

TenCate Advanced Composites USA, Inc.

HTS 150 gsm/TC250 UD Tape Prepreg - NCAMP Pre-Qualification Data

Background:

This data set of lamina and laminate properties has been tested using the NCAMP program protocols and test methods. All mechanical testing was performed at a certified, independent test laboratory. The individual data and stress-strain curves are available upon request. The laminates were cured by TenCate Advanced Composites using an oven/vacuum bag cure process at 26 in Hg minimum vacuum. Wet specimen conditioning took place at the independent certified laboratory under 145°F (63°C) and 85% RH conditions until saturation (less than 0.05% moisture for 3 successive 7 day measurements periods). Mechanical testing has been performed at the following conditions: Room Temperature Dry (RTD) = 70°F, Cold Temperature Dry (CTD) = -65°F, Elevated Temperature Dry (ETD) = 180°F and Elevated Temperature Wet (ETW) = 180°F. Additionally fluid exposure testing was performed to show the resin system's resistance to those commonly found in aircraft and vehicle systems.

Resin System	Resin System Designation		Manufacturer	
	TC250 Toughened Epoxy		TenCate Advanced Composites USA	
Cure Temperature	265°F (129°C) Std Cure - Can alternately be initially cured at 180°F (82°C) for prototyping and can be post cured to 350°F (177°C) to increase thermal properties			
Density (nominal)	1.21	g/cc	1 hr post cure @ 350°F	
Dry Tg by DMA	284°F	140°C	374°F	190°C
Wet Tg by DMA	257°F	125°C		
(Saturation at 145F/85% RH)	90.40%		Retention of Dry Tg	

Fiber Type	Toho Tenax HTS 12k Carbon		Fiber Lot # 51021	
Tensile Strength	666	ksi		
Tensile Modulus	34.7	Msi		
Strain	1.78	%		
Density	1.77	g/cc		

Prepreg Format:	Unidirectional Tape, 24" Width
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Cure Conditions For This Data	Vacuum Bag/Oven Cure, 3°F straight up to 265°F, dwell for 2 hours (unless where noted)
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	Sample 1	Sample 2	Sample 3	Avg	Std Dev
Resin Content (35 +/-3%)	32.90%	33.90%	33.30%	33.4	0.50%
FAW (150 +/- 5 gsm)	152	152	151	151.3	0.60%
Flow	11%	10.60%	11.40%	11%	N/A
Volatile Content	0.10%	0.10%	0.10%	0.10%	N/A

Notes

Cure Cycle: For this data set, TenCate Advanced Composites USA has elected to use a straightforward cure cycle, with a 3°F/min ramp to 265°F followed by a 2 hour dwell, to demonstrate the robust nature of the TC250 resin system.. While this on the whole resulted in very low laminate porosity levels, it does have some adverse effects on Interlaminar Shear values especially with the 32 ply (0.160" thick) interlaminar shear specimens that the NCAMP testing protocol specifies. TenCate has therefore supplemented this data set with data from shear laminates cured with a 185 +/- 5F, 45 minute dwell (This is the standard cure cycle for TC250) to show the improvements made to Interlaminar Shear Properties using the dwell cycle during the cure process. It is noted below in the tables where the alternate cure profile and/or specimen thickness' have been utilized for interlaminar shear testing.

Quasi Isotropic Laminate used for this test set was 25% 0°, 50% +/-45°, 25% 90° as it was the most balanced of the NCAMP protocol laminate constructions.

