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**TESTING
OF
FRPE LAMINATE**

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The test results contained in this report pertain only to the samples submitted for testing and not necessarily to all similar products.

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TESTING OF FRPE LAMINATE

INTRODUCTION:

This report presents the results of Compression, Flexural, Hardness and Tensile tests conducted on samples of FRPE laminate. The testing was authorized by Jeff Finley of Strongwell - Chatfield Division on December 23, 2008. The testing and data analysis were completed on February 13, 2009.

The scope of our work was limited to conducting Tensile and Impact tests on the samples submitted and reporting the results.

SUMMARY OF RESULTS:

Tensile, ASTM D638

Sample	Specimen	Peak Stress, psi	Strain at Break, %	Modulus, psi	Stress at Break, psi	Elongation at Break, in	Elongation at Yield, in
Control	Average	73,911	1.58	4,929,032	71,677	0.101	0.032
	Std. Dev.	3,801	0.09	221,977	4,509	0.098	0.002
Exposed	Average	73,574	1.64	5,319,828	73,574	0.033	0.033
	Std. Dev.	1,566	0.10	309,287	1,566	0.002	0.002
Percent Strength Retained (Peak Stress Control versus Exposed) 99.5%							

Impact, ASTM D256

Sample		Corrected Energy, in-lbs	Corrected Energy, ft-lbs/in
Control	Average	106.5	54.8
	Std. Dev.	15.2	7.9
Exposed	Average	105.1	53.9
	Std. Dev.	15.0	7.8
Percent Strength Retained (Corrected Energy Control versus Exposed) 98.4%			

From the above testing the AMSE A112.19.8a-2008, section 3.2.2.3 K factor would be 1.02.

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SAMPLE IDENTIFICATION:

The samples were identified as FRPE. Fourteen ASTM D 638 Type I tensile specimens and 28 ASTM D 256 IZOD Bars were supplied by the client.

TEST METHODS:

The IZOD test bars were sent out for notching. After the IZOD specimens were returned, one half of the Tensile Bars and one half of the IZOD specimens were placed into a QUV weathering chamber. The specimens were exposed to ASTM G 154 cycle 1 for a period of 750 hours.

The samples were allowed to condition at standard laboratory conditions of 72 ± 4°F and 50 ± 5% relative humidity for at least 40 hours prior to testing. Testing was done according to ASTM Standards detailed below, with notes of deviations.

Test Method	Test Method Title	Parameters &/or Deviations from Method
ASTM D638	Standard Test Method for Tensile Properties of Plastics	Type 1 Tensile Bones Test Speed 0.2 ipm
ASTM D 256	Standard Test Method for Determining the Izod Pendulum Impact Resistance of Plastics	Test Method A
ASTM G 154	Standard Test Method for Determining the Izod Pendulum Impact Resistance of Plastics	Cycle 1

CALIBRATED TEST EQUIPMENT:

MTS Universal Testing machine, model Qtest/50LP, System No. 1532, Stork TCT asset # MM210-009, calibrated 4-08

Mitutoyo Calipers, model CD-8C, S# 0006565, ID MM160-068, calibrated 9-08

Mitutoyo Calipers, model 505-637-50, ID MM160-007, calibrated 9-08

Q-Panel QUV, S/N 91-7398-43, ID MM190-009, calibrated 11-08

UNCALIBRATED TEST EQUIPMENT:

Holding grips, fixtures and clamps

Stanley razor knife

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TEST DATA:

ASTM D 638, Tensile

Sample	Specimen	Width, in	Thickness, in	Peak Load, lbf	Peak Stress, psi	Strain at Break, %	Modulus, psi	Stress at Break, psi	Elongation at Break, in	Elongation at Yield, in
Control	#1	0.501	0.165	5725	69,256	1.57	4,783,995	69,256	0.031	0.031
	#2	0.502	0.162	6058	74,496	1.53	5,310,208	74,496	0.031	0.031
	#3	0.498	0.164	6350	77,749	1.56	4,768,938	77,749	0.031	0.031
	#4	0.502	0.161	6245	77,271	1.72	4,857,526	70,648	0.234	0.035
	#5	0.503	0.161	5732	70,785	1.50	4,924,491	66,237	0.178	0.030
Average					73,911	1.58	4,929,032	71,677	0.101	0.032
Standard Deviation					3,801	0.09	221,977	4,509	0.098	0.002
Exposed	#1	0.5	0.161	6023	74,815	1.58	5,239,445	74,815	0.032	0.032
	#2	0.501	0.161	5932	73,544	1.62	5,100,147	73,544	0.032	0.032
	#3	0.499	0.162	5830	72,124	1.67	5,450,854	72,124	0.033	0.033
	#4	0.497	0.161	5757	71,942	1.54	5,019,343	71,942	0.031	0.031
	#5	0.502	0.162	6135	75,445	1.79	5,789,353	75,445	0.036	0.036
Average					73,574	1.64	5,319,828	73,574	0.033	0.033
Standard Deviation					1,566	0.10	309,287	1,566	0.002	0.002

