane Laminate		
Specification / Revision:	n/a	*Test Procedure:*	ASTM D5379-05
Specimen Conditions:	73°F / 47% RH	*Test Temperature:*	73°F
Test Performed By:	Robert Thompson	*Date of Test:*	06-02-2010

TEST RESULTS:

Test No.	Width (inch)	Thickness (inch)	Ultimate Load (lbs)	Load @ 2% Strain (lbs)	Load @ 5% Strain (lbs)	Shear Stress @ 2% Offset (psi)	Shear Stress @ 5% Offset (psi)	Ultimate Sear Strength (psi)	Chore Shear Modulus (msi)
1	0.449	0.0761	281	169	190	4941	5562	8238	0.286
2	0.452	0.0773	307	184	207	5272	5932	8800	0.296
3	0.448	0.0768	291	180	207	5239	6018	8456	0.321
4	0.450	0.0773	309	187	213	5362	6136	8886	0.325
5	0.449	0.0771	283	164	191	4735	5527	8182	0.325
					Average	5109	5835	8512	0.311
					Standard Deviation	762	275	320	0.018
					Coefficient of Variation	5.1	4.7	3.7	5.8

Note: *For Information Only.*

Equipment	Size or Type	Control No.	Calibration Due		Equipment	Size or Type	Control No.	Calibration Due
Load Frame	60 K	1279	11-02-10		Inspection Device	6" Caliper	1376	08-04-10
Load Cell	5 K	2020	11-02-10		Micrometer	1" Ball	2430	08-04-10
Test Speed	0.05 Inch/Minute		---					
Strain Device	CEA-06-062WT-350				A66AD409		---	GF=2.15

This is to certify that the above tests were performed in accordance with the terms of the purchase order requirements.
Test equipment is calibrated with standards traceable to the NIST.

Neptune Research, Inc.
1346 South Killian Drive
Lake Park, Florida 33403
Revision:

EXOVA REPORT NO.: 292085
DATE OF REPORT: June 7, 2010
PURCHASE ORDER NO: 00NR1042610

Type of Test:	**Heat Deflection / Shore "D" Hardness**		**0° Direction**
Material Identification	Carbon Fiber Reinforced Polyurethane Laminate		
Specification / Revision:	n/a	*Test Procedure:*	ASTM D648-07 / D2240-05
Specimen Conditions:	73°F as received	*Test Temperature:*	2°C/minute / 73°F
		Maximum Fiber Stress	264 psi
Test Performed By:	Tim Stetson / Renee Nussy	*Date of Test:*	05-21-2010

TEST RESULTS:

Heat Deflection 2°C/minute				
Test No.	**Thickness (inch)**	**Depth (inch)**	**Required Grams**	**Deflection (°F)**
1	0.077	0.506	198	325
2	0.083	0.506	198	329

Shore "D" Hardness 73°F	
Test No.	**Hardness Points**
1	88
2	87
3	88
4	89
5	88
Average	88

For Information ONLY.

Equipment:	Exova Control Number:	Calibration Date:	Calibration Date Due:
PTC	2180	04-07-10	04-07-11
Heat Deflection Apparatus	1630	n/a	n/a
Thermometer	2138	09-09-09	09-09-10

This is to certify that the above tests were performed in accordance with the terms of the purchase order requirements.
Test equipment is calibrated with standards traceable to the NIST.

Exova OCM

Neptune Research, Inc.
1346 South Killian Drive
Lake Park, Florida 33403
Revision:

EXOVA REPORT NO.: 292085
DATE OF REPORT: June 7, 2010
PURCHASE ORDER NO: 00NR1042610

Type of Test:	**Coefficient of Thermal Expansion by Thermal Mechanical Analysis (TMA) 0° & 90°Direction**		
Material Identification	Carbon Fiber Reinforced Polyurethane Laminate		
Test Procedure	ASTM E831-09		
Test Temperature:	-30°C to 30°C @ 5°C/minute	*Nitrogen Purge:*	40 cc/minute
Test Performed By:	Tim Stetson / Renee Nussy	*Date of Test:*	05-21-2010

TEST RESULTS:

Direction	Length (mm)	Width (mm)	Thickness (mm)	Fiber Orientation	C.T.E. (µm/m°C) From -30°C to 30°C
0° Direction	6.37	6.35	6.2688	0°	3.218
90° Direction	6.37	6.36	6.344	90°	23.40

Note: – For Information Only.

Customer's Purchase Order calls to test 1 specimen / lot.

Equipment:	Control Number:	Calibration Date:	Calibration Date Due:
TA-TMA	2405	05-11-10	06-11-10
6" Caliper	1373	02-04-10	08-04-10
Expansion Probe	---	---	---

This is to certify that the above tests were performed in accordance with the terms of the purchase order requirements.
Test equipment is calibrated with standards traceable to the NIST.

Signed for and on behalf of Exova

Darrell Reed
Senior Quality Engineer

OCM 052 CERT. APPROVAL

Signed for and on behalf of Exova

Tim Stetson
Mechanical Laboratory Supervisor

OCM 051 CERT. APPROVAL

Accredited Nadcap™
Non Metallic Materials

LABORATORY ACCREDITATION BUREAU ACCREDITED
Certificate # L2195 Testing
ISO 17025

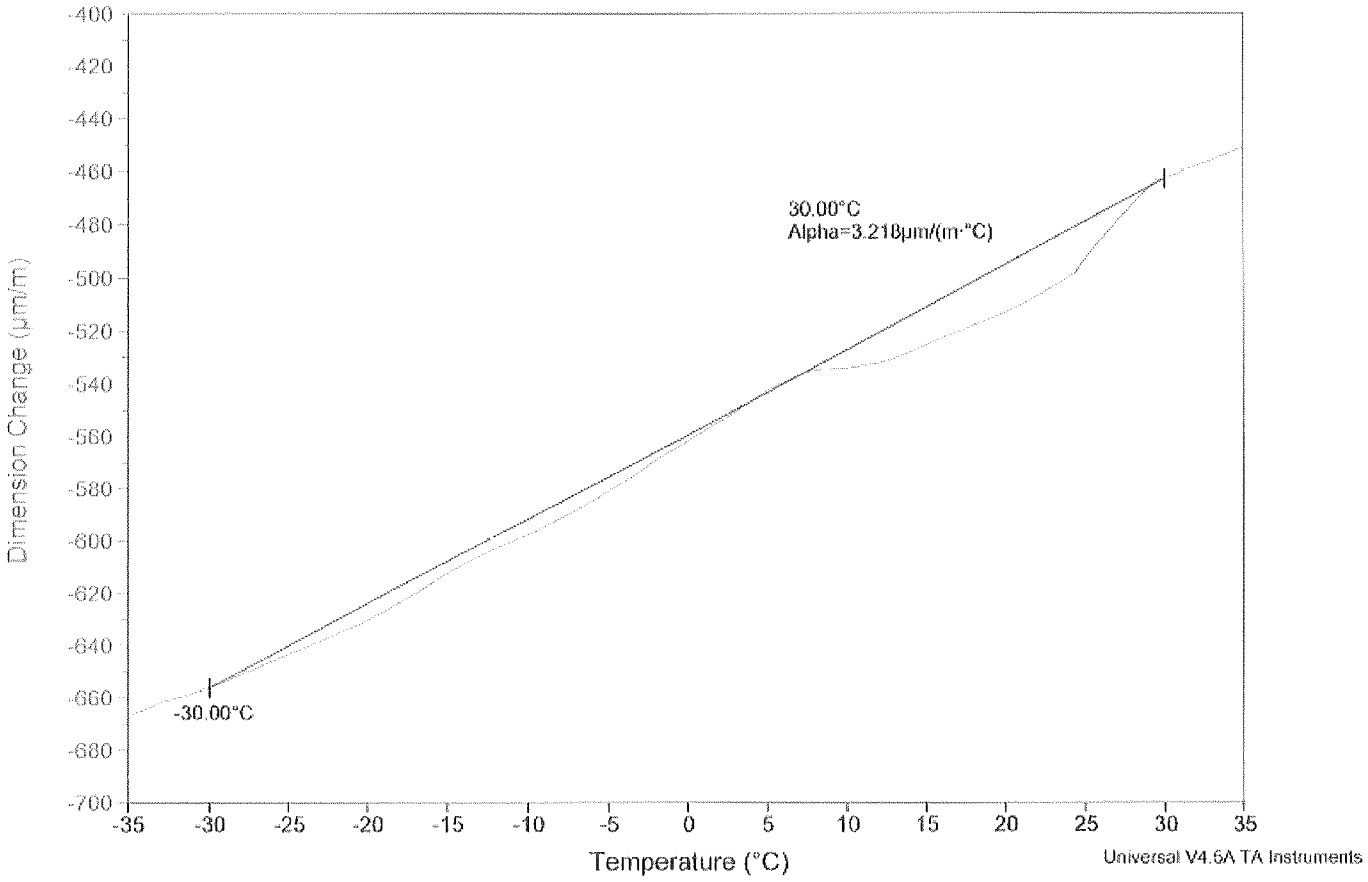
Neptune Research, Inc.
1346 South Killian Drive
Lake Park, Florida 33403
Revision:

EXOVA REPORT NO.: 292085
DATE OF REPORT: June 7, 2010
PURCHASE ORDER NO: 00NR1042610

Sample: Neptune Research Inc.
Size: 6.2688 mm
Method: -30/30/5""C
Comment: Carbon fiber reinforced polyurethane 0°direction

TMA

File: T:\TMA\2010\292000\292085-0°.002
Operator: rn
Run Date: 21-May-2010 06:07
Instrument: TMA Q400 V22.1 Build 27



0° Direction

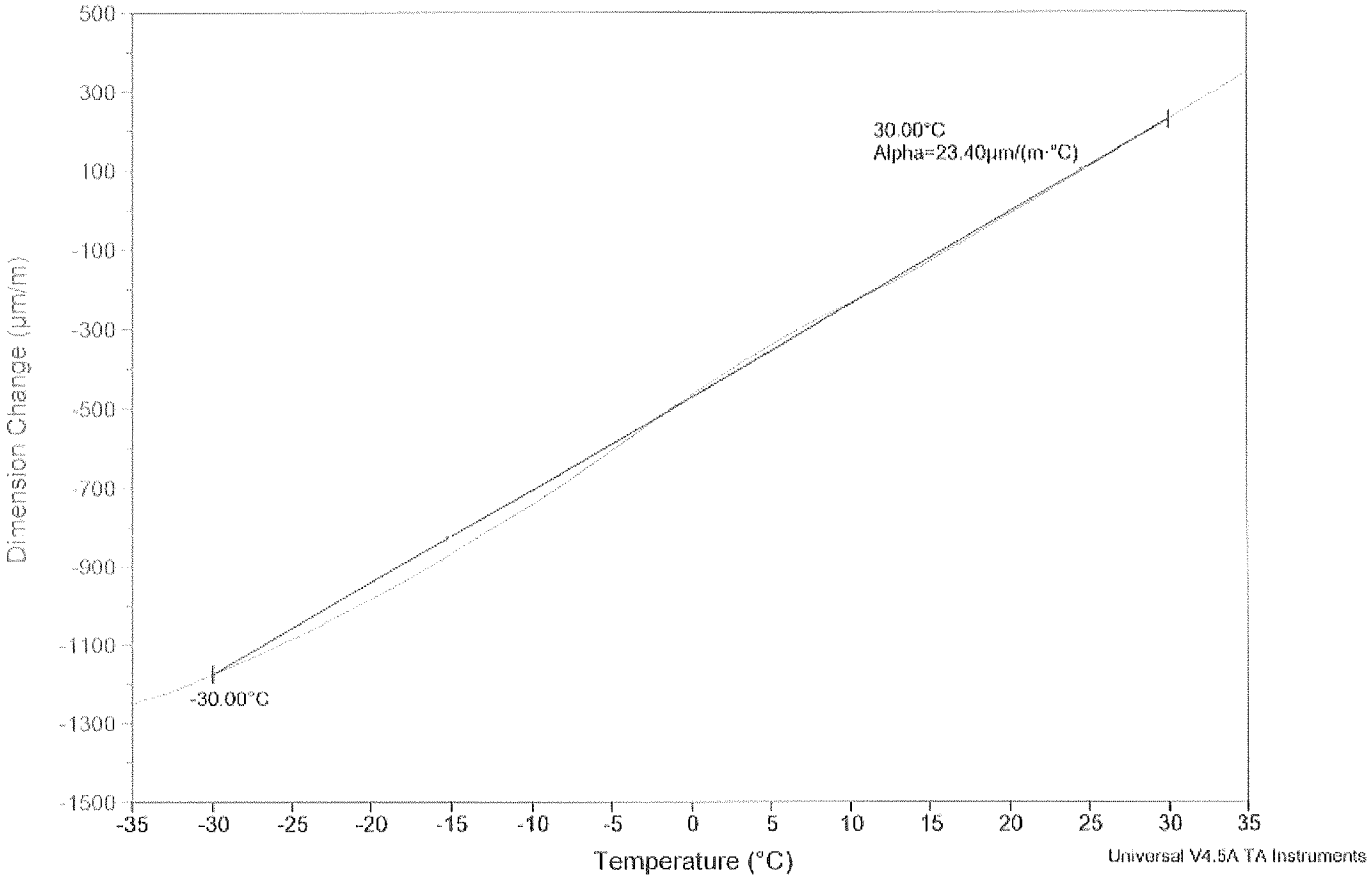
Neptune Research, Inc.
1346 South Killian Drive
Lake Park, Florida 33403
Revision:

EXOVA REPORT NO.: 292085
DATE OF REPORT: June 7, 2010
PURCHASE ORDER NO: 00NR1042610

Sample: Neptune Research Inc.
Size: 6.3444 mm
Method: -30/30/5°°C
Comment: Carbon fiber reinforced polyurethane 90°direction

TMA

File: T:\TMA\2010\292000\292085-90°.002
Operator: rn
Run Date: 21-May-2010 07:00
Instrument: TMA Q400 V22.1 Build 27



90° Direction

Exova-OCM Test Laboratory, Inc. 3883 East Eagle Drive Anaheim, California 92807 (714) 630-3003

Contact Information:

Company: _____

Contact(s): _____

Address: _____

City: _____ State:_____ Zip / Postal Code: _____

Phone: _____ Fax: _____

E-mail: _____

Geometry of Concrete:

Beam: _____ Column: _____ Slab: _____

Load on each column / beam: _____ Magnitude: _____ Dead / Live

Diameter / Cross-sectional area of beams & columns: _____

Type of Beam: _____ Modulus of concrete: _____

Poisson's ratio of concrete: _____

Compression strength of concrete:_____ Length of Repair: _____

Cross – Sectional area of beam / columns: _____

Bars Properties: _____ Strength: _____ Modulus: _____

Tensile strength of the concrete: _____

Properties of the Concrete

Fine aggregate: _____ Coarse aggregate: _____ Admixture: _____

Installation Questions:

Can the area be prepared by sandblasting? Yes / No Can the area be prepared with power tools? Yes / No

Access elevation - Above Grade: _____ Below grade: _____

Vertical wrap est ft: _____ Horizontal wrap est ft: _____

Is there limited access to the damaged area? Yes / No Describe: _____

_____

Who will perform the installation? _____

Emergency repair: Yes / No Scheduled start date: _____

Completed By: _____

Please complete all sections that apply, attach any digital photos or drawings: Send this information to sales@neptuneresearch.com. For immediate assistance contact Neptune Research, Inc. (561) 683-6992 / (800) 328-8366.