Date: 3-26-2008

Test Temperature Definitions	RTD	CTD	ETD	ETW
	75°F Dry	-65°F Dry	180°F Dry	180°F Wet

Test	Fiber Vol	Condition	Method	Value (Raw)	units	Value (60% Norm)	Notes
0° Tensile Strength	58.49%	RTD	D3039	297.7	ksi	305.39	
0° Tensile Modulus	58.49%	RTD	D3039	19.75	Msi	20.26	
Poisson's Ratio	58.49%	RTD	D3039	0.296		0.296	
0° Tensile Strength	58.49%	CTD	D3039	285.3	ksi	292.7	
0° Tensile Modulus	58.49%	CTD	D3039	19.47	Msi	19.97	
Poisson's Ratio	58.49%	CTD	D3039	0.3528		0.3528	
0° Tensile Strength	58.49%	ETW	D3039	295	ksi	302.7	
0° Tensile Modulus	58.49%	ETW	D3039	19.01	Msi	19.5	
Poisson's Ratio	58.49%	ETW	D3039	0.287		0.287	
90° Tensile Strength	54.48%	RTD	D3039	7.414	ksi	8.17	
90° Tensile Modulus	54.48%	RTD	D3039	1.29	Msi	1.42	
90° Tensile Strength	54.48%	CTD	D3039	8.34	ksi	9.18	
90° Tensile Modulus	54.48%	CTD	D3039	1.53	Msi	1.69	
90° Tensile Strength	54.48%	ETW	D3039	4.43	ksi	4.88	
90° Tensile Modulus	54.48%	ETW	D3039	1.07	Msi	1.18	
Cross Ply Tensile Strength	55.65%	RTD	D3039	130.76	ksi	136.61	
Cross Ply Tensile Modulus	55.65%	RTD	D3039	9.9	Msi	10.35	
Cross Ply Tensile Strength	55.65%	CTD	D3039	121	ksi	126.42	
Cross Ply Tensile Modulus	55.65%	CTD	D3039	9.61	Msi	10.04	
Cross Ply Tensile Strength	55.65%	ETW	D3039	130.3	ksi	136.1	
Cross Ply Tensile Modulus	55.65%	ETW	D3039	10.04	Msi	10.49	
Un-notched Tensile Strength	57.43%	RTD	D3039	92.27	ksi	96.4	Quasi-Isotropic Laminate Test
Un-notched Tensile Modulus	57.43%	RTD	D3039	6.83	Msi	7.13	Quasi-Isotropic Laminate Test
Un-notched Tensile Strength	57.43%	CTD	D3039	95.28	ksi	99.55	Quasi-Isotropic Laminate Test
Un-notched Tensile Modulus	57.43%	CTD	D3039	7.24	Msi	7.57	Quasi-Isotropic Laminate Test
Un-notched Tensile Strength	57.43%	ETW	D3039	100.7	ksi	105.2	Quasi-Isotropic Laminate Test
Un-notched Tensile Modulus	57.43%	ETW	D3039	6.79	Msi	7.09	Quasi-Isotropic Laminate Test
Open Hole Tensile Strength	50.13%	RTD	D5766	55.84	ksi	58.75	
Open Hole Tensile Strength	50.13%	CTD	D5766	53.36	ksi	56.14	
Open Hole Tensile Strength	50.13%	ETW	D5766	60.4	ksi	63.5	
Filled Hole Tensile Strength	51.58%	RTD	D6742	58.67	ksi	68.25	
Filled Hole Tensile Strength	51.58%	CTD	D6742	54.47	ksi	63.36	
Filled Hole Tensile Strength	51.58%	ETW	D6742	59.3	ksi	69.0	