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TEST DATA Continued:

ASTM D 256, Impact

Sample	Specimen	"E" Thickness, in	"A" Depth, in	Width, in	"E"- "A" Notch, in	Impact Reading, in/lbf	Type Break	Correction Factor, in-lbs	Corrected Energy, in-lbs	Corrected Energy, ft-lbs/in
Control	1	0.4990	0.4086	0.163	0.0904	103	NB	2.4	100.6	51.4
	2	0.5065	0.4089	0.162	0.0976	78	NB	2.7	75.3	38.7
	3	0.4990	0.4104	0.162	0.0886	108	NB	2.5	105.5	54.3
	4	0.4990	0.4095	0.162	0.0895	110	NB	2.5	107.5	55.3
	5	0.5000	0.4104	0.162	0.0896	106	NB	2.5	103.5	53.2
	6	0.4985	0.4102	0.162	0.0883	123	NB	2.2	120.8	62.1
	7	0.4985	0.4079	0.163	0.0906	112	NB	2.4	109.6	56.0
	8	0.4965	0.4080	0.162	0.0885	122	NB	2.2	119.8	61.6
	9	0.5000	0.4093	0.161	0.0907	114	NB	2.4	111.6	57.8
	10	0.5010	0.4080	0.163	0.0930	90	NB	2.6	87.4	44.7
	11	0.4995	0.4113	0.162	0.0882	87	NB	2.6	84.4	43.4
	12	0.4955	0.4075	0.161	0.0880	123	NB	2.2	120.8	62.5
	13	0.4985	0.4075	0.162	0.0910	128	NB	2.3	125.7	64.7
	14	0.4990	0.4083	0.162	0.0907	118	NB	2.2	118.0	60.7
Average								2.4	106.5	54.8
Standard Deviation								0.2	15.2	7.9

Type Break NB = Non-Break - An incomplete break where the fracture extends less than 90 % of the distance between the vertex of the notch and the opposite side.

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TEST DATA Continued:

ASTM D 256, Impact

Sample	Specimen	"E" Thickness, in	"A" Depth, in	Width, in	"E"- "A" Notch, in	Impact Reading, in/lbf	Type Break	Correction Factor, in-lbs	Corrected Energy, in-lbs	Corrected Energy, ft-lbs/in
Exposed	1	0.4945	0.4077	0.162	0.0868	106	NB	2.5	103.5	53.2
	2	0.4940	0.4137	0.164	0.0803	98	NB	2.6	95.4	48.5
	3	0.5015	0.4094	0.164	0.0921	89	NB	2.6	86.4	43.9
	4	0.5015	0.4085	0.164	0.0930	124	NB	2.2	121.8	61.9
	5	0.5025	0.4076	0.162	0.0949	108	NB	2.5	105.5	54.3
	6	0.4995	0.4072	0.163	0.0923	122	NB	2.2	119.8	61.2
	7	0.4945	0.4086	0.161	0.0859	109	NB	2.5	106.5	55.1
	8	0.5000	0.4081	0.162	0.0919	131	NB	2.3	128.7	66.2
	9	0.4930	0.4067	0.162	0.0863	93	NB	2.6	90.4	46.5
	10	0.5005	0.4093	0.16	0.0912	118	NB	2.2	115.8	60.3
	11	0.5000	0.4084	0.163	0.0916	114	NB	2.4	111.6	57.1
	12	0.5000	0.4077	0.163	0.0923	87	NB	2.6	84.4	43.1
	13	0.4985	0.4081	0.162	0.0904	86	NB	2.6	83.4	42.9
	14	0.4980	0.4098	0.161	0.0882	120	NB	2.2	117.8	61.0
Average								2.4	105.1	53.9
Standard Deviation								0.2	15.0	7.8

REMARKS:

The test materials not consumed in testing will be retained for 14 days from the date of this report and then discarded unless we receive written notification requesting otherwise.

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