Disclaimer: Neptune Research, the Manufacturer of Syntho-Glass®XT and Viper-Skin™, will replace at no charge to the purchaser any product proved to be defective. Responsibility of the Manufacturer and the Distributor is limited to replacement of the product only. Neither the Manufacturer nor the Distributor shall be liable for consequential or incidental damage or loss of any kind as they do not have any control over the conditions under which these products may be used or over the methods of application. Users should test the product for their particular need and suitability. Users should consult with the Manufacturer or the Distributor for all proposed repairs using the Syntho-Glass XT and /or Viper-Skin Systems. Written procedures for specific repairs are available upon request from the Manufacturer or Distributor. All proposed repairs using the Syntho-Glass XT and/or Viper-Skin Systems must be installed or supervised by Certified Technicians.

Recommended Steps During Field Inspection:

1. Field Inspection Requirements in accordance with ACI 364.1R
2. A licensed design professional should conduct a field Investigation in accordance with ACI 437R
    a. Existing dimensions of the structural member
    b. Location, size, and cause of cracks and spalls
    c. Location and extent of corrosion of reinforcing steel
    d. Presence of active corrosion
    e. Quantity and location of existing reinforcing steel
    f. In-place compressive strength of concrete and soundness of the concrete
3. A pull-off adhesion test should be conducted in accordance with ACI 503R
    a. The concrete bonding surface area should have a minimum pull-off adhesion in tensile of 200PSI (1.4MPa)
    b. The concrete bonding surface are should have a minimum compressive strength of 2,500PS
    c. Column wrapping for confinement are not regulated by these minimum compressive & pull values
4. Strength limits-FRP reinforcement should not cause member failure under sustained service load
5. Fire & Life safety-FRP systems should comply with all applicable building and fire codes.
    a. Smoke & flame spread rating in accordance with ASTM E84
6. Maximum Service Temperature Tg testing in accordance with ASTM D4065
    a. Dry application Tg – 27 F
7. Minimum concrete substrate strength not recommended for corroded reinforced steel or deteriorated concrete
    a. Concerning to note: alkali-silica reactions, carbonation, longitudinal cracking around corroded reinforced steel, and laminar cracking at the location of the steel reinforcement
8. Arresting any ongoing corrosion and repairing any degradation to the substrate is required

Testing Requirements: tensile strength, durability, resistance to creep, bond to substrate & Tg
Ultimate Tensile Strength = ACI 440.3R & ASTM D3039 & D7205
Compressive behavior = Externally bonded FRP systems should not be used as compression reinforcements.
Creep-rupture= As long as the sustained stress in the FRP is below the creep rupture stress limits, the strength of the FRP is available for nonsustained loads

VIPER SKIN™

INSTALLATION VALIDATION PROCEDURE
QUALITY CONTROL RECORDS

Project name or Job reference number: _____ **Date:** _____

Company: _____

Contact(s): _____

Address: _____

City: _____ State: _____ Country: _____ Zip / Postal Code: _____

Phone: _____ Fax: _____ E-mail: _____

Quality Control Records	Requirements	Value #/ Initials
Method Statement		
Material Preparation	Raw materials inspected to ensure proper labeling, within expiration date, proper requirements & quantities	Initial:
Record Expiration Dates	Syntho-Poxy: Lot # & Born on Date; SubLV: Lot # & Born on Date; Viper-Skin: Lot #(s):	
Surface Preparation		
Inspection	Blast Cleaning	Initial:
Surface preparation and profiling shall promote continuous intimate contact between the FRP system and concrete by providing a clean, smooth, and flat or convex surface as stated in ACI 546R & ICRI 03730		
Installation Conditions:		
Inspection		Initial:
Ambient Temperature: _____ Relative Humidity: _____ Surface Temperature of concrete: _____ Surface dryness per ACI 503.4: _____		
Repair Length		
Dimensions	The overall Viper-Skin composite repair length MUST be within the minimum axial repair length specified within the NRI composite calculations.	Length:
Application Controls		
Material Preparation	Raw materials inspected to ensure proper labeling, requirements & quantities	Initial:
Syntho-Poxy	The Syntho-Poxy was mixed using the 50 mil applicator gun & static mixing nozzle. The Syntho-Poxy was applied within 10 minutes.	Initial:
Cured epoxy putty	The Syntho-Poxy was inspected to ensure the filler material conforms to the geometry of the column or beam's cylinder shape	Initial:
SubLV Epoxy Mixing	100% of the Kevlar Epoxy part A & B was mixed until uniform in color (light green) or mixed using the pneumatic gun and static mixing nozzle	Initial:
SubLV Epoxy Application Thickness	30-60 Mils of epoxy was applied which was within the target range of technical data requirements	Initial:
Syntho-Glass XT Resin Activating	100% of the composite wrap was activated with fresh water or salt water	Initial:
Syntho-Glass XT	Correct # of layers of composite wraps were applied based on NRI's calculations	# Layers:
Viper Skin Resin Activating	100% of the composite wrap was activated with fresh water or salt water	Initial:
Viper Skin	Correct # of layers of composite wraps were applied based on NRI's calculations	# Layers:
Compression Film	100% of the outer layers of composite wrap are wrapped with 2 layers of compression film and perforated every 8 – 16 layers while the resin is still tacky	Initial:
Test on Repair		
Cure SubLV epoxy	Hardness requirements of the epoxy meet Shore D requirements of the technical data	Value:
Cure Viper-Skin Wrap	Hardness requirements of the composite wrap meet Shore D requirements of the technical data	Initial:
Composite wrap	Correct # of layers of composite wraps were applied based on NRI's calculations	# Layers:
Dimensions	The Viper-Skin overall repair length is within the minimum axial repair length specified within the calculations.	Length:

QUALITY CONTROL RECORDS

Using a Shore D hardness tester, do the following upon completion of repair:

a. Viper-Skin™outer layer should have an average Shore D of 70 after 24 hr
b. Testing should be performed ensuring the pin is placed on the highest point of the composite repair to ensure proper reading
c. A minimum of 10 tests shall be done to get the average
d. The test point shall be placed directly on a fiber and not the valley where the fibers cross as this could result in a false low reading.
e. The Syntho-SubSea LV Epoxy should be tested using the Shore D hardness tester after 24 hrs and should have an average Shore D value of 70.
f. The epoxy used for this test should be an excess amount left over from the repair and can be place on an area outside of the pipe.
g. The highest point to the epoxy should be where the pin is placed
h. A minimum of 10 tests shall be done to get the average.

All test parameters and to be performed to ensure that all materials have been properly mixed and ensure complete curing profile of the Viper-Skin composite repair system.

NEPTUNERESEARCH.COM
1346 S. KILLIAN DRIVE • LAKE PARK, FL 33403 USA • 561.683.6992

SYNTHO-GLASS® XT

INSTALLATION VALIDATION PROCEDURE

QUALITY CONTROL RECORDS

Project name or Job reference number: _____ **Date:**_____

Company: _____

Contact(s): _____

Address: _____

City: _____ State: _____ Country:_____ Zip / Postal Code:_____

Phone: _____ Fax: _____ E-mail: _____

Quality Control Records	Requirements			Value #/ Initials
Method Statement				
Material Preparation	Raw materials inspected to ensure proper labeling, within expiration date, proper requirements & quantities			Initial:
Record Expiration Dates	Syntho-Poxy: Lot # & Born on Date	SubLV: Lot # & Born on Date	Syntho-Glass XT: Lot #(s):	

Surface Preparation		
Inspection	Blast Cleaning	Initial:

Surface preparation and profiling shall promote continuous intimate contact between the FRP system and concrete by providing a clean, smooth, and flat or convex surface as stated in ACI 546R & ICRI 03730

Installation Conditions:		
Inspection		Initial:

Ambient Temperature: _____ Relative Humidity: _____ Surface Temperature of concrete: _____ Surface dryness per ACI 503.4: _____

Repair Length		
Dimensions	The overall Syntho-Glass XT composite repair length MUST be within the minimum axial repair length specified within the NRI composite calculations.	Length:

Application Controls		
Material Preparation	Raw materials inspected to ensure proper labeling, requirements & quantities	Initial:
Syntho-Poxy	The Syntho-Poxy was mixed using the 50 mil applicator gun & static mixing nozzle. The Syntho-Poxy was applied within 10 minutes.	Initial:
Cured epoxy putty	The Syntho-Poxy was inspected to ensure the filler material conforms to the geometry of the column or beam's cylinder shape	Initial:
SubLV Epoxy Mixing	100% of the Kevlar Epoxy part A & B was mixed until uniform in color (light green) or mixed using the pneumatic gun and static mixing nozzle	Initial:
SubLV Epoxy Application Thickness	30-60 Mils of epoxy was applied which was within the target range of technical data requirements	Initial:
Syntho-Glass XT Resin Activating	100% of the composite wrap was activated with fresh water or salt water	Initial:
Syntho-Glass XT	Correct # of layers of composite wraps were applied based on NRI's calculations	# Layers:
Compression Film	100% of the outer layers of composite wrap are wrapped with 2 layers of compression film and perforated every 8 – 16 layers while the resin is still tacky	Initial:

Test on Repair		
Cure SubLV epoxy	Hardness requirements of the epoxy meet Shore D requirements of the technical data	Value:
Pull-off test results	Bond strength _____ Failure mode _____ Location_____	Initial:
Cure Syntho-Glass XT Wrap	Hardness requirements of the composite wrap meet Shore D requirements of the technical data	Value:
Composite wrap	Correct # of layers of composite wraps were applied based on NRI's calculations	# Layers:
Dimensions	The Syntho-Glass XT overall repair length is within the minimum axial repair length specified within the calculations.	Length:

QUALITY CONTROL RECORDS

Using a Shore D hardness tester, do the following upon completion of repair:

a. Syntho-Glass XT outer layer should have an average Shore D of 70 after 24 hr
b. Testing should be performed ensuring the pin is placed on the highest point of the composite repair to ensure proper reading
c. A minimum of 10 tests shall be done to get the average
d. The test point shall be placed directly on a fiber and not the valley where the fibers cross as this could result in a false low reading.
e. The Syntho-SubSea LV Epoxy should be tested using the Shore D hardness tester after 24 hrs and should have an average Shore D value of 70.
f. The epoxy used for this test should be an excess amount left over from the repair and can be place on an area outside of the pipe.
g. The highest point to the epoxy should be where the pin is placed
h. A minimum of 10 tests shall be done to get the average.

All test parameters and to be performed to ensure that all materials have been properly mixed and ensure complete curing profile of the Syntho-Glass XT composite repair system.

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QA/QC Material Traceability:

Manufacturer's born on Date: located on foil pouch
Manufacturer's Lot Number: located on foil pouch
ISO (see ISO certificate)

Procedures to be taken in handling and storage:

For ideal shelf life, store in a cool, shaded area at an ambient temperature of 72°F (23°C). Do not expose materials to temperatures above 110°F (44°C) or below 40°F (5°C).

Syntho-Glass®XT is packaged within a hermetically sealed foil pouch to protect the Syntho-Glass XT composite wrap from atmospheric moisture. Because the Syntho-Glass XT composite wrap cures when exposed to water or air humidity, care must be taken in handling the sealed bags to prevent puncturing or scuffing. If the protective foil pouch is punctured the Syntho-Glass XT composite wrap will be exposed to atmospheric moisture which will cause the Syntho-Glass XT outer composite wrap to cure within the foil bag.

Shelf Life: NRI provides a 12 month shelf-life if Syntho-Glass XT is stored in a cool dry place and the protective foil pouch is free from puncture damage.

Current MSDS available at http://neptuneresearch.com/downloads/

NRI ◊ Lake Park FL ◊ 561.683.6992 ◊ 561.683.8366 Fax

1. Scope

1.1. This specification and application guide may be used for the application of the Syntho-Glass®XT System for externally bonded applications including beams, slabs, columns, walls, joint/connections, smokestacks, vaults, domes, tunnels, silos, pipes and trusses.

1.2. This specification and application guide covers external repairs of concrete, with an upper temperature limit of the cured system rated for Tg – 27 F = 173°F (73°C) for dry conditions.

1.3. Concrete repairs should not be conducted if any of the following are present: alkali-silica reactions, delayed ettringite formation, carbonation, longitudinal cracking around corroded reinforced steel, and laminar cracking at the location of the steel reinforcement.

1.4. Arresting of any ongoing corrosion and repairing of any degradation to the substrate is required.

1.5. The ACI 440.2R-08 "Guide for the design and construction of externally bonded FRP systems for strengthening concrete structures", was used as the standard for the qualification of the Syntho-Glass XT system for concrete remediation.

1.6. The engineer shall follow the general guidelines provided by this specification and application guide to ensure that the implementation of the Syntho-Glass XT System is comprehensive and correct for the specified work.

1.7. The Engineer shall also follow any written procedures providing further details appropriate for specific types of repairs, to ensure that the implementation of the Syntho-Glass XT System is comprehensive and correct for the specified work.

1.8. **The installation contractor is required to have completed NRI's operator qualified training and all installations should be in accordance with the installation procedures developed by NRI. Deviation from the procedures developed by NRI should not be allowed without written consent and after consulting with NRI.**

1.9. **The installation of NRI's Syntho-Glass XT system should not be applied on surfaces that are below 50°F (10°C) or above 150°F (65°C)**

1.10. To obtain the material specifications and installation manual, contact:
NRI 1346 S Killian Drive, Lake Park, FL 33403; 561-683-6992 (phone), 561-683-8366 (fax), customerservice@neptuneresearch.com (email).

2. General Surface Preparation Requirements

2.1. Personal protective gear of glove, eye guards and coveralls should be worn during installation.

2.2. All loose concrete should be removed before surface preparation begins.

2.3. All defective areas of the concrete substrate shall be removed according to ACI 545R-96 & ICRI No. 03730, using appropriate equipment such as an air or electric powered jackhammer or saw.

2.4. All defective areas of the concrete substrate shall be removed at a sufficient depth of at least 1/2" (12.7mm) beyond the repair area to expose sound aggregates. If any reinforcing steel is exposed in the process that appears to be deteriorated or its bond with the concrete is broken during the cleaning process, an additional nominal depth of 3/4" (19mm) or at least 1/4" (6.4mm) larger than the largest aggregate in repair material shall be cut from underneath the steel. If any deterioration is noticed in the repair area, its sources shall be located and treated before starting the surface preparation.

2.5. Upon removing defective concrete and before restoring the defective area, the substrate shall be cleaned from any dust, laitance, grease, oil, curing compounds, impregnations, foreign particles, wax, and bonding inhibiting materials.

2.6. Defects may include loose and broken debris or delaminated and spalled sections of concrete, voids, honeycombs and deteriorated concrete.