Test	Fiber Vol	Condition	Method	Value (Raw)	units	Value (60% Norm)	Notes
0 Compression Strength	57.00%	RTD	D695	208	ksi	218.95	Tested at certified lab to show D695 Compression Stength Comparison to D6641
0 Compression Strength	57.00%	ETW	D695	174.8	ksi	192.1	Tested at certified lab to show D695 Compression Stength Comparison to D6641. 22 day moisture exposure
0 Compression Strength	58.29%	RTD	D6641	N/A	ksi	251.01	
0 Compression Modulus	56.48%	RTD	D6641	18.14	Msi	19.27	
0 Compression Strength	58.29%	CTD	D6641	N/A	ksi	291.65	
0 Compression Modulus	56.48%	CTD	D6641	18.25	Msi	19.39	
0 Compression Strength	58.29%	ETD	D6641	N/A	ksi	229.65	
0 Compression Modulus	56.48%	ETD	D6641	18.25	Msi	19.39	
0 Compression Strength	58.29%	ETW	D6641	N/A	ksi	189.9	
0 Compression Modulus	56.48%	ETW	D6641	16.89	Msi	17.95	
90 Compression Strength	54.48%	RTD	D6641	30.46	ksi	32.36	
90 Compression Modulus	54.48%	RTD	D6641	1.35	Msi	1.43	
90 Compression Strength	54.48%	CTD	D6641	40.57	ksi	43.1	
90 Compression Modulus	54.48%	CTD	D6641	1.45	Msi	1.54	
90 Compression Strength	54.48%	ETW	D6641	19.00	ksi	20.2	
90 Compression Modulus	54.48%	ETW	D6641	1.13	Msi	1.20	
Un-notched Compression Strength	55.31%	RTD	D6641	86.27	ksi	93.58	Quasi-Isotropic Laminate Test
Un-notched Compression Modulus	55.31%	RTD	D6641	6.55	Msi	7.11	Quasi-Isotropic Laminate Test
Un-notched Compression Strength	55.31%	ETW	D6641	70.1	ksi	76.0	Quasi-Isotropic Laminate Test
Un-notched Compression Modulus	55.31%	ETW	D6641	6.33	Msi	6.87	Quasi-Isotropic Laminate Test
Open Hole Compression Strength	53.29%	RTD	D6484	38.31	ksi	40.31	
Open Hole Compression Strength	53.29%	ETW	D6484	35.8	ksi	37.6	
Filled Hole Compression Strength	52.23%	RTD	D6742	49.37	ksi	56.71	
Filled Hole Compression Strength	52.23%	ETW	D6742	39.6	ksi	45.4	
Compression After Impact (1500in-lb)	50.90%	RTD	D7136 / 7	19.70	ksi	23.20	
In Plane Shear Strength	53.74%	RTD	D3846	13.3	ksi	14.85	
In Plane Shear Modulus	53.74%	RTD	D3846	1.29	Msi	1.44	
In Plane Shear Strength	53.74%	CTD	D3846	12.02	ksi	13.42	
In Plane Shear Modulus	53.74%	CTD	D3846	0.82	Msi	0.92	
In Plane Shear Strength	53.74%	ETD	D3846	12.95	ksi	14.47	
In Plane Shear Modulus	53.74%	ETD	D3846	0.585	Msi	0.654	
In Plane Shear Strength	53.74%	ETW	D3846	No Data	ksi	No Data	Test specimens lost by test lab
In Plane Shear Modulus	53.74%	ETW	D3846	No Data	Msi	No Data	Test specimens lost by test lab
In Plane Shear Strength	53.74%	EFR	D3846	13.81	ksi	15.41	
In Plane Shear Strength	53.74%	RFR	D3846	13.95	ksi	15.58	

Notes:

* EFR is the acronym for Aviation Gas & RFR is the acronym for JP8 Jet Fuel

Test	Fiber Vol	Condition	Method	Value (Raw)	units	Value (60% Norm)	Notes
QI Short Beam Shear Strength	54.89%	RTD	D2344	10.48	ksi		Quasi-Isotropic Laminate Test
QI Short Beam Shear Strength	54.89%	CTD	D2344	10.67	ksi		Quasi-Isotropic Laminate Test
QI Short Beam Shear Strength	54.89%	ETW	D2344	7.51	ksi		Quasi-Isotropic Laminate Test
Interlaminar Tensile Strength	58.44%	RTD	D6415	81.8	ksi	80.4	
Interlaminar Tensile Strength	58.44%	ETW	D6415	50.2	ksi	51.6	
Single Shear Bearing Strength	50.38%	RTD	D5961	129.1	ksi	153.8	
Single Shear Bearing Strength	50.38%	ETW	D5961	89.3	ksi	106.3	