2.7. Surface preparation shall promote continuous intimate contact between the FRP system and concrete by providing a clean, smooth, and flat or convex surface. All irregularities, unevenness and sharp protrusions in the surface profile shall be grinded away to a smooth surface with less than 1/32" (0.8mm) deviation. Disk grinders or other similar devices shall be used to remove stain, paint, or any other surface substance that may affect the bond. Voids or depressions with diameters larger than 1/2" (12.7mm) or depths greater than 1/8" (3.2mm), when measured from a 12" (305mm) straight edge placed on the surface of the concrete should be filled.

2.8. All inside and outside concerns and sharp edges shall be rounded or chamfered to a minimum radius of 12.7mm (1/2" inch).

2.9. All cracks in the surface of the concrete or substrate that are wider than 1/100" (0.25mm) shall be filled using pressure injection of epoxy. The FRP system should not be installed for a minimum of 24 hours after crack injection was completed.

2.10. Any unevenness in the surface of the concrete greater than 1/32" (1mm) out of plane variations or fins, protrusions, bug holes, depressions voids, and roughened corners shall be filled and smoothed over using an epoxy or polymer cement mortar with a strength equal or greater than the strength of the original concrete. All patching materials shall be cured a minimum of 7 days before installing the FRP system.

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3. Materials

3.1. **Syntho-Poxy™HC 50ml Epoxy Cartridge** (Item No. SPHC50N)

3.1.1. The Syntho-Poxy HC 50ml "cartridge" Epoxy is a high compressive strength [17,000 psi (1,172.1bar)] two-part A & B epoxy that is dispensed from a 50ml cartridge. (liquid epoxy resin and amine-based curing agent)

3.1.2. After cure, the Syntho-Poxy HC epoxy will provide benefits which may include sealing, load transfer, and the creation of a smooth transition between the damaged area and the Syntho-Glass®XT.

3.1.3. Syntho-Poxy HC epoxy is engineered for above water & below water sealing applications. The epoxy should be mixed with the static mixing nozzle and dispended into all defects and trawled in all directions to remove any air pockets that could be trapped between the concrete surface and the liquid epoxy. Once the epoxy is applied to the repair site make sure the edges of the putty are feathered out to create a uniform surface matching the profile of the concrete structure.

3.1.4. The physical specification values shall meet the values given on the datasheet for Syntho-Poxy HC.

3.2. **Syntho-SubSea™LV Epoxy** (Item No. SUBLV, SUBLVG, SUBLV10G, SUBLV.4) Storage cans or .4 gallon cartridges (Item # SUBLV.4) which requires a pneumatic applicator gun (Item # EAGD.4M and EAGD.4P) and static mixing nozzle (Item # SUBLVNOZ).

3.2.1. Syntho-SubSea LV Epoxy is a non-hazardous epoxy formula which can be substituted for Syntho-SubSea™ Epoxy.

3.2.2. Syntho-SubSea LV Epoxy is comprised of a Kevlar®-reinforced two-part resin (liquid epoxy resin and amine-based curing agent).

3.2.3. After cure, the Syntho-SubSea LV Epoxy will provide benefits which may include sealing, corrosion protection, load transfer, adhesion between substrates, and the creation of a smooth transition between the damaged area and the Syntho-Glass XT.

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3.2.4. Syntho-SubSea LV Epoxy is designed for underwater & above water sealing applications. It should be applied at a maximum 30 mil (0.762 mm) thickness.

3.2.5. The Physical Specification values shall meet the values given on the datasheet for Syntho-SubSea LV.

3.3. **Syntho-Glass®XT** (Item No. XT215, 330, 430, 450, 830, 860, 1030, 1060, 1260)

3.3.1. As packaged, Syntho-Glass XT is comprised of an asymmetric biaxial plain weave fiberglass tape that is impregnated by an uncured (liquid) polyurethane resin.

3.3.2. The resin component of Syntho-Glass XT is activated by fresh or salt water and hardens as it cures, resulting in a thermo set composite.

3.3.3. The hardening of the resin component produces a pressure-retaining fiberglass-reinforced composite sleeve, resistant to attack by petroleum products and many other chemicals, and possessing its greatest strength in the circumferential (hoop) direction of the concrete that is being repaired.

3.3.4. The physical specification values shall meet the values given on the datasheet for Syntho-Glass XT.

3.4. **EC3™Epoxy Top Coat** (Item No. EC3SEALG and EC3SEALC)

3.4.1. EC3 Epoxy is a chemically resistance, UV stable weather-able top coating used to provide an external barrier over the Syntho-Glass XT.

3.4.2. The product is engineered for above water applications and should be applied at a 10 mil (0.254 mm) thickness.

3.5. **Syntho-Glass®UV** (Item No. SGUV215, 330, 430, 450, 830, 860, 1030, 1060, 1260)

3.5.1. As packaged, Syntho-Glass UV is an aliphatic UV stable moisture cured polyurethane prepreg composite used as the final layer of protection from UV light. This last layer is a sacrificial protection layer and will be in addition to the recommend number of layers specified by the composite calculator.

4. Application of Syntho-Poxy™HC 50ml Epoxy Cartridge as Load Transfer Material

4.1. Syntho-Poxy HC is supplied in a 50ml epoxy cartridge that is dispensed using a hand held applicator gun and mixed with a static mixing nozzle. The resin and hardener are properly mixed

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with the static mixer to ensure the correct physical properties of the liquid epoxy. Working time is only 10 minutes. Dispense only enough liquid epoxy that you can install in 10 minutes.

4.2. Syntho-Poxy HC is dispended out of a handheld applicator gun (Item # EAGD50MIL) and mixed through a static mixing nozzle (Item # SPHCNOZ). Follow the step by step direction provided with the Syntho-Poxy HC applicator gun to ensure proper applicator usage.

4.3. Apply the Syntho-Poxy HC mixture to clean, prepared surface by using a spatula, trowel or putty knife, working the material into all indentations to assure that no air bubbles remain.

4.4. Voids or depressions with diameters larger than 1/2" (12.7mm) or depths greater than 1/8" (3.2mm), when measured from a 12" (305mm) straight edge placed on the surface of the concrete should be filled.

4.5. Fill all anomalies or voids with the liquid epoxy to match the contour of the outside diameter of the concrete.

4.6. All cracks in the surface of the concrete or substrate that are wider than 1/100" (0.25mm) shall be filled using pressure injection of the Syntho-Poxy HC. Feather the edges of the application to ensure a water-tight seal.

4.7. NOTE: Replace the mixing nozzle (Item # SPHCNOZ) after each 10 min application to ensure proper mixing of the Syntho-Poxy HC

4.8. The FRP system should not be installed for a minimum of 24 hours after crack injection was completed.

6. Application of Syntho-SubSea™LV

6.1. Syntho-SubSea LV is supplied in two precisely proportioned parts: Part A, liquid epoxy resin; and Part B, curing agent (also known as "Hardener"). NOTE: The Syntho-SubSea LV is available in individual storage cans (Item # SUBLV, LGV, LV10G) or a .4 gallon cartridge (Item # SUBLV.4) which requires a pneumatic applicator gun (Item # PNEUMATIC_GUN) and static mixing nozzle (Item # SUBLVNOZ).

Application of Syntho-SubSea™LV with a Pneumatic Applicator Gun & Static Mixing Nozzle

6.2. Syntho-SubSea LV is supplied in a .4 gallon epoxy cartridge that is dispensed using a pneumatic applicator gun and mixed with a static mixing nozzle. The resin and hardener are properly mixed with the static mixer to ensure the correct physical properties of the liquid epoxy. Working time is only 30 minutes. Dispense only enough liquid epoxy that you can install in 30 minutes.

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6.3. Syntho-SubSea LV is dispensed using an applicator gun (Item #EAGD.4M, EAGD.4P) and mixed through a static mixing nozzle (Item # SUBLVNOZ). Follow the step by step directions provided with the Syntho-SubSea™LV pneumatic applicator gun to ensure proper applicator usage.

6.4. Apply the Syntho-SubSea LV mixture to clean, prepared surface by using a spatula, trowel or putty knife, working the material into all indentations to assure that no air bubbles remain.

6.5. Feather the edges of the application to ensure a water-tight seal.

6.6. NOTE: Replace the mixing nozzle (Item # SUBLVNOZ) after each 30 min application to ensure proper mixing of the Syntho-SubSea LV

6.7. **Apply Syntho-SubSea LV around entire circumference of the concrete and make sure to extend the coverage based on the minimum composite repair length specified by NRI's composite calculator.** NOTE: inspect the Syntho-SubSea LV coverage to ensure proper mil thickness of 30mil – 60mil using a mil gauge supplied in the applicator tool box. Make sure 100% of the concrete surface is coated.

6.8. A 30mil – 60mil thickness is recommended for the Syntho-SubSea LV primary layer

Application of Syntho-SubSea™ LV Mixing Manually or With Jiffy Mixer

6.9. Add 100% of the Curing Agent (Part B) into the container of liquid epoxy resin (Part A). It is essential for the installer to add ***all*** of Part B into the container of Part A in order to achieve proper curing.

6.10. Complete and thorough mixing of the two parts is required in order to obtain the correct curing properties; and can be achieved by stirring the two parts together until a smooth, uniform, streak-free consistency is reached. A jiffy mixer and handheld drill can be used to mix 100% of the A & B in a clean bucket.

6.11. Apply mixture to clean, prepared surface by using a spatula, trowel or putty knife, working the material into all indentations to assure that no air bubbles remain.

6.12. Feather the edges of the application to ensure a water-tight seal.

6.13. **Apply Syntho-SubSea LV around entire circumference of the concrete based on the minimum composite repair length specified by NRI's composite calculator.** NOTE: inspect the Syntho-SubSea LV coverage to ensure proper mil thickness of 30mil – 60mil using a mil gauge supplied in the applicator tool box. Make sure 100% of the pipe surface is coated.

6.14. A 30mil – 60mil thickness is recommended for the Syntho-SubSea LV primary layer.

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7. Application of Syntho-Glass®XT

7.1. Do not open the bag containing Syntho-Glass XT until you are ready to use it.

7.2. In hot or humid location, water shall be sprayed on each layer of Syntho-Glass XT while it is being applied (instead of immersing the Syntho-Glass XT in water before application), in order to slow down the curing and thus provide the installer sufficient working time.

7.3. In cold weather applications, the temperature of the repair area must be brought up to 40° F (5°C) prior to the application of Syntho-Glass XT since its resin component will not begin to cure at lower temperatures.

7.4. The tape shall be spirally wrapped around the concrete with a 50% overlap.

7.5. Each completed wrap over the repair area shall have the specified number of layers of Syntho-Glass XT when completed.

7.6. Hold the end of the tape firmly to the surface of the pipe at the starting point. **The starting point shall be on the borders** of the Syntho-SubSea LV primary layer on either side.

7.7. **NOTE: Ensure the total repair length of the Syntho-Glass XT composite is applied at the required length specified by NRI's composite calculations**.

7.8. The best position for a starting point is between an 8 o'clock and 10 o'clock position on the outer diameter of the concrete.

7.9. Unroll the tape, keeping it as close to the surface of the pipe as possible. Do not use a long lead of tape. The roll of tape shall always be in an upright position, with the tape being applied from the lower edge of the roll to maintain proper pressure.

7.10. Apply sufficient tension by pulling on the roll of tape as the layers are being applied.

7.11. The tape may be applied from right to left (R-T-L) or from left to right (L-T-R). At the end of the first wrap, reverse the direction of the wrap and continue to apply the Syntho-Glass XT. Do not reverse the direction of the application without completing an entire wrap along the length of the repair area.

7.12. The Syntho-Glass XT application shall extend, with the same number of layers as being applied over the repair area itself, into an "overwrap" region beyond the damaged region in the axial direction on each side of the damaged region.

7.13. After the application of Syntho-Glass XT, the entire area shall be manually molded and squeezed into the cloth in the direction of the wrap. This procedure shall be repeated every four layers (two wraps).

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7.14. The completed Syntho-Glass XT application shall be overwrapped by two layers of compression film & perforated using the perforator tool. The compression film may be removed when Syntho-Glass XT has reached its initial cure time.

7.15. The Syntho-Glass XT installation shall be ready for service when the resin has cured sufficiently to provide adhesion between layers and has reached a hardness of 70 shore D.

7.16. For vertical installations such as concrete columns, Syntho-Glass XT application shall begin at the bottom of the repair area and proceed upwards on the last layer to prevent water collection on the FRP edges.

7.17. For sub-sea and splash zone Installations, the last (outer) wrap shall be tied down or overwrapped in a manner that will ensure that the currents or wave action will not affect the adhesion of the last layer of fiberglass tape before the resin has reached its initial cure.

7.18. For sub-sea Installations, open the bag of Syntho-Glass XT underwater, at the repair site, after all cleaning has been completed.

7.19. For higher impact resistance, apply additional layers of Syntho-Glass®24 over the Syntho-Glass XT.

7.20. **NOTE: For Non-Buried applications, a Syntho-Glass XT Installation must be coated with a UV-blocking and weather resistance coating of Syntho-Glass®UV, Wrapid Bond™, or an approved coating by NRI**.

7.21. For cold weather Installations, follow procedures above. However, as an additional step, after applying the final outer wrap of a compression film, then apply a heating pad over the entire repaired area since Syntho-Glass XT will not cure by itself at temperatures under 40ºF (5ºC).

7.22. For hot weather Installations, follow procedures above. However, use ice water in the sprayer if possible, to slow down the curing and thus allow the installer sufficient working time. Furthermore, store unopened bags of Syntho-Glass XT in a separate container in an ice chest if possible.

7.23. The installer shall follow the written procedures and software provided by the manufacturer in order to calculate the minimum number of layers of Syntho-Glass XT required for specific types of repairs.

7.24. The Engineer shall follow the written procedures and software provided by the Manufacturer in order to calculate the minimum axial length of repair, which includes the length directly over the repair area, the overwrap length extending beyond the repair area while remaining at the same number of layers, and the taper length extending at each end beyond the overwrap region.

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Warranty/Disclaimer: NRI, the Manufacturer of Syntho-Glass®XT will replace at no charge to the purchaser any product proved to be defective. Responsibility of the Manufacturer and the Distributor is limited to replacement of the product only. Neither the Manufacturer nor the Distributor shall be liable for consequential or incidental damage or loss of any kind as they do not have any control over the conditions under which these products may be used or over the methods of application. Users should test the product for their particular need and suitability. Users should consult with the Manufacturer or the Distributor for all proposed repairs using the Syntho-Glass®XT System. Written procedures for specific repairs are available upon request from the Manufacturer or Distributor. All proposed repairs to concrete structures using the Syntho-Glass®XT System must be installed or supervised by Certified Technicians. Syntho-Glass®XT is not an approved coating system. Failing to coat per standard procedures can lead to atmospheric corrosion damage. Apply protective coatings per company standards. Kevlar® is a registered trademark of E. I. du Pont Nemours and Company.

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QA/QC Material Traceability:

Manufacturer's born on Date: located on foil pouch
Manufacturer's Lot Number: located on foil pouch
ISO (see ISO certificate)

Procedures to be taken in handling and storage:

For ideal shelf life, store in a cool, shaded area at an ambient temperature of 72°F (23°C). Do not expose materials to temperatures above 110°F (44°C) or below 40°F (5°C).

Viper-Skin™ is packaged within a hermetically sealed foil pouch to protect the Viper-Skin composite wrap from atmospheric moisture. Because the Viper-Skin composite wrap cures when exposed to water or air humidity, care must be taken in handling the sealed bags to prevent puncturing or scuffing. If the protective foil pouch is punctured the Viper-Skin composite wrap will be exposed to atmospheric moisture which will cause the Viper-Skin outer composite wrap to cure within the foil bag.

Shelf Life: NRI provides a 12 month shelf-life if Viper-Skin is stored in a cool dry place and the protective foil pouch is free from puncture damage.

Current MSDS available at http://neptuneresearch.com/downloads/

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Innovative Composite Solutions

VIPER-SKIN™

SPECIFICATION AND APPLICATION GUIDE

1. Scope

1.1. This specification and application guide may be used for the application of the Viper-Skin™ System for externally bonded applications including beams, slabs, columns, walls, joint/connections, smokestacks, vaults, domes, tunnels, silos, pipes and trusses.

1.2. This specification and application guide covers external repairs of concrete, with an upper temperature limit of the cured system rated for Tg – 27 F = 173°F (73°C) for dry conditions.

1.3. Concrete repairs should not be conducted if any of the following are present: alkali-silica reactions, delayed ettringite formation, carbonation, longitudinal cracking around corroded reinforced steel, and laminar cracking at the location of the steel reinforcement.

1.4. Arresting of any ongoing corrosion and repairing of any degradation to the substrate is required.

1.5. The ACI 440.2R-08 "Guide for the design and construction of externally bonded FRP systems for strengthening concrete structures", was used as the standard for the qualification of the Viper-Skin system for concrete remediation.

1.6. The engineer shall follow the general guidelines provided by this specification and application guide to ensure that the implementation of the Viper-Skin System is comprehensive and correct for the specified work.

1.7. The Engineer shall also follow any written procedures providing further details appropriate for specific types of repairs, to ensure that the implementation of the Viper-Skin System is comprehensive and correct for the specified work.

1.8. **The installation contractor is required to have completed NRI's operator qualified training and all installations should be in accordance with the installation procedures developed by NRI. Deviation from the procedures developed by NRI should not be allowed without written consent and after consulting with NRI.**

1.9. **The installation of NRI's Viper-Skin system should not be applied on surfaces that are below 50°F (10°C) or above 150°F (65°C)**

1.10. To obtain the material specifications and installation manual, contact:
NRI 1346 S Killian Drive, Lake Park, FL 33403; 561-683-6992 (phone), 561-683-8366 (fax), customerservice@neptuneresearch.com (email).

2. General Surface Preparation Requirements

2.1. Personal protective gear of glove, eye guards and coveralls should be worn during installation.

2.2. All loose concrete should be removed before surface preparation begins.

2.3. All defective areas of the concrete substrate shall be removed according to ACI 545R-96 & ICRI No. 03730, using appropriate equipment such as an air or electric powered jackhammer or saw.

2.4. All defective areas of the concrete substrate shall be removed at a sufficient depth of at least 1/2" (12.7mm) beyond the repair area to expose sound aggregates. If any reinforcing steel is exposed in the process that appears to be deteriorated or its bond with the concrete is broken during the cleaning process, an additional nominal depth of 3/4" (19mm) or at least 1/4" (6.4mm) larger than the largest aggregate in repair material shall be cut from underneath the steel. If any deterioration is noticed in the repair area, its sources shall be located and treated before starting the surface preparation.

2.5. Upon removing defective concrete and before restoring the defective area, the substrate shall be cleaned from any dust, laitance, grease, oil, curing compounds, impregnations, foreign particles, wax, and bonding inhibiting materials.

2.6. Defects may include loose and broken debris or delaminated and spalled sections of concrete, voids, honeycombs and deteriorated concrete.

2.7. Surface preparation shall promote continuous intimate contact between the FRP system and concrete by providing a clean, smooth, and flat or convex surface. All irregularities, unevenness and sharp protrusions in the surface profile shall be grinded away to a smooth surface with less than 1/32" (0.8mm) deviation. Disk grinders or other similar devices shall be used to remove stain, paint, or any other surface substance that may affect the bond. Voids or depressions with diameters larger than 1/2" (12.7mm) or depths greater than 1/8" (3.2mm), when measured from a 12" (305mm) straight edge placed on the surface of the concrete should be filled.

2.8. All inside and outside concerns and sharp edges shall be rounded or chamfered to a minimum radius of 12.7mm (1/2" inch).

2.9. All cracks in the surface of the concrete or substrate that are wider than 1/100" (0.25mm) shall be filled using pressure injection of epoxy. The FRP system should not be installed for a minimum of 24 hours after crack injection was completed.

2.10. Any unevenness in the surface of the concrete greater than 1/32" (1mm) out of plane variations or fins, protrusions, bug holes, depressions voids, and roughened corners shall be filled and smoothed over using an epoxy or polymer cement mortar with a strength equal or greater than the strength of the original concrete. All patching materials shall be cured a minimum of 7 days before installing the FRP system.

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NRI Innovative Composite Solutions

3. Materials

3.1. **Syntho-Poxy™HC 50ml Epoxy Cartridge** (Item No. SPHC50N)

3.1.1. The Syntho-Poxy HC 50ml "cartridge" Epoxy is a high compressive strength [17,000 psi (1,172.1bar)] two-part A & B epoxy that is dispensed from a 50ml cartridge. (liquid epoxy resin and amine-based curing agent)

3.1.2. After cure, the Syntho-Poxy HC epoxy will provide benefits which may include sealing, load transfer, and the creation of a smooth transition between the damaged area and the Viper-Skin.

3.1.3. Syntho-Poxy HC epoxy is engineered for above water & below water sealing applications. The epoxy should be mixed with the static mixing nozzle and dispended into all defects and trawled in all directions to remove any air pockets that could be trapped between the concrete surface and the liquid epoxy. Once the epoxy is applied to the repair site make sure the edges of the putty are feathered out to create a uniform surface matching the profile of the concrete structure.

3.1.4. The physical specification values shall meet the values given on the datasheet for Syntho-Poxy HC.

3.2. **Syntho-SubSea™LV Epoxy** (Item No. SUBLV, SUBLVG, SUBLV10G, SUBLV.4) Storage cans or .4 gallon cartridges (Item # SUBLV.4) which requires a pneumatic applicator gun (Item # EAGD.4M and EAGD.4P) and static mixing nozzle (Item # SUBLVNOZ).

3.2.1. Syntho-SubSea LV Epoxy is a non-hazardous epoxy formula which can be substituted for Syntho-SubSea™ Epoxy.

3.2.2. Syntho-SubSea LV Epoxy is comprised of a Kevlar®-reinforced two-part resin (liquid epoxy resin and amine-based curing agent).

3.2.3. After cure, the Syntho-SubSea LV Epoxy will provide benefits which may include sealing, corrosion protection, load transfer, adhesion between substrates, and the creation of a smooth transition between the damaged area and the Viper-Skin.

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3.2.4. Syntho-SubSea LV Epoxy is designed for underwater & above water sealing applications. It should be applied at a maximum 30 mil (0.762 mm) thickness.

3.2.5. The Physical Specification values shall meet the values given on the datasheet for Syntho-SubSea LV.

3.3. **Syntho-Glass®XT** (Item No. XT215, 330, 430, 450, 830, 860, 1030, 1060, 1260)

3.3.1. As packaged, Syntho-Glass®XT is comprised of an asymmetric biaxial plain weave fiberglass tape that is impregnated by an uncured (liquid) polyurethane resin.

3.3.2. The resin component of Syntho-Glass®XT is activated by fresh or salt water and hardens as it cures, resulting in a thermo set composite.

3.3.3. The hardening of the resin component produces a pressure-retaining fiberglass-reinforced composite sleeve, resistant to attack by petroleum products and many other chemicals, and possessing its greatest strength in the circumferential (hoop) direction of the concrete that is being repaired.

3.3.4. The physical specification values shall meet the values given on the datasheet for Syntho-Glass®XT.

3.4. **Viper-Skin™** (Item No. VS210, 2210, 415, 430, 460, 630, 815, 830, 860, 1030, 1060, 1260)

3.4.1. As packaged, Viper-Skin is comprised of a biaxial weave carbon and glass fiber tape that is impregnated by an uncured (liquid) polyurethane resin.

3.4.2. The resin component of Viper-Skin is activated by fresh or salt water and hardens as it cures, resulting in a thermo set composite.

3.4.3. The hardening of the resin component produces a pressure-retaining carbon and glass reinforced composite sleeve, resistant to attack by petroleum products and many other chemicals, and possessing its greatest strength in the circumferential (hoop) direction of the concrete that is being repaired.

3.4.4. The physical specification values shall meet the values given on the datasheet for Viper-Skin.

3.5. **EC3™ Epoxy Top Coat** (Item No. EC3SEALG and EC3SEALC)

3.5.1. EC3 Epoxy is a chemically resistance, UV stable weather-able top coating used to provide an external barrier over the Viper-Skin.

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3.5.2. The product is engineered for above water applications and should be applied at a 10 mil (0.254 mm) thickness.

3.6. **Syntho-Glass®UV** (Item No. SGUV215, 330, 430, 450, 830, 860, 1030, 1060, 1260)

3.6.1. As packaged, Syntho-Glass UV is an aliphatic UV stable moisture cured polyurethane prepreg composite used as the final layer of protection from UV light. This last layer is a sacrificial protection layer and will be in addition to the recommend number of layers specified by the composite calculator.

4. Application of Syntho-Poxy™HC 50ml Epoxy Cartridge as Load Transfer Material

4.1. Syntho-Poxy HC is supplied in a 50ml epoxy cartridge that is dispensed using a hand held applicator gun (Item No. EAGD50ML) and mixed with a static mixing nozzle. The resin and hardener are properly mixed with the static mixer to ensure the correct physical properties of the liquid epoxy. Working time is only 10 minutes. Dispense only enough liquid epoxy that you can install in 10 minutes.

4.2. Syntho-Poxy HC is dispended out of a handheld applicator gun (Item # EAGD50MIL) and mixed through a static mixing nozzle (Item # SPHCNOZ). Follow the step by step direction provided with the Syntho-Poxy HC applicator gun to ensure proper applicator usage.

4.3. Apply the Syntho-Poxy HC mixture to clean, prepared surface by using a spatula, trowel or putty knife, working the material into all indentations to assure that no air bubbles remain.

4.4. Voids or depressions with diameters larger than 1/2" (12.7mm) or depths greater than 1/8" (3.2mm), when measured from a 12" (305mm) straight edge placed on the surface of the concrete should be filled.

4.5. Fill all anomalies or voids with the liquid epoxy to match the contour of the outside diameter of the concrete.

4.6. All cracks in the surface of the concrete or substrate that are wider than 1/100" (0.25mm) shall be filled using pressure injection of the Syntho-Poxy HC. Feather the edges of the application to ensure a water-tight seal.

4.7. NOTE: Replace the mixing nozzle (Item # SPHCNOZ) after each 10 min application to ensure proper mixing of the Syntho-Poxy HC

4.8. The FRP system should not be installed for a minimum of 24 hours after crack injection was completed.

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6. Application of Syntho-SubSea™LV

6.1. Syntho-SubSea LV is supplied in two precisely proportioned parts: Part A, liquid epoxy resin; and Part B, curing agent (also known as "Hardener"). NOTE: The Syntho-SubSea LV is available in individual storage cans (Item # SUBLV, LGV, LV10G) or a .4 gallon cartridge (Item # SUBLV.4) which requires a pneumatic applicator gun (Item # PNEUMATIC_GUN) and static mixing nozzle (Item # SUBLVNOZ).

Application of Syntho-SubSea™LV with a Pneumatic Applicator Gun & Static Mixing Nozzle

6.2. Syntho-SubSea LV is supplied in a .4 gallon epoxy cartridge that is dispensed using a pneumatic applicator gun and mixed with a static mixing nozzle. The resin and hardener are properly mixed with the static mixer to ensure the correct physical properties of the liquid epoxy. Working time is only 30 minutes. Dispense only enough liquid epoxy that you can install in 30 minutes.

6.3. Syntho-SubSea LV is dispensed using a pneumatic applicator gun (Item #EAGD.4M, EAGD.4P) and mixed through a static mixing nozzle (Item # SUBLVNOZ). Follow the step by step directions provided with the Syntho-SubSea LV pneumatic applicator gun to ensure proper applicator usage.

6.4. Apply the Syntho-SubSea LV mixture to clean, prepared surface by using a spatula, trowel or putty knife, working the material into all indentations to assure that no air bubbles remain.

6.5. Feather the edges of the application to ensure a water-tight seal.

6.6. NOTE: Replace the mixing nozzle (Item # SUBLVNOZ) after each 30 min application to ensure proper mixing of the Syntho-SubSea LV

6.7. **Apply Syntho-SubSea LV around entire circumference of the concrete and make sure to extend the coverage based on the minimum composite repair length specified by NRI's composite calculator.** NOTE: inspect the Syntho-SubSea LV coverage to ensure proper mil thickness of 30mil – 60mil using a mil gauge supplied in the applicator tool box. Make sure 100% of the concrete surface is coated.

6.8. A 30mil – 60mil thickness is recommended for the Syntho-SubSea LV primary layer

Application of Syntho-SubSea™ LV Mixing Manually or With Jiffy Mixer

6.9. Add 100% of the Curing Agent (Part B) into the container of liquid epoxy resin (Part A). It is essential for the installer to add ***all*** of Part B into the container of Part A in order to achieve proper curing.

6.10. Complete and thorough mixing of the two parts is required in order to obtain the correct curing properties; and can be achieved by stirring the two parts together until a smooth, uniform,

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streak-free consistency is reached. A jiffy mixer and handheld drill can be used to mix 100% of the A & B in a clean bucket.

6.11. Apply mixture to clean, prepared surface by using a spatula, trowel or putty knife, working the material into all indentations to assure that no air bubbles remain.

6.12. Feather the edges of the application to ensure a water-tight seal.

6.13. **Apply Syntho-SubSea LV around entire circumference of the concrete based on the minimum composite repair length specified by NRI's composite calculator.** NOTE: inspect the Syntho-SubSea LV coverage to ensure proper mil thickness of 30mil – 60mil using a mil gauge supplied in the applicator tool box. Make sure 100% of the pipe surface is coated.

6.14. A 30mil – 60mil thickness is recommended for the Syntho-SubSea LV primary layer.

7. Application of Syntho-Glass®XT

7.1. NRI recommends applying 2 layers of Syntho-Glass XT before any Viper-Skin application to prevent possible galvanic cell or any issues associated with cathodic protection to arise.

7.2. Do not open the bag containing Syntho-Glass XT until you are ready to use it.

7.3. Immerse roll of Syntho-Glass XT in water for 20 seconds then spirally wrap around the concrete with a 50% overlap to achieve the recommended 2 layers.