Test	Fiber Vol	Condition	Method	Value (Raw)	units	% Retention from NCAMP RTD	Notes
Interlaminar Shear Strength		RTD	D2344	14.2	ksi	100%	16 ply specimen with the following Cure Cycle (3F up to 185F, 45 min dwell at 185F, 265F 2 hours)
Interlaminar Shear Strength		RTD	D2344	11.98	ksi	100%	NCAMP 32 ply specimen with the following Cure Cycle (3F up to 185F, 45 min dwell at 185F, 265F 2 hours)
Interlaminar Shear Strength	56.02%	RTD	D2344	11.20	ksi	100%	NCAMP 32 ply specimen. Straight up 3F/min ramp rate with no dwell at 185F
Interlaminar Shear Strength	56.02%	CTD	D2344	12.96	ksi	116%	NCAMP 32 ply specimen. Straight up 3F/min ramp rate with no dwell at 185F
Interlaminar Shear Strength	56.02%	ETD	D2344	9.74	ksi	87%	NCAMP 32 ply specimen. Straight up 3F/min ramp rate with no dwell at 185F
Interlaminar Shear Strength	56.02%	ETW	D2344	8.62	ksi	77%	NCAMP 32 ply specimen. Straight up 3F/min ramp rate with no dwell at 185F
Interlaminar Shear Str (IPA)	56.02%	RT	D2344	11.95	ksi	107%	NCAMP 32 ply specimen. Straight up 3F/min ramp rate with no dwell at 185F
Interlaminar Shear Str (MEK)	56.02%	RT	D2344	12.10	ksi	108%	NCAMP 32 ply specimen. Straight up 3F/min ramp rate with no dwell at 185F
Interlaminar Shear Str (Glycol)	56.02%	RT	D2344	11.90	ksi	106%	NCAMP 32 ply specimen. Straight up 3F/min ramp rate with no dwell at 185F
Interlaminar Shear Str (Hyd Oil #1)	56.02%	RT	D2344	11.06	ksi	99%	NCAMP 32 ply specimen. Straight up 3F/min ramp rate with no dwell at 185F
Interlaminar Shear Str (Hyd Oil #2)	56.02%	RT	D2344	11.73	ksi	105%	NCAMP 32 ply specimen. Straight up 3F/min ramp rate with no dwell at 185F
Interlaminar Shear Str (Eng Oil #1)	56.02%	RT	D2344	11.25	ksi	100%	NCAMP 32 ply specimen. Straight up 3F/min ramp rate with no dwell at 185F
Interlaminar Shear Str (Eng Oil #2)	56.02%	RT	D2344	11.48	ksi	103%	NCAMP 32 ply specimen. Straight up 3F/min ramp rate with no dwell at 185F
Interlaminar Shear Str (Salt Water)	56.02%	RT	D2344	11.07	ksi	99%	NCAMP 32 ply specimen. Straight up 3F/min ramp rate with no dwell at 185F
Interlaminar Shear Str (DI Water)	56.02%	RT	D2344	11.03	ksi	98%	NCAMP 32 ply specimen. Straight up 3F/min ramp rate with no dwell at 185F
Interlaminar Shear Str (85% RH Sat)	56.02%	RT	D2344	10.34	ksi	92%	NCAMP 32 ply specimen. Straight up 3F/min ramp rate with no dwell at 185F
Interlaminar Shear Strength (EFR)*	56.02%	RT	D2344	11.67	ksi	104%	NCAMP 32 ply specimen. Straight up 3F/min ramp rate with no dwell at 185F
Interlaminar Shear Strength (RFR)*	56.02%	RT	D2344	11.57	ksi	103%	NCAMP 32 ply specimen. Straight up 3F/min ramp rate with no dwell at 185F

Notes:

* EFR is the acronym for Aviation Gas & RFR is the acronym for JP8 Jet Fuel

TenCate Advanced Composites USA, Inc.