8. Application of Viper-Skin™

8.1. Do not open the bag containing Viper-Skin until you are ready to use it.

8.2. In hot or humid location, water shall be sprayed on each layer of Viper-Skin while it is being applied (instead of immersing the Viper-Skin in water before application), in order to slow down the curing and thus provide the installer sufficient working time.

8.3. In cold weather applications, the temperature of the repair area must be brought up to 40° F (5°C) prior to the application of Viper-Skin since its resin component will not begin to cure at lower temperatures.

8.4. The tape shall be spirally wrapped around the concrete with a 50% overlap.

8.5. Each completed wrap over the repair area shall have the specified number of layers of Viper-Skin when completed.

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8.6. Hold the end of the tape firmly to the surface of the pipe at the starting point. **The starting point shall be on the borders** of the Syntho-SubSea LV primary layer on either side.

8.7. **NOTE: Ensure the total repair length of the Viper-Skin composite is applied at the required length specified by NRI's composite calculations**.

8.8. The best position for a starting point is between an 8 o'clock and 10 o'clock position on the outer diameter of the concrete.

8.9. Unroll the tape, keeping it as close to the surface of the pipe as possible. Do not use a long lead of tape. The roll of tape shall always be in an upright position, with the tape being applied from the lower edge of the roll to maintain proper pressure.

8.10. Apply sufficient tension by pulling on the roll of tape as the layers are being applied.

8.11. The tape may be applied from right to left (R-T-L) or from left to right (L-T-R). At the end of the first wrap, reverse the direction of the wrap and continue to apply the Viper-Skin. Do not reverse the direction of the application without completing an entire wrap along the length of the repair area.

8.12. The Viper-Skin application shall extend, with the same number of layers as being applied over the repair area itself, into an "overwrap" region beyond the damaged region in the axial direction on each side of the damaged region.

8.13. After the application of Viper-Skin, the entire area shall be manually molded and squeezed into the cloth in the direction of the wrap. This procedure shall be repeated every four layers (two wraps).

8.14. The completed Viper-Skin application shall be overwrapped by two layers of compression film & perforated using the perforator tool. The compression film may be removed when Viper-Skin has reached its initial cure time.

8.15. The Viper-Skin installation shall be ready for service when the resin has cured sufficiently to provide adhesion between layers and has reached a hardness of 70 shore D.

8.16. For vertical installations such as concrete columns, Viper-Skin application shall begin at the bottom of the repair area and proceed upwards on the last layer to prevent water collection on the FRP edges.

8.17. For sub-sea and splash zone Installations, the last (outer) wrap shall be tied down or overwrapped in a manner that will ensure that the currents or wave action will not affect the adhesion of the last layer of fiberglass tape before the resin has reached its initial cure.

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8.18. For sub-sea Installations, open the bag of Viper-Skin underwater, at the repair site, after all cleaning has been completed.

8.19. For higher impact resistance, apply additional layers of Syntho-Glass®24 over the Viper-Skin.

8.20. **NOTE: For Non-Buried applications, a Viper-Skin Installation must be coated with a UV-blocking and weather resistance coating of Syntho-Glass®UV, Wrapid Bond™, or an approved coating by NRI**.

8.21. For cold weather Installations, follow procedures above. However, as an additional step, after applying the final outer wrap of a compression film, then apply a heating pad over the entire repaired area since Viper-Skin will not cure by itself at temperatures under 40ºF (5ºC).

8.22. For hot weather Installations, follow procedures above. However, use ice water in the sprayer if possible, to slow down the curing and thus allow the installer sufficient working time. Furthermore, store unopened bags of Viper-Skin in a separate container in an ice chest if possible.

8.23. The installer shall follow the written procedures and software provided by the manufacturer in order to calculate the minimum number of layers of Viper-Skin required for specific types of repairs.

8.24. The Engineer shall follow the written procedures and software provided by the Manufacturer in order to calculate the minimum axial length of repair, which includes the length directly over the repair area, the overwrap length extending beyond the repair area while remaining at the same number of layers, and the taper length extending at each end beyond the overwrap region.

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IMS INTERNATIONAL

Certificate of Registration

This is to certify that

Neptune Research Inc.

Located at

1346 S.Killian Drive
Lake Park
FL 33403
USA

conforms to the following standard for the defined scope of supply

standard

BS EN ISO 9001:2008

scope of supply

The Production of Resin Impregnated Fiberglass Cloth and other Resin Based Products used for Long Lasting Repair of Pipes and Pipelines.

Subject to the continued satisfactory operation of the management system, this certificate is valid until the 16th July 2012

Date of Certification 16th July 2003

Re-issued 7th August 2009

Certificate Number 1165

Signed by Dr. James H O'Geran

UKAS QUALITY MANAGEMENT
078

This certificate is issued within ISO Management Services International LLP's accredited scope. The use of the accreditation mark indicates accreditation in respect of those activities covered by UKAS's accreditation certificate number 078

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Section I

Neptune Research 1346 South Killian Drive Lake Park, Florida 33403	Emergency Telephone Number – 800-535-5053 Telephone Number for Information – 800-328-0090 / 561-683-6992
Product Name – Syntho Poxy™HC Part A (Resin)	Date Prepared – 10.20.10

Section II—Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity, Common Name(s) CAS#)	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
Bisphenol A diglycidyl ether (258068-38-6)	N/A	N/A	N/A	60-80
Crystalline Silica (67762907)	0.1 g/m3	0.05 mg/m3	N/A	-

Section III—Physical/Chemical Characteristics

Vapor Pressure (mm Hg) – ND Specific Gravity (H20 = 1) – 1.329 Vapor Density (AIR = 1) – ND
Evaporation Rate (Butyl Acetate = 1) Ether =1 – N/A Boiling Point – N/A Melting Point – N/A
Solubility in Water: Insoluble
Appearance and Odor – Gray paste with mild, not offensive odor

Section IV—Fire and Explosion Hazard Data

Flash Point – 277°F (136°C)	Flammable Limits - N/A	LEL - N/A	UEL - N/A

Extinguishing Media: Use water fog, foam, dry chemical or carbon dioxide to extinguish flames.

Special Fire Fighting Procedures: Firefighters should wear full protective cloth and self-contained breathing apparatus. Thoroughly decontaminate fire fighting equipment and fire fighting apparel after the incident.

Section V—Reactivity Data

Stability: Stable
Hazardous Decomposition or Byproducts: Fumes produced when heated may include oxides of carbon.
Incompatibility (Materials to Avoid: Can react vigorously with strong oxidizing agents, strong Lewis or mineral acids, and strong mineral and organic bases. Do not allow molten material to contact water or liquids as this can cause violent eruptions, splatter hot material, or ignite flammable materials. Reaction with some curing agents will release considerable heat and possible violent decomposition.
Hazardous Polymerization: Will not occur
Conditions to Avoid: High temperatures

Section VI—Health Hazard Data

Route(s) of Entry: Skin and Eye contact

Acute Skin Contact: May be slightly irritating. Repeated skin contact may result in an allergic skin reaction causing itching, burning, redness or swelling. Contact with hot material can cause thermal burns which may result in permanent damage.

Chronic Skin Contact: None anticipated

Acute Eye Contact: May cause temporary discomfort or irritation. Contact with hot material can cause thermal burns which may result in permanent damage or blindness.

Acute Ingestion: May cause gastrointestinal irritation if swallowed.

Inhalation: This material does not normally present an inhalation hazard. However, in applications where vapors caused by high temperature or mists are created, breathing may cause a mild burning sensation in the nose, throat, and lungs.

Carcinogenicity: Not listed
NTP – No IARC Monographs – No OSHA Regulated – No

Medical Conditions Generally Aggravated by Exposure – Not Determined

Emergency and First Aid Procedures -

Ingestion: Do not induce vomiting. Have victim rinse out mouth with water, then drink sips of water to remove taste from mouth. In general, no treatment is necessary unless large quantities of product are ingested. Get medical advice. If vomiting occurs spontaneously, keep head below hips to prevent aspiration.
Inhalation: Move patient to fresh air. If breathing has stopped or is labored give assisted respiration (e.g. mouth to-mouth). Supplemental oxygen may be indicated. Seek medical advice. Prevent aspiration of vomit. Turn victim's head to the side.
Skin contact: In case of contact with hot product, immediately flood the affected area with cold water. Wipe excess material from exposed area. Flush exposed skin with water and follow by washing with soap if available. Carefully remove clothing; if clothing is stuck to a burn area do not pull it off, but cut around it. Cover burn area with a clean material. Transport victim to nearest medical facility for treatment.
Eye contact: Flush with copious amount of water. Preferably lukewarm, for at least 15 minutes, holding eyelids open at all times.

Section VII—Precautions for Safe Handling and Use

Steps to Take if Material Is Released or Spilled – Avoid contact with skin and eyes. Scrape or wipe up spilled material. Collect in suitable and properly labeled containers.
Waste Disposal Method – In accordance with federal, state and local regulations.
Precautions to Be Taken in Handling and Storing – Avoid contact with eyes, skin or clothing. Avoid breathing vapor mist or spray. Use with good ventilation. Wash after handling and before eating, drinking or smoking. Keep in cool, dry, ventilated storage and in closed containers.
Transportation Information – DOT (49 CFR 171-180) – Unrestricted; IATA – Unrestricted; IMO – Unrestricted

Section VIII—Control Measures

Respiratory – N/A Monitoring – N/A Medical Surveillance – N/A
Skin protection – Appropriate impervious gloves. Because a variety of protective gloves exist, consult glove manufacturer to determine the proper type for a specific operation.
Eyes – Safety glasses or goggles.
Ventilation – Local exhaust sources regarding industrial ventilation (i.e. ACGIH Industrial Ventilation) should be consulted for guidance about adequate ventilation.

Section IX—Other Information

The information contained herein is based on the data available to us and is believed to be accurate. The data is offered in good faith as typical values and not product specification. The information in this data sheet was compiled from the information supplied by the vendors of the components of this compound. Neptune Research, Inc. makes no warranty either expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. The recommended industrial hygiene and safe handling procedures are believed to be genuinely applicable. However, each user should review these recommendations in the specific context of the intended use and determine whether they are appropriate. Neptune Research, Inc. assumes no responsibility for injury from the use of the product described herein. This information is intended only to assist in the safe handling of this material.

Innovative Composite Solutions

Section I

Neptune Research 1346 South Killian Drive Lake Park, Florida 33403	Emergency Telephone Number – 800-535-5053 Telephone Number for Information – 800-328-0090 / 561-683-6992
Product Name – Syntho Poxy™HC Part B (Catalyst)	Date Prepared – 10.20.10

Section II—Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity, Common Name(s) CAS#)	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
Mercaptan Polymer (Trade Secret)	N/A	N/A	N/A	Proprietary
Crystalline Silica (67762907)	0.1 mg/m3	0.05 mg/m3	N/A	Proprietary
Barium Sulfate (7727-43-7)	N/A	N/A	N/A	Proprietary

Section III—Physical/Chemical Characteristics

Vapor Pressure (mm Hg) – ND Specific Gravity (H20 = 1) – 1.304 Vapor Density (AIR = 1) – ND
Evaporation Rate (Butyl Acetate = 1) Ether =1 – N/A Boiling Point – N/A Melting Point – N/A
Solubility in Water: Insoluble
Appearance and Odor – White paste with mercaptan odor

Section IV—Fire and Explosion Hazard Data

Flash Point – 270°F (130°C)	Flammable Limits - N/A	LEL - N/A	UEL - N/A

Extinguishing Media: Use water fog, foam, dry chemical or carbon dioxide to extinguish flames.

Special Fire Fighting Procedures: Firefighters should wear full protective cloth and self-contained breathing apparatus. Thoroughly decontaminate fire fighting equipment and fire fighting apparel after the incident.

Section V—Reactivity Data

Stability: Stable
Hazardous Decomposition or Byproducts: Fumes produced when heated may include oxides of carbon.
Incompatibility (Materials to Avoid: Can react vigorously with strong oxidizing agents, strong Lewis or mineral acids, and strong mineral and organic bases. Do not allow molten material to contact water or liquids as this can cause violent eruptions, splatter hot material, or ignite flammable materials. Reaction with some curing agents will release considerable heat and possible violent decomposition.
Hazardous Polymerization: Will not occur
Conditions to Avoid: High temperatures

Section VI—Health Hazard Data

Route(s) of Entry: Skin and Eye contact

Acute Skin Contact: May be slightly irritating. Repeated skin contact may result in an allergic skin reaction causing itching, burning, redness or swelling. Contact with hot material can cause thermal burns which may result in permanent damage.

Chronic Skin Contact: None anticipated

Acute Eye Contact: May cause temporary discomfort or irritation. Contact with hot material can cause thermal burns which may result in permanent damage or blindness.

Acute Ingestion: May cause gastrointestinal irritation if swallowed.

Inhalation: This material does not normally present an inhalation hazard. However, in applications where vapors caused by high temperature or mists are created, breathing may cause a mild burning sensation in the nose, throat, and lungs.

Carcinogenicity: Not listed
NTP – No IARC Monographs – No OSHA Regulated – No

Medical Conditions Generally Aggravated by Exposure – Not Determined

Emergency and First Aid Procedures -

Ingestion: Do not induce vomiting. Have victim rinse out mouth with water, then drink sips of water to remove taste from mouth. In general, no treatment is necessary unless large quantities of product are ingested. Get medical advice. If vomiting occurs spontaneously, keep head below hips to prevent aspiration.
Inhalation: Move patient to fresh air. If breathing has stopped or is labored give assisted respiration (e.g. mouth to-mouth). Supplemental oxygen may be indicated. Seek medical advice. Prevent aspiration of vomit. Turn victim's head to the side.
Skin contact: In case of contact with hot product, immediately flood the affected area with cold water. Wipe excess material from exposed area. Flush exposed skin with water and follow by washing with soap if available. Carefully remove clothing; if clothing is stuck to a burn area do not pull it off, but cut around it. Cover burn area with a clean material. Transport victim to nearest medical facility for treatment.
Eye contact: Flush with copious amount of water. Preferably lukewarm, for at least 15 minutes, holding eyelids open at all times.

Section VII—Precautions for Safe Handling and Use

Steps to Take if Material Is Released or Spilled – Avoid contact with skin and eyes. Scrape or wipe up spilled material. Collect in suitable and properly labeled containers.
Waste Disposal Method – In accordance with federal, state and local regulations.
Precautions to Be Taken in Handling and Storing – Avoid contact with eyes, skin or clothing. Avoid breathing vapor mist or spray. Use with good ventilation. Wash after handling and before eating, drinking or smoking. Keep in cool, dry, ventilated storage and in closed containers.
Transportation Information – DOT (49 CFR 171-180) – Unrestricted; IATA – Unrestricted; IMO – Unrestricted

Section VIII—Control Measures

Respiratory – N/A Monitoring – N/A Medical Surveillance – N/A
Skin protection – Appropriate impervious gloves. Because a variety of protective gloves exist, consult glove manufacturer to determine the proper type for a specific operation.
Eyes – Safety glasses or goggles.
Ventilation – Local exhaust sources regarding industrial ventilation (i.e. ACGIH Industrial Ventilation) should be consulted for guidance about adequate ventilation.
Respiratory – Respirator that meets OSHA 1910.134 must be followed when conditions warrant use.

Section IX—Other Information

The information contained herein is based on the data available to us and is believed to be accurate. The data is offered in good faith as typical values and not product specification. The information in this data sheet was compiled from the information supplied by the vendors of the components of this compound. Neptune Research, Inc. makes no warranty either expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. The recommended industrial hygiene and safe handling procedures are believed to be genuinely applicable. However, each user should review these recommendations in the specific context of the intended use and determine whether they are appropriate. Neptune Research, Inc. assumes no responsibility for injury from the use of the product described herein. This information is intended only to assist in the safe handling of this material.

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Section I

Neptune Research 1346 South Killian Drive Lake Park, Florida 33403	Emergency Telephone Number – 800-535-5053 Telephone Number for Information – 800-328-0090 / 561-683-6992
Product Name – Syntho SubSea LV Part A (Resin) Epoxy	Date Prepared – 12.6.10

Section II—Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity, Common Name(s) CAS#)	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
Bisphenol A: Epoxy Resin (25068-38-6)	N/A	N/A	N/A	50-75

Section III—Physical/Chemical Characteristics

Vapor Pressure (mm Hg) – ND Specific Gravity (H20 = 1) – 1.2 Kgs/Ltr Vapor Density (AIR = 1) – ND
Evaporation Rate (Butyl Acetate = 1) Ether =1 – N/A Boiling Point – N/A Melting Point – N/A
Solubility in Water: Immiscible
Appearance and Odor – White paste with mild odor

Section IV—Fire and Explosion Hazard Data

Flash Point – >200°F	Flammable Limits - N/A	LEL - N/A	UEL - N/A

Extinguishing Media: Foam, carbon dioxide, powder, and water spray.
Special Fire Fighting Procedures: Firefighters should wear butyl rubber boots, gloves, and body suit and a self-contained breathing apparatus.

Section V—Reactivity Data

Stability: Stable
Hazardous Decomposition or Byproducts: Fumes produced when heated may include oxides of carbon.
Incompatibility (Materials to Avoid) None.
Hazardous Polymerization: Will not occur
Conditions to Avoid: Mixing large volumes with epoxy curing agents such as SUB01 Part B. Volumes of one gallon are safe however expect a significant exotherm within 15 - 20 minutes at 70°F.

Section VI—Health Hazard Data

Route(s) of Entry: Skin and Eye contact
Acute Skin Contact: Exposure may cause skin irritation and sensitization.
Chronic Skin Contact: None anticipated
Acute Eye Contact: May cause eye irritation.
Acute Ingestion: May cause gastrointestinal irritation if swallowed.
Inhalation: Inhalation of mists may cause irritation in the respiratory tract.
Carcinogenicity: Not listed
NTP – No IARC Monographs – No OSHA Regulated – No
Medical Conditions Generally Aggravated by Exposure – Not Determined
Emergency and First Aid Procedures -

Ingestion: In the event of ingestion, administer 3-4 glasses of water. Do not induce vomiting. Seek medical advice.
Inhalation: Move patient to fresh air. If breathing has stopped or is labored give assisted respiration (e.g. mouth to-mouth). Supplemental oxygen may be indicated. Seek medical advice. Prevent aspiration of vomit. Turn victim's head to the side.
Skin contact: Remove contaminated clothing and shoes. Remove product and immediately flush affected area with water for at least 15 minutes. If irritation persists, get medical attention.
Eye contact: Flush with copious amount of water. Preferably lukewarm, for at least 15 minutes, holding eyelids open at all times.

Section VII—Precautions for Safe Handling and Use

Steps to Take if Material Is Released or Spilled – Avoid contact with skin and eyes. Scrape or wipe up spilled material. Collect in suitable and properly labeled containers.
Waste Disposal Method – In accordance with federal, state and local regulations.
Precautions to Be Taken in Handling and Storing – Avoid contact with eyes, skin or clothing. Avoid breathing vapor mist or spray. Use with good ventilation. Wash after handling and before eating, drinking or smoking. Keep in cool, dry, ventilated storage and in closed containers.
Transportation Information – DOT (49 CFR 172) - Unrestricted, IATA – Unrestricted

Section VIII—Control Measures

Respiratory – N/A Monitoring – N/A Medical Surveillance – N/A
Skin protection – Appropriate impervious gloves. Because a variety of protective gloves exist, consult glove manufacturer to determine the proper type for a specific operation.
Eyes – Safety glasses or goggles.
Ventilation – Local exhaust sources regarding industrial ventilation (i.e. ACGIH Industrial Ventilation) should be consulted for guidance about adequate ventilation.

Section IX—Other Information

The information contained herein is based on the data available to us and is believed to be accurate. The data is offered in good faith as typical values and not product specification. The information in this data sheet was compiled from the information supplied by the vendors of the components of this compound. Neptune Research, Inc. makes no warranty either expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. The recommended industrial hygiene and safe handling procedures are believed to be genuinely applicable. However, each user should review these recommendations in the specific context of the intended use and determine whether they are appropriate. Neptune Research, Inc. assumes no responsibility for injury from the use of the product described herein. This information is intended only to assist in the safe handling of this material.

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Section I

Neptune Research 1346 South Killian Drive Lake Park, Florida 33403	Emergency Telephone Number – 800-535-5053 Telephone Number for Information – 800-328-0090 / 561-683-6992
Product Name – Syntho-SubSea LV Part B (Catalyst)	Date Prepared – 12.6.10

Section II—Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity, Common Name(s) CAS#)	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
Trade Secret Resins	N/A	N/A	N/A	20-50
Benzyl Alcohol (100-51-6)	0.1 mg/m3	N/A	N/A	12-24
2,4,6-tri(dimethylaminomethyl)phenol (90-72-2)	5 ppm	N/A	N/A	1-2

Section III—Physical/Chemical Characteristics

Vapor Pressure (mm Hg) – ND Specific Gravity (H20 = 1) – 1.56 Vapor Density (AIR = 1) – ND
Evaporation Rate (Butyl Acetate = 1) Ether =1 – N/A Boiling Point – N/A Melting Point – N/A
Solubility in Water: Slightly miscible
Appearance and Odor – Green Paste with mild odor

Section IV—Fire and Explosion Hazard Data

Flash Point – >200°F	Flammable Limits - N/A	LEL - N/A	UEL - N/A

Extinguishing Media: Water Spray, Foam, Dry Chemical, Dry Sand or Limestone

Special Fire Fighting Procedures: Firefighters should wear butyl rubber boots, gloves, and body suit and a self-contained breathing apparatus.

Section V—Reactivity Data

Stability: Stable
Hazardous Decomposition or Byproducts: Fumes produced when heated may include oxides of carbon, nitrogen oxides, aldehydes, nitrosamines, amines, ammonia, organic acid vapors and unspecified others.
Incompatibility (Materials to Avoid) Acids, (e.g. Sulfuric, Phosphoric, Acetic, Citric etc.). Oxidizing and reducing agents (e.g. Perchlorates, nitrates, Hydrides and sulfites etc.).
Hazardous Polymerization: Will not occur
Conditions to Avoid: NA

Section VI—Health Hazard Data

Route(s) of Entry: Skin and Eye contact

Acute Skin Contact: Exposure may cause skin irritation and burns.

Chronic Skin Contact: None anticipated

Acute Eye Contact: May cause eye irritation or burns. May cause permanent visual impairment.

Acute Ingestion: May cause gastrointestinal irritation if swallowed.

Inhalation: Inhalation of mists may cause irritation in the respiratory tract. The micronized silica contained in this formula is completely bound and wetted by the resinous components so exposure during normal application by brush or spreader is not possible. It is possible however that free silica would become airborne during sanding or abrasive blasting operations. Excessive inhalation of dusts containing silica may result in the development of disabling pulmonary fibrosis known as Silicosis. There is sufficient evidence in humans for the Carcinogenicity of inhaled crystalline silica in the form of quartz from occupational sources.

Carcinogenicity: Not listed
NTP – No IARC Monographs – No OSHA Regulated – No

Medical Conditions Generally Aggravated by Exposure – Preexisting eye, skin and respiratory disorders may be aggravated by exposure to this product, exercise caution in handling. Remove from skin using liquid soap or detergent - always avoid using solvents to remove skin contamination.

Emergency and First Aid Procedures -

Ingestion: In the event of ingestion, administer 3-4 glasses of water. Do not induce vomiting. Seek medical advice.
Inhalation: In normal use inhalation is extremely unlikely. If breathing has stopped or is labored give mouth-to-mouth assistance, prevent aspiration of vomit, move to fresh air, and call a physician.
Skin contact: Remove from skin using soap and water. Avoid using solvents to remove any skin contamination. Remove contaminated shoes and clothing. DO NOT APPLY GREASES OR OINTMENTS. Victims of a major skin contact should remain under medical observation for at least 24 hours due to possible delayed effects.
Eye contact: Flush with copious amount of water. Preferably lukewarm, for at least 15 minutes, holding eyelids open at all times.

Section VII—Precautions for Safe Handling and Use

Steps to Take if Material Is Released or Spilled – Avoid contact with skin and eyes. Scrape or wipe up spilled material. Collect in suitable and properly labeled containers.
Waste Disposal Method – In accordance with federal, state and local regulations.
Precautions to Be Taken in Handling and Storing – Avoid contact with eyes, skin or clothing. Avoid breathing vapor mist or spray. Use with good ventilation. Wash after handling and before eating, drinking or smoking. Keep in cool, dry, ventilated storage and in closed containers.
Transportation Information – DOT (49 CFR 172) - Unrestricted, IATA – Unrestricted

Section VIII—Control Measures

Respiratory – N/A Monitoring – N/A Medical Surveillance – N/A
Skin protection – Appropriate impervious gloves. Because a variety of protective gloves exist, consult glove manufacturer to determine the proper type for a specific operation.
Eyes – Safety glasses or goggles.
Ventilation – Local exhaust sources regarding industrial ventilation (i.e. ACGIH Industrial Ventilation) should be consulted for guidance about adequate ventilation.

Section IX—Other Information

The information contained herein is based on the data available to us and is believed to be accurate. The data is offered in good faith as typical values and not product specification. The information in this data sheet was compiled from the information supplied by the vendors of the components of this compound. Neptune Research, Inc. makes no warranty either expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. The recommended industrial hygiene and safe handling procedures are believed to be genuinely applicable. However, each user should review these recommendations in the specific context of the intended use and determine whether they are appropriate. Neptune Research, Inc. assumes no responsibility for injury from the use of the product described herein. This information is intended only to assist in the safe handling of this material.

Innovative Composite Solutions

Section I

Neptune Research 1346 South Killian Drive Lake Park, Florida 33403	Emergency Telephone Number – 800-535-5053 Telephone Number for Information – 800-328-0090 / 561-683-6992
Product Name – Syntho-Glass XT	Date Prepared – 10.21.10

Section II—Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity, Common Name(s) CAS#)	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
Fiberglass Cloth (None)	N/A	N/A	N/A	70
Polymeric Diphenylmethane Diisocyanate (CAS #9016-87-9)	N/A	N/A	N/A	19
Hydroxyl Terminated Poly (oxalkylene) Polyol (CAS #25791-96-2)	N/A	N/A	N/A	9
P-Toluenesulfonyl isocyanate (CAS #4083-64-1)	N/A	N/A	N/A	<1
Titanium Dioxide (CAS #25322-68-3)	15 mg/m3	10 mg/m	N/A	1

Section III—Physical/Chemical Characteristics

Vapor Pressure (mm Hg) – ND Specific Gravity (H20 = 1) – >2 Vapor Density (AIR = 1) – ND
Evaporation Rate (Butyl Acetate = 1) Ether =1 – N/A Boiling Point – ND Melting Point – N/A
Solubility in Water: Not miscible
Appearance and Odor – Resin impregnated tape with no odor

Section IV—Fire and Explosion Hazard Data

Flash Point – NA	Flammable Limits - N/A	LEL – ND	UEL - ND

Extinguishing Media: Water fog, foam, CO2, dry chemical

Special Fire Fighting Procedures: Do not enter confined fire space without full bunker gear (helmet with face shield, bunker coats, gloves, and rubber boots) including a positive pressure NIOSH approved self-contained breathing apparatus.

Section V—Reactivity Data

Stability: Stable
Hazardous Decomposition or Byproducts: Oxides of carbon and other unknown hydrocarbons.
Incompatibility (Materials to Avoid) Organic solvents such as kerosene
Hazardous Polymerization: Will not occur
Conditions to Avoid: Elevated temperatures
Materials to Avoid: Organic solvents such as kerosene.

Section VI—Health Hazard Data

Route(s) of Entry: Skin and Eye contact

Acute Skin Contact: Contact with skin causes irritation and redness.

Chronic Skin Contact: None anticipated

Acute Eye Contact: Contact with eyes causes irritation.

Acute Ingestion: No exposure effects anticipated under normal work conditions. May cause gastrointestinal irritation if swallowed.

Inhalation: No exposure effects anticipated under normal work conditions.

Carcinogenicity: Not listed
NTP – No IARC Monographs – No OSHA Regulated – No

Medical Conditions Generally Aggravated by Exposure – Not Determined

Emergency and First Aid Procedures -

Ingestion: Do not induce vomiting, consult a physician immediately
Inhalation: Move to an area free from risk of further exposure. Administer oxygen or artificial respiration as needed. Obtain medical attention.
Skin contact: Remove contaminated clothing. Wash affected skin thoroughly with soap and water. Wash contaminated clothing thoroughly before reuse. Seek medical attention if irritation develops or persists after area is washed.
Eye contact: Flush with copious amount of water. Preferably lukewarm, for at least 15 minutes, holding eyelids open at all times.

Section VII—Precautions for Safe Handling and Use

Steps to Take if Material Is Released or Spilled – Pick up material and dispose of according to the applicable Federal, State, or local regulations. Do not allow to enter sewers/surface or ground water.
Waste Disposal Method – In accordance with federal, state and local regulations.
Precautions to Be Taken in Handling and Storing – Avoid contact with skin or eyes. Wash thoroughly after use and before work breaks. Keep in cool, dry, ventilated storage and in closed containers.
Transportation Information – DOT (49 CFR 172) - Unrestricted, IATA - Unrestricted

Section VIII—Control Measures

Respiratory – N/A Monitoring – N/A Medical Surveillance – N/A
Skin protection – Appropriate impervious gloves. Because a variety of protective gloves exist, consult glove manufacturer to determine the proper type for a specific operation.
Eyes – Safety glasses or goggles.
Ventilation – Local exhaust sources regarding industrial ventilation (i.e. ACGIH Industrial Ventilation) should be consulted for guidance about adequate ventilation.

Section IX—Other Information

The information contained herein is based on the data available to us and is believed to be accurate. The data is offered in good faith as typical values and not product specification. The information in this data sheet was compiled from the information supplied by the vendors of the components of this compound. Neptune Research, Inc. makes no warranty either expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. The recommended industrial hygiene and safe handling procedures are believed to be genuinely applicable. However, each user should review these recommendations in the specific context of the intended use and determine whether they are appropriate. Neptune Research, Inc. assumes no responsibility for injury from the use of the product described herein. This information is intended only to assist in the safe handling of this material.