HTS 193 gsm SFP/TC250 Fabric Prepreg - NCAMP Pre-Qualification Data

Background:

This data set of lamina and laminate properties has been tested using the NCAMP program protocols and test methods. All mechanical testing was performed at a certified, independent test laboratory. The individual data and stress-strain curves are available upon request. The laminates were cured by TenCate Advanced Composites using an oven/vacuum bag cure process at 26 in Hg minimum vacuum. Wet specimen conditioning took place at the independent certified laboratory under 145°F (63°C) and 85% RH conditions until saturation (less than 0.05% moisture for 3 successive 7 day measurements periods). Mechanical testing has been performed at the following conditions: Room Temperature Dry (RTD) = 70°F, Cold Temperature Dry (CTD) = -65°F, Elevated Temperature Dry (ETD) = 180°F and Elevated Temperature Wet (ETW) = 180°F. No fluid exposure tests were performed on the 12k, HTS spread fabric prepreg as this testing was carried out fully on the HTS UD Tape to adequately show the resistance of the TC250 resin system to the fluids.

Resin System	Resin System Designation		Manufacturer	
	TC250 Toughened Epoxy		TenCate Advanced Composites USA	
Cure Temperature	265°F (129°C) Std Cure - Can alternately be initially cured at 180°F (82°C) for prototyping and can be post cured to 350°F (177°C) to increase thermal properties			
Density (nominal)	1.21	g/cc	1 hr post cure @ 350°F	
Dry Tg by DMA	276°F	136°C	374°F	190°C
Wet Tg by DMA	244°F	118°C		
(Saturation at 145F/85% RH)	88.30%		Retention of Dry Tg	

Fiber Type	Toho Tenax HTS 12k Carbon		Fabric Type: 12k HTS Spread Fabric, Plain Weave, 193 +/- 8 gsm FAW	
Tensile Strength	662 / 681	ksi	Fabric Lot # 31239	
Tensile Modulus	34.6 / 34.65	Msi	Fiber Lot # 51221 / 60121	
Strain	1.8 / 1.83	%		
Density	1.76	g/cc		

Prepreg Format	Plain Weave Fabric, 12k Spread, 193 gsm Nominal FAW, 50" Width
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Cure Conditions For This Data	Vacuum Bag/Oven Cure, 3°F straight up to 265°F, dwell for 2 hours (unless where noted)
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	Sample 1	Sample 2	Sample 3	Avg	Std Dev
Resin Content (42 +/-3%)	40.70%	40.50%	41.60%	41%	0.40%
FAW (193 +/- 8 gsm)	193	193	193	193	0.00%
Flow	19.3%	19.7%	19.8%	19.6%	N/A
Volatile Content	0.10%	0.10%	0.10%	0.10%	N/A
Gel Time	6 minutes				

Notes
Cure Cycle: For this data set, TenCate Advanced Composites USA has elected to use the most simplistic cure cycle, a straight 3°F ramp to 265°F followed by a 2 hour dwell, to demonstrate the robust nature of the TC250 resin system.. While this on the whole resulted in very low laminate porosity levels, it does have some adverse effects on Interlaminar Shear values especially with the 32 ply (0.160" thick) interlaminar shear specimens that the NCAMP testing protocol specifies. TenCate has therefore supplemented this data set with data from shear laminates cured with a 185 +/- 5F, 45 minute dwell (This is the standard cure cycle for TC250) to show the improvements made to Interlaminar Shear Properties using the dwell cycle during the cure process. It is noted below in the tables where the alternate cure profile and/or specimen thickness' have been utilized for interlaminar shear testing.
Quasi Isotropic Laminate used for this test set was 25% 0°, 50% +/-45°, 25% 90° as it was the most balanced of the NCAMP protocol laminate constructions.

Date: 3-26-2008

Test Temperature Definitions	RTD	CTD	ETD	ETW
	75°F Dry	-65°F Dry	180°F Dry	180°F Wet