Innovative Composite Solutions

Section I

Neptune Research 1346 South Killian Drive Lake Park, Florida 33403	Emergency Telephone Number – 800-535-5053 Telephone Number for Information – 800-328-0090 / 561-683-6992
Product Name – Viper Skin	Date Prepared – 10.20.10

Section II—Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity, Common Name(s) CAS#)	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
Carbon Fiber Cloth (None)	N/A	N/A	N/A	50
Synthetic Urethane Polymer (59676-67-1)	N/A	N/A	N/A	40
Diphenylmethane Diisocyanate (26447-40-5)	N/A	N/A	N/A	10

Section III—Physical/Chemical Characteristics

Vapor Pressure (mm Hg) – ND Specific Gravity (H20 = 1) – >2 Vapor Density (AIR = 1) – ND
Evaporation Rate (Butyl Acetate = 1) Ether =1 – N/A Boiling Point – ND Melting Point – N/A
Solubility in Water: Not miscible
Appearance and Odor – Resin impregnated tape with no odor

Section IV—Fire and Explosion Hazard Data

Flash Point – NA	Flammable Limits - N/A	LEL – ND	UEL - ND

Extinguishing Media: Water fog, foam, CO2, dry chemical

Special Fire Fighting Procedures: Do not enter confined fire space without full bunker gear (helmet with face shield, bunker coats, gloves, and rubber boots) including a positive pressure NIOSH approved self-contained breathing apparatus.

Section V—Reactivity Data

Stability: Stable
Hazardous Decomposition or Byproducts: Oxides of carbon and other unknown hydrocarbons.
Incompatibility (Materials to Avoid) Organic solvents such as kerosene
Hazardous Polymerization: Will not occur
Conditions to Avoid: Elevated temperatures
Materials to Avoid: Organic solvents such as kerosene.

Section VI—Health Hazard Data

Route(s) of Entry: Skin and Eye contact

Acute Skin Contact: Contact with skin causes irritation and redness.

Chronic Skin Contact: None anticipated

Acute Eye Contact: Contact with eyes causes irritation.

Acute Ingestion: No exposure effects anticipated under normal work conditions. May cause gastrointestinal irritation if swallowed.

Inhalation: No exposure effects anticipated under normal work conditions.

Carcinogenicity: Not listed
NTP – No IARC Monographs – No OSHA Regulated – No

Medical Conditions Generally Aggravated by Exposure – Not Determined

Emergency and First Aid Procedures -

Ingestion: Do not induce vomiting, consult a physician immediately
Inhalation: Move to an area free from risk of further exposure. Administer oxygen or artificial respiration as needed. Obtain medical attention.
Skin contact: Remove contaminated clothing. Wash affected skin thoroughly with soap and water. Wash contaminated clothing thoroughly before reuse. Seek medical attention if irritation develops or persists after area is washed.
Eye contact: Flush with copious amount of water. Preferably lukewarm, for at least 15 minutes, holding eyelids open at all times.

Section VII—Precautions for Safe Handling and Use

Steps to Take if Material Is Released or Spilled – Pick up material and dispose of according to the applicable Federal, State, or local regulations. Do not allow to enter sewers/surface or ground water.
Waste Disposal Method – In accordance with federal, state and local regulations.
Precautions to Be Taken in Handling and Storing – Avoid contact with skin or eyes. Wash thoroughly after use and before work breaks. Keep in cool, dry, ventilated storage and in closed containers.
Transportation Information – DOT (49 CFR 172) - Unrestricted, IATA - Unrestricted

Section VIII—Control Measures

Respiratory – N/A Monitoring – N/A Medical Surveillance – N/A
Skin protection – Appropriate impervious gloves. Because a variety of protective gloves exist, consult glove manufacturer to determine the proper type for a specific operation.
Eyes – Safety glasses or goggles.
Ventilation – Local exhaust sources regarding industrial ventilation (i.e. ACGIH Industrial Ventilation) should be consulted for guidance about adequate ventilation.

Section IX—Other Information

The information contained herein is based on the data available to us and is believed to be accurate. The data is offered in good faith as typical values and not product specification. The information in this data sheet was compiled from the information supplied by the vendors of the components of this compound. Neptune Research, Inc. makes no warranty either expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. The recommended industrial hygiene and safe handling procedures are believed to be genuinely applicable. However, each user should review these recommendations in the specific context of the intended use and determine whether they are appropriate. Neptune Research, Inc. assumes no responsibility for injury from the use of the product described herein. This information is intended only to assist in the safe handling of this material.

Innovative Composite Solutions

Section I

Neptune Research 1346 South Killian Drive Lake Park, Florida 33403	Emergency Telephone Number – 800-535-5053 Telephone Number for Information – 800-328-0090 / 561-683-6992
Product Name – Titan XT Part A (Resin) Epoxy	Date Prepared – 1.14.2011

Section II—Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity, Common Name(s) CAS#)	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
(Chloromethyl) Oxirane 4,4'- (1-Methylethylidene) Bisphenol Copolymer (25068-38-6)	N/A	N/A	N/A	<1
Reaction product with Epicholorohydrin & Bisphenol A (25085-99-8)	N/A	N/A	N/A	10-15
Epoxy Phenol Novolac Resin (28064-14-4)	N/A	N/A	N/A	20-60
Siloxanes & silicones, di-ME, reaction products with Silica (67762-90-7)	N/A	N/A	N/A	1-5
Polyoxyethylene Sorbitan Monolaurate (9005-64-5)	N/A	N/A	N/A	.1-1
Gamma-glycidoxypropyltrimethoxysilane (3530-83-8)	N/A	N/A	N/A	.1-1
Butadiene Acrylic Copolymer (Proprietary)	N/A	N/A	N/A	5-10

Section III—Physical/Chemical Characteristics

Vapor Pressure (mm Hg) – ND Specific Gravity (H20 = 1) – 1.2 Vapor Density (AIR = 1) – >1
Evaporation Rate (Butyl Acetate– <1) , Ether – N/A Boiling Point – N/A Melting Point – N/A
Solubility in Water: Negligible
Appearance and Odor – Slightly viscous white paste with mild odor

Section IV—Fire and Explosion Hazard Data

Flash Point – No evaluated	Flammable Limits - N/A	LEL - N/A	UEL - N/A

Extinguishing Media: Carbon dioxide, dry chemical, or water spray.
Special Fire Fighting Procedures: Firefighters should wear butyl rubber boots, gloves, and body suit and a self-contained breathing apparatus.

Section V—Reactivity Data

Stability: Stable under normal conditions
Hazardous Decomposition or Byproducts: Carbon monoxide, carbon dioxide
Incompatibility (Materials to Avoid): Strong oxidizing agents and acids
Hazardous Polymerization: Will not occur
Conditions to Avoid: Not determined

Section VI—Health Hazard Data

Route(s) of Entry: Skin contact and inhalation
Acute Skin Contact: Exposure may cause skin irritation and sensitization.
Chronic Skin Contact: None anticipated
Acute Eye Contact: May cause moderate eye irritation.
Acute Ingestion: May cause gastrointestinal irritation if swallowed.
Inhalation: Inhalation of mists may cause irritation in the respiratory tract.
Carcinogenicity: Not listed
NTP – No IARC Monographs – No OSHA Regulated – No
Medical Conditions Generally Aggravated by Exposure – Allergy, skin or eye conditions

Emergency and First Aid Procedures -

Ingestion: In the event of ingestion- Do not induce vomiting. Seek medical advice.
Inhalation: Move patient to fresh air. If breathing has stopped or is labored give assisted respiration (e.g. mouth to-mouth). Supplemental oxygen may be indicated. Seek medical advice. Prevent aspiration of vomit. Turn victim's head to the side.
Skin contact: Remove contaminated clothing and shoes. Remove product and immediately flush affected area with soap and water for at least 15 minutes. If irritation persists, get medical attention.
Eye contact: Flush with copious amount of water for at least 15 minutes, holding eyelids open at all times. Seek medical advice.

Section VII—Precautions for Safe Handling and Use

Steps to Take if Material Is Released or Spilled – Avoid contact with skin and eyes. Scrape or wipe up spilled material. Collect in suitable and properly labeled containers.
Waste Disposal Method – In accordance with federal, state and local regulations.
Precautions to Be Taken in Handling and Storing – Avoid contact with eyes, skin or clothing. Avoid breathing vapor mist or spray. Use with good ventilation. Wash after handling and before eating, drinking or smoking. Keep in cool, dry, ventilated storage @ maximum of 35°C.
Transportation Information – DOT (49 CFR 172) - Unrestricted, IATA – Unrestricted

Section VIII—Control Measures

Respiratory – N/A Monitoring – N/A Medical Surveillance – N/A
Skin protection – Appropriate impervious gloves. Because a variety of protective gloves exist, consult glove manufacturer to determine the proper type for a specific operation.
Eyes – Safety glasses or goggles.
Ventilation – Local exhaust sources regarding industrial ventilation (i.e. ACGIH Industrial Ventilation) should be consulted for guidance about adequate ventilation.

Section IX—Other Information

The information contained herein is based on the data available to us and is believed to be accurate. The data is offered in good faith as typical values and not product specification. The information in this data sheet was compiled from the information supplied by the vendors of the components of this compound. Neptune Research, Inc. makes no warranty either expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. The recommended industrial hygiene and safe handling procedures are believed to be genuinely applicable. However, each user should review these recommendations in the specific context of the intended use and determine whether they are appropriate. Neptune Research, Inc. assumes no responsibility for injury from the use of the product described herein. This information is intended only to assist in the safe handling of this material.

Innovative Composite Solutions

Section I

Neptune Research 1346 South Killian Drive Lake Park, Florida 33403	Emergency Telephone Number – 800-535-5053 Telephone Number for Information – 800-328-0090 / 561-683-6992
Product Name – Titan XT Part B (Catalyst) Epoxy	Date Prepared – 1.14.2011

Section II—Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity, Common Name(s) CAS#)	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
Tetraethylenepentamine (112-57-2)	N/A	N/A	N/A	4-20
Methyleneoxide, polymer with benzenamine, hydrogenated (135108-88-2)	N/A	N/A	N/A	5-20
Methylenebiscyclohexanamine, 4,4' (1761-71-3)	N/A	N/A	N/A	50-80
Benzyldimethylamine (103-83-3)	N/A	N/A	N/A	1-10
Gamma-aminopropyltriethoxysilane (919-30-2)	N/A	N/A	N/A	.1-2
Polyoxyethylene (20) Sorbitan Monolaurate (9005-64-5)	N/A	N/A	N/A	.2-1

Section III—Physical/Chemical Characteristics

Vapor Pressure (mm Hg) – ND Specific Gravity (H20 = 1) – 1.2 Vapor Density (AIR = 1) – >1
Evaporation Rate (Butyl Acetate– <1) , Ether – N/A Boiling Point – N/A Melting Point – N/A
Solubility in Water: Negligible
Appearance and Odor – Dark amber to brown liquid with mild odor

Section IV—Fire and Explosion Hazard Data

Flash Point – >230°F (>110°C)	Flammable Limits - N/A	LEL - N/A	UEL - N/A

Extinguishing Media: Carbon dioxide, dry chemical, or water spray.
Special Fire Fighting Procedures: Firefighters should wear butyl rubber boots, gloves, and body suit and a self-contained breathing apparatus.

Section V—Reactivity Data

Stability: Stable under normal conditions
Hazardous Decomposition or Byproducts: Carbon monoxide, carbon dioxide
Incompatibility (Materials to Avoid): Strong oxidizing agents and acids
Hazardous Polymerization: Will not occur
Conditions to Avoid: Elevated temperatures

Section VI—Health Hazard Data

Route(s) of Entry: Skin contact and inhalation
Acute Skin Contact: Exposure may cause skin irritation and sensitization.
Chronic Skin Contact: None anticipated
Acute Eye Contact: May cause moderate eye irritation.
Acute Ingestion: May cause gastrointestinal irritation if swallowed.
Inhalation: Inhalation of mists may cause irritation in the respiratory tract.
Carcinogenicity: Not listed
NTP – No IARC Monographs – No OSHA Regulated – No
Medical Conditions Generally Aggravated by Exposure – Allergy, skin or eye conditions

Emergency and First Aid Procedures -

Ingestion: In the event of ingestion- Do not induce vomiting. Seek medical advice.
Inhalation: Move patient to fresh air. If breathing has stopped or is labored give assisted respiration (e.g. mouth to-mouth). Supplemental oxygen may be indicated. Seek medical advice. Prevent aspiration of vomit. Turn victim's head to the side.
Skin contact: Remove contaminated clothing and shoes. Remove product and immediately flush affected area with soap and water for at least 15 minutes. If irritation persists, get medical attention.
Eye contact: Flush with copious amount of water for at least 15 minutes, holding eyelids open at all times. Seek medical advice.

Section VII—Precautions for Safe Handling and Use

Steps to Take if Material Is Released or Spilled – Avoid contact with skin and eyes. Scrape or wipe up spilled material. Collect in suitable and properly labeled containers.
Waste Disposal Method – In accordance with federal, state and local regulations.
Precautions to Be Taken in Handling and Storing – Avoid contact with eyes, skin or clothing. Avoid breathing vapor mist or spray. Use with good ventilation. Wash after handling and before eating, drinking or smoking. Keep in cool, dry, ventilated storage @ maximum of 35°C.
Transportation Information – DOT (49 CFR 172) - Unrestricted, IATA – Unrestricted

Section VIII—Control Measures

Respiratory – N/A Monitoring – N/A Medical Surveillance – N/A
Skin protection – Appropriate impervious gloves. Because a variety of protective gloves exist, consult glove manufacturer to determine the proper type for a specific operation.
Eyes – Safety glasses or goggles.
Ventilation – Local exhaust sources regarding industrial ventilation (i.e. ACGIH Industrial Ventilation) should be consulted for guidance about adequate ventilation.

Section IX—Other Information

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Innovative Composite Solutions

1. **Agreement.** This order of sale (including ail attachments hereto and any amendments or modifications made in accordance with the terms hereof, collectively the "Order") constitutes an expression of intent by NEPTUNE RESEARCH INC. ("Seller") to sell the goods, machinery, equipment and services specified on the face hereof (collectively the "Goods") at the price(s) and with the delivery date{s) so specified, upon the terms and conditions set forth herein and in accordance with any specifications on the face hereof and in any attachments, schedules, exhibits, designs or drawings attached hereto (collectively the "Specifications"), This Order shall not constitute an acceptance of any provisions in any purchase order or confirmation of Purchaser that add to or conflict with the terms hereof. This Order shall constitute the entire contract between Purchaser and Seller, notwithstanding any such varying provisions or any form or electronic message sent by Purchaser after the date hereof. Any proposal to vary any of the terms hereof is hereby objected to and rejected, and shall not form a part of the contract. Technical documents, including but not limited to any drawings, descriptions, illustrations or designs, whether supplied by Seller or Purchaser, and whether or not included as part of the Specifications, shall serve only to provide approximations and general guidance as to the characteristics of the Goods and shall not bind either party. There are no oral understandings between Purchaser and Seller, and no agreements other than those embodied herein. This Order may not be amended or modified except in writing signed by an authorized representative of Seller.

2. **Cancellation.** Purchaser may not cancel this Order, or any part, without Seller's written consent. If Purchaser wrongfully cancels this Order, Purchaser shall be liable to Seller for any of the following expenses incurred by Seller: (i) direct costs in connection with the ordering or purchase of materials or parts in connection herewith; (H) engineering and labor costs in connection herewith; (iii) administrative and overhead costs allocable to work already performed in connection herewith and (iv) costs and expenses to which Seller has been committed prior to cancellation of this order. The amount payable by Purchaser as set forth above shall be reduced by the amount of any payments made by Purchaser in respect of the Goods prior to the date of cancellation. In addition to the above, Purchaser agrees to pay Seller an amount equal to 15% of the total amount payable as set forth above, to compensate Seller for its anticipated profits lost as a result of Purchaser's cancellation. All sums owing pursuant to this paragraph shall be payable in full immediately upon Purchaser's receipt of written notice thereof from Seller.

3. **Price.** All prices are quoted F.O.B. Shipping Point and unless otherwise agreed in writing, and except for Seller's internal costs with respect to inspection and compliance with governmental laws and regulations, do not include any costs of freight, insurance, special packaging or installation, any costs of inspection, permits or other compliance with governmental laws and regulations, any sales, use, excise, customs or other taxes, duties or fees, or any other charges, all of which must be paid by Purchaser. In the event Seller includes any such charges in any price herein, Seller may adjust such charges at any time prior to payment thereof by Seller on Purchaser's behalf in respect of any applicable changes in governing laws or regulations; and Purchaser agrees to pay any additional charges incurred as a result of any such adjustment.

4. **Payment and Inspection.** Unless otherwise agreed in writing, payment is due within thirty days of invoice. Payment terms shall be per Seller's standard payment terms included in this order. If Purchaser delays delivery of any Goods, Seller shall submit, and Purchaser shall pay, invoices for such Goods as if delivery had been made on the originally estimated delivery date; and in addition, Purchaser shall pay all reasonable storage and other expenses incurred by Seller as a result of such delay. Purchaser may inspect Goods delivered hereunder upon receipt at final destination. Within ten business days thereafter, Purchaser shall give written notice to Seller of any alleged defect in the condition or quality of such Goods, or of any alleged nonconformities with the Specifications, and shall indicate the basis of its claim in detail. Purchaser's failure to furnish such notice in a timely, manner shall constitute irrevocable acceptance of the Goods. Purchaser agrees to pay interest on any payment due under this order at a rate of 18% per annum, computed on the basis of a 360-day year and the actual days elapsed and to accrue from the date such payment is due until paid in full; provided, however, that if such rate exceeds the maximum rate permitted under applicable law, then interest shall be charged at the maximum rate permitted under such law. In addition, Purchaser agrees to pay all costs, including reasonable attorneys' fees, incurred by Seller in the enforcement of any obligation of Purchaser hereunder.

5. **Delivery.** Goods are sold F.O.B. Shipping Point. Unless otherwise agreed in writing, Seller may select the method of, and arrange for, transportation to final destination. The delivery date specified on the face hereof represents Seller's estimate of the date of delivery of the Goods and is based, in part, on information supplied by Purchaser. Accordingly, Seller will attempt in good faith, but does not guarantee or covenant, to deliver the Goods by such estimated delivery date; and Seller shall not be obligated to take any extraordinary steps to meet such delivery date (including the use of overtime labor) nor shall Seller be liable for any damages suffered by Purchaser as a result of Seller's inability to meet the estimated delivery date.

6. **Passage of Title and Security Agreement.** Title to Goods delivered hereunder shall pass to Purchaser at the time of F.O.B. delivery to carrier, and Purchaser agrees to assume all risk of loss of the Goods at that time. Purchaser hereby grants to Seller a security interest in all such Goods to secure payment of all sums due Seller hereunder. Purchaser agrees to execute promptly any financing statements or further documents Seller deems necessary to perfect its security interest, and to perform all other acts necessary for the perfection and preservation of such security interest.

7. **Limited Warranty.** Subject to the limitations and exceptions below, all Goods delivered hereunder are warranted to be free from material defects in materials and workmanship for the Warranty Period (as defined below). This warranty shall apply only if (i) Purchaser notifies Seller in writing of the claimed defect within 20 days of discovery; (ii) Purchaser discovers the claimed defect within the Warranty Period; and (iii) Purchaser allows Seller to inspect the Goods claimed to be defective. This warranty shall not apply to Goods that have not been installed and/or operated and maintained in accordance with installation or operating instructions or that have been accidentally damaged, or to Goods with defects attributable in any way to installation, modification or repair made by any party other than Seller; nor shall this warranty apply if (i) Purchaser or a third party modifies or repairs the Goods without Seller's prior written approval; or (ii) after discovery of a defect, Purchaser fails to take prompt and reasonable steps to prevent the defect from becoming more serious. Further, this warranty shall not apply to the component parts of any Goods manufactured in whole or in part by a party other than Seller and resold by Seller except to the extent that any such third party has warranted such to Seller and is liable to Seller under such warranty. In the event Purchaser complies in full with all of its obligations under this Order, including but not limited to payment in full in respect of the Goods, and the conditions of this paragraph are satisfied, Seller shall correct any material defect either by

(i) supplying F.O.B. Seller's plant replacement parts or (ii) repairing any defective parts. If in Seller's judgment repair or replacement would be commercially impracticable, Seller shall issue Purchaser a refund or credit in the amount of the purchase price of the defective Goods. As used herein, the "Warranty Period" is 12 months. The Warranty Period shall commence on the earlier of; (i) the date of shipment (or the date of completion of installation if Seller has undertaken to install the Goods); or

(ii) if delivery or installation is delayed for reasons beyond Seller's reasonable control, the 30th day following the date upon which shipment would have been made (or if Seller has undertaken to install the Goods, the 30th day following the date upon which installation would have been completed) absent the delay. The foregoing warranty is exclusive and made only to Purchaser. SELLER MAKES NO OTHER EXPRESS, IMPLIED OR STATUTORY WARRANTY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND ALL SUCH WARRANTIES ARE HEREBY EXPRESSLY EXCLUDED. Seller makes no warranty relative to damages caused by abrasion, chemicals, corrosion, wear or abnormal temperature. No person is authorized to give any additional warranties on Seller's behalf or to assume for Seller any other liability in connection herewith, except in a writing signed by an authorized officer of Seller. For purposes of this paragraph, "Goods" shall specifically include any and all parts thereof.

8. **Limitation of Remedies.** Purchaser's sole and exclusive remedy against Seller arising out of or in connection with any claimed defect in any Goods sold hereunder, whether based upon contract, tort, warranty, strict liability or negligence, and whether for personal injury, commercial loss or other monetary loss, shall be at Seller's option the repair or replacement of such Goods that Seller determines in its reasonable judgment and upon inspection to be defective, or if in Seller's judgment repair or replacement would be commercially impracticable, the issuance to Purchaser of a credit

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or refund in the amount of the purchase price of such Goods. SELLER SHALL NOT BE LIABLE FOR ANY ADDITIONAL LOSS OR DAMAGE ARISING DIRECTLY OR INDIRECTLY FROM THE USE OF GOODS SOLD HEREUNDER OR FOR ANY SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES WHATSOEVER. Any action resulting from any breach, defect or failure of Seller to perform hereunder must be commenced within one year after the cause of action has accrued. For purposes of this paragraph, "Goods" shall specifically include any and all parts thereof.

9. **Engineering Services.** Unless otherwise agreed in writing, Purchaser shall be responsible for the erection, installation and start-up of the Goods, and shall pay all related expenses. Seller at its option may provide the services of its personnel in connection with or subsequent to the erection, installation or start-up of the Goods if Purchaser so desires, and Purchaser shall pay all related expenses incurred by Seller, including but not limited to traveling and living expenses of Seller's personnel, as well as a fee for labor performed by Seller's personnel in connection therewith, based on Seller's normal hourly rates. In the event Seller furnishes any installation services, Purchaser shall at its expense furnish the required installation space for all Goods, and shall timely comply with all applicable specifications for installation up to and through the date of completion of installation.

10. **Confidential Information.** Purchaser acknowledges that Seller has a proprietary interest in all information, technical data, designs, specifications and memoranda relating to the Goods and any processes and methods with respect to the operation thereof (collectively the "Information"), that the Information is a unique and valuable business asset of Seller, and that Seller would be seriously and irreparably harmed by its wrongful disclosure or other misuse. Purchaser therefore agrees not to use any of the Information for any purpose other than the installation, servicing and operation of the Goods, not to copy any of the Information or disclose any part thereof to any person or entity other that its employees (and then only to the extent required in the performance of their work), and to return all of the Information in its possession to Seller upon request. Purchaser additionally agrees to use reasonable care to insure that its employees, subcontractors and suppliers do not disclose any part of the Information to any other person or entity or appropriate any part of the Information to their own use.

11. **Patents.** Seller shall indemnify and hold Purchaser harmless from any liability or cost arising out of any suit, action or claim for the infringement of any patent or patent rights which are or may be asserted against Purchaser because of the design, nature or structure of any of Seller's standard-design Goods; provided, however, that (i) Purchaser notifies Seller in writing of the existence of any such suit, action or claim within 10 days after Purchaser's discovery thereof; (ii) Purchaser grants to Seller exclusive control over the defense and litigation of any such suit, action or claim, and over its negotiation, settlement or compromise; and (iii) in the event infringement occurs, or Seller in its reasonable judgment determines that infringement is likely to occur, Purchaser permits Seller at Seller's option (A) to procure on Purchaser's behalf a license acceptable to Purchaser for the continued use of the Goods, (B) to modify the Goods to the extent necessary to cure any problems of infringement, or (C) to issue Purchaser a refund or credit for the Goods in the amount of the fair market value of the Goods at that time. Purchaser shall indemnify and hold Seller harmless from any liability or cost arising out of any suit, action or claim for the infringement of any patent or patent rights that are or may be asserted against Seller because of the design, nature, structure or use of any Goods ordered hereunder, to the extent such liability or cost arises from or is caused by designs or specifications furnished by Purchaser or modified at Purchaser's request, and Purchaser shall indemnify and hold Seller harmless from any liability for loss or damage, and from all court costs, attorneys' fees and other expenses, incurred by or imposed upon Seller, in connection with the defense of any action brought against Seller by reason of Seller's performance of this Order. At Seller's request, Purchaser shall promptly assume full responsibility for the defense of any such action which may be brought against Seller.

12. **Force Majeure.** Each party shall be excused from the duty to render timely performance of any obligation hereunder if such inability to perform is caused directly or indirectly by act of God, flood, war, riot, fire, accident, explosion, strikes or labor trouble, act of government, delay or default by subcontractor or supplier of materials or services, transportation difficulty, the existence of any circumstance making performance commercially impracticable or any other cause beyond the party's reasonable control; provided, however, that the obligation to make any payment due and owing under this Order shall not be excused for any reason whatsoever. In the event of a Force Majeure event Seller's schedule shall be adjusted accordingly and the contract price shall be adjusted to include any additional costs, overhead and reasonable profit.

13. **Wavier of Compliance; Severability.** Waiver by either party of a breach by the other of any provision of this Order shall not be deemed a full force and effect. Any part of this contract held to be invalid or unenforceable shall be deemed ineffective to the extent thereof without affecting the validity or enforceability of any other part of this contact.

14. **Governing Law.** This Order shall be governed and construed under the laws of the State of Florida and of the United States of America.

15. **Arbitration.** Any controversy or claim arising out of or relating to this Order or the performance or breach hereof shall be settled in West Palm Beach, Florida by arbitration in accordance with the Rules of the American Arbitration Association, and judgment upon the award rendered by the Arbitrator(s) may be entered in any court having jurisdiction thereof. The parties consent to the jurisdiction of the state and federal courts in Florida for all purposes in connection with such arbitration. The parties further consent that any process, notice of motion or other application to either of such courts or any judge thereof may be served by registered mail or personal service outside the State of Florida, provided a reasonable time for appearance is allowed, or in such other manner as may be allowed under the rules of such courts.

16. **Assignment.** Neither this Agreement nor any associated Order Acknowledgement may be assigned by the Purchaser, or its contents publicized by the Purchaser, without the written consent of Seller. Seller shall have the right to assign, transfer or sublicense all or any part of this Agreement or any associated Order Acknowledgement to another at any time and without the consent of Purchaser.

17. **Miscellaneous.** The various provisions of this Agreement and any associated Order Acknowledgement are severable, and any determination of invalidity or unenforceability of any one provision hereof shall no bearing on the continuing force and effect of the remaining provisions hereof. This Agreement and any associated Order Acknowledgement and the terms and conditions contained herein constitute the entire understanding of the parties with respect to the purchase and sale of the Goods, and any prior agreements, with respect thereto, whether written or oral, are superseded hereby. This Agreement and any associated Order Acknowledgement shall be binding on the parties and their respective successors and any permitted assigns.

18. **Electronic Data Interchange.** The parties may execute a Order Acknowledgement by transmitting and receiving the data contained in the Order Acknowledgement electronically rather than in paper form. To provide the legal validity and enforceability of such Order Acknowledgement, the parties further agree that the data transmitted herein will be considered "in writing" and to have been "signed." The parties agree not to contest the validity or enforceability of a Order Acknowledgement because of the electronic origination, transmission, storage or handling of such Order Acknowledgement. Any computer printout of the data contained in the Order Acknowledgement will be considered an "original" when maintained in the ordinary course of business and will be admissible as between the parties to the same extent and under the same conditions as other business records maintained in documentary form. The parties agree to properly use those security procedures which are reasonably sufficient to ensure that a transmission of the data contained in a Order Acknowledgement is authorized and to protect its business records and data from improper sources.

19. **Export Restrictions.** Buyer shall not export or re-export Goods in violation of any applicable laws or regulations of the United States or the country in which Purchaser obtained them.

WARRANTY/DISCLAIMER

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NRI, the Manufacturer, will replace at no charge to the purchaser any product proven to be defective. Responsibility of the Manufacturer and the Distributor is limited to replacement of the product only. Neither the Manufacturer nor the Distributor shall be liable for consequential or incidental damage or loss of any kind as they do not have any control over the conditions under which these products may be used or over the methods of application. Users should test the product for their particular need and suitability. Users should consult with the Manufacturer or the Distributor for all proposed repairs using the NRI products. Written procedures for specific repairs are available upon request from the Manufacturer or Distributor. NRI utilizes a process of continuous product improvement for all our products. While we do strictly adhere to our products' specifications, we routinely implement product improvements. Therefore, please contact Manufacturer or Distributor for the most current product specifications. All proposed repairs to piping systems using the Viper Skin™, Syntho Glass® XT, Syntho Glass®24, Trident Wrap™, and Trident Seal™ system must be installed or supervised by a Certified Technicians. Viper Skin™, Syntho Glass® XT, Syntho Glass®24, Trident Wrap™, and Trident Seal™ are NOT a stand alone coating system. Failing to apply a corrosion coating per the manufacturer's standard can lead to atmospheric corrosion damage.

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