Test	Fiber Vol	Condition	Method	Value (Raw)	units	Value (60% Norm)	Notes
0° Tensile Strength	49.83%	RTD	D3039	107	ksi	128.8	
0° Tensile Modulus	49.83%	RTD	D3039	8.39	Msi	10.1	
Poisson's Ratio	49.83%	RTD	D3039	0.045		0.045	
0° Tensile Strength	49.83%	CTD	D3039	103.3	ksi	124.3	
0° Tensile Modulus	49.83%	CTD	D3039	8.70	Msi	10.51	
Poisson's Ratio	49.83%	CTD	D3039	0.071		0.071	
0° Tensile Strength	49.83%	ETW	D3039	110.3	ksi	132.8	
0° Tensile Modulus	49.83%	ETW	D3039	8.41	Msi	10.12	
Poisson's Ratio	49.83%	ETW	D3039	0.047		0.047	
90° Tensile Strength	49.18%	RTD	D3039	96.0	ksi	116.5	
90° Tensile Modulus	49.18%	RTD	D3039	8.12	Msi	9.86	
90° Tensile Strength	49.18%	CTD	D3039	93.4	ksi	113.3	
90° Tensile Modulus	49.18%	CTD	D3039	8.68	Msi	10.54	
90° Tensile Strength	49.18%	ETW	D3039	102.2	ksi	124.0	
90° Tensile Modulus	49.18%	ETW	D3039	8.04	Msi	9.76	
Cross Ply Tensile Strength	48.34%	RTD	D3039	106.1	ksi	131.7	
Cross Ply Tensile Modulus	48.34%	RTD	D3039	8.25	Msi	10.24	
Cross Ply Tensile Strength	48.34%	CTD	D3039	98.4	ksi	122.2	
Cross Ply Tensile Modulus	48.34%	CTD	D3039	5.94	Msi	7.38	
Cross Ply Tensile Strength	48.34%	ETW	D3039	108.7	ksi	135	
Cross Ply Tensile Modulus	48.34%	ETW	D3039	8.08	Msi	10.03	
Un-notched Tensile Strength	49.17%	RTD	D3039	77.5	ksi	94.6	Quasi-Isotropic laminate test
Un-notched Tensile Modulus	49.17%	RTD	D3039	5.73	Msi	6.99	Quasi-Isotropic laminate test
Un-notched Tensile Strength	49.17%	CTD	D3039	76.7	ksi	93.5	Quasi-Isotropic laminate test
Un-notched Tensile Modulus	49.17%	CTD	D3039	6.08	Msi	7.42	Quasi-Isotropic laminate test
Un-notched Tensile Strength	49.17%	ETW	D3039	80.4	ksi	98.1	Quasi-Isotropic laminate test
Un-notched Tensile Modulus	49.17%	ETW	D3039	5.53	Msi	6.74	Quasi-Isotropic laminate test
Open Hole Tensile Strength	48.20%	RTD	D5776	43.8	ksi	54.6	
Open Hole Tensile Strength	48.20%	CTD	D5766	41.7	ksi	51.9	
Open Hole Tensile Strength	48.20%	ETW	D5766	46.6	ksi	58.0	
Filled Hole Tensile Strength	47.75%	RTD	D6742	44.7	ksi	56.2	
Filled Hole Tensile Strength	47.75%	CTD	D6742	43.8	ksi	55.1	
Filled Hole Tensile Strength	47.75%	ETW	D6742	46.6	ksi	58.6	

Test	Fiber Vol	Condition	Method	Value (Raw)	units	Value (60% Norm)	Notes
0 Compression Strength	48.48%	RTD	D695	105.3	ksi	130.3	
0 Compression Modulus	48.48%	RTD	D6641	8.26	Msi	8.77	
0 Compression Strength	48.48%	CTD	D695	112.1	ksi	138.7	
0 Compression Modulus	48.48%	CTD	D6641	8.34	Msi	8.86	
0 Compression Strength	48.48%	ETD	D695	94.1	ksi	116.4	
0 Compression Modulus	48.48%	ETD	D6641	8.04	Msi	8.54	
0 Compression Strength	48.48%	ETW	D695	83.0	ksi	102.7	
0 Compression Modulus	48.48%	ETW	D6641	8.44	Msi	8.97	
90 Compression Strength	49.44%	RTD	D695	97.8	ksi	118.7	
90 Compression Modulus	49.44%	RTD	D6641	7.80	Msi	9.46	
90 Compression Strength	49.44%	CTD	D695	108.4	ksi	131.5	
90 Compression Modulus	49.44%	CTD	D6641	8.00	Msi	9.71	
90 Compression Strength	49.44%	ETD	D695	93.6	ksi	113.6	
90 Compression Modulus	49.44%	ETD	D6641	8.02	Msi	9.73	
90 Compression Strength	49.44%	ETW	D695	85.4	ksi	103.6	
90 Compression Modulus	49.44%	ETW	D6641	7.80	Msi	9.46	
Un-notched Compression Strength	47.89%	RTD	D6641	69.8	ksi	87.4	Quasi-Isotropic laminate test
Un-notched Compression Modulus	47.89%	RTD	D6641	5.44	Msi	6.82	Quasi-Isotropic laminate test
Un-notched Compression Strength	47.89%	ETW	D6641	55.1	ksi	69.0	Quasi-Isotropic laminate test
Un-notched Compression Modulus	47.89%	ETW	D6641	5.45	Msi	6.82	Quasi-Isotropic laminate test
Open Hole Compression Strength	46.46%	RTD	D6484	37.9	ksi	49	
Open Hole Compression Strength	46.46%	ETW	D6484	32.8	ksi	42.3	
Filled Hole Compression Strength	46.35%	RTD	D6742	55.4	ksi	73.1	
Filled Hole Compression Strength	46.35%	ETW	D6742	34.6	ksi	44.8	
Compression After Impact (1500in-lb)	48.36%	RTD	D7136 / 7	22.6	ksi	28.1	
QI Short Beam Shear Strength	48.84%	RTD	D2344	7.864	ksi	N/A	Quasi-Isotropic laminate test
QI Short Beam Shear Strength	48.84%	CTD	D2344	9.164	ksi	N/A	Quasi-Isotropic laminate test
QI Short Beam Shear Strength	48.84%	ETW	D2344	6.696	ksi	N/A	Quasi-Isotropic laminate test
Interlaminar Tensile Strength	49.27%	RTD	D6641	49.6	ksi	68.4	
Interlaminar Tensile Strength	49.27%	ETW	D6641	50.2	ksi	69.3	
Single Shear Bearing Strength	47.03%	RTD	D5961	135.2	ksi	172.4	
Single Shear Bearing Strength	47.03%	ETW	D5961	102.3	ksi	130.6	

Test	Fiber Vol	Condition	Method	Value (Raw)	units	Value (60% Norm)	Notes
In Plane Shear Strength	48.60%	RTD	D3846	12.6	ksi	15.6	
In Plane Shear Modulus	48.60%	RTD	D3846	0.55	Msi	0.68	
In Plane Shear Strength	48.60%	CTD	D3846	14.54	ksi	18	
In Plane Shear Modulus	48.60%	CTD	D3846	0.65	Msi	0.8	
In Plane Shear Strength	48.60%	ETW	D3846	10.17	ksi	12.60	
In Plane Shear Modulus	48.60%	ETW	D3846	0.46	Msi	0.57	

Test	Fiber Vol	Condition	Method	Value (Raw)	units	% Retention of NCAMP RTD	Notes
Interlaminar Shear Strength	49.27%	RTD	D2344	10.2	ksi	N/A	(3F up to 185F, 45 min dwell at 185F, 3F up to 265F and dwell for 2 hours)
Interlaminar Shear Strength	49.27%	RTD	D2344	8.59	ksi	N/A	NCAMP Specimen with straight up, 3F/min ramp cure cycle with no dwell at 185F
Interlaminar Shear Strength	49.27%	CTD	D2344	8.24	ksi	95.6%	NCAMP Specimen with straight up, 3F/min ramp cure cycle with no dwell at 185F
Interlaminar Shear Strength	49.27%	ETD	D2344	9.74	ksi	113.4%	NCAMP Specimen with straight up, 3F/min ramp cure cycle with no dwell at 185F
Interlaminar Shear Strength	49.27%	ETW	D2344	6.732	ksi	78.3%	NCAMP Specimen with straight up, 3F/min ramp cure cycle with no dwell at 185F