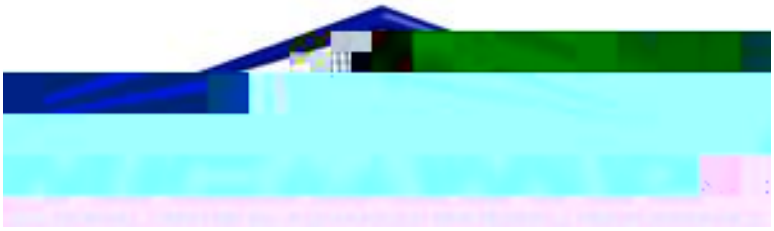

TenCate BT250E-6 S2 Unitape 284 gsm 33% RC Qualification Material Property Data Report

FAA Special Project Number: TD03019RC-R

NCAMP Test Report Number: CAM-RP-2015-040 N/C

Report Date: October 25, 2017

Testing Facility:
National Institute for Aviation Research
Wichita State University
1845 N. Fairmount
Wichita, KS 67260-0093

Test Panel Fabrication Facility:
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Evelyn Lian **Rachael Andrulonis**

Approved by:

Ed Hooper
Digitally signed by Ed Hooper
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Date: 2018.01.19 14:15:20 -06'00'

Ed Hooper (NCAMP AER)

REVISIONS:

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N/C	Vinsensius Tanoto	10/25/2017	Document Initial Release

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1. Introduction

1.1 Scope

The test methods and results described in this document are intended to provide basic composite properties essential to most methods of analysis and are consistent with CMH-17-1G—Composite Materials Handbook for Polymer Matrix Composites. This report contains material property data of common usefulness to wide range of projects. The lamina material property data have been generated with FAA oversight through FAA Special Project Number TD03019RC-R, and also meet the requirements of NCAMP Standard Operating Procedure NSP 100; the test panels and test specimens have been inspected by an FAA Designated Airworthiness Representative (DAR) and the testing has been witnessed by an FAA Designated Engineering Representative (DER). However, the data may not fulfill all the needs of any specific company's program; specific properties, environments, laminate architecture, and loading situations may require additional testing.

The use of NCAMP material and process specifications do not guarantee material or structural performance. Material users should be actively involved in evaluating material performance and quality including, but not limited to, performing regular purchaser quality control tests, performing periodic equivalency/additional testing, participating in material change management activities, conducting statistical process control, and conducting regular supplier audits.

The applicability of NCAMP material property data, material allowables, and specifications must be evaluated on case-by-case basis by aircraft companies and certifying agencies. NCAMP assumes no liability whatsoever, expressed or implied, related to the use of the material property data, material allowables, and specifications.

This report contains material property data only. Statistical analysis of the data including the calculations of b-basis values is given in a separate report TenCate Advance Composites S2 Unitape with BT250E-6 Resin Material Allowables Qualification Statistical Analysis Report, NCP-RP-2015-021 N/C. The qualification material was procured to Erickson Air-Crane (EAC) Material Specification ES0096 Revision B dated May 23, 2013. An equivalent NCAMP Material Specification NMS 250/3 Rev Initial Release dated January 2, 2018 has been created, which contains specification limits that are derived from guidelines in DOT/FAA/AR-03/19. The qualification test panels were cured in accordance with Erickson Air-Crane (EAC) Process Specification ES0098 Revision A dated June 15, 2011. An equivalent NCAMP Process Specification NPS 81250 baseline “C” Cure Cycle Rev Initial Release dated October 20, 2017 has been created. The Erickson Air-Crane (EAC) test plan EAC2029 Rev C was used for this qualification program.

Part fabricators that wish to utilize the material property data, allowables, and specifications may be able to do so by demonstrating the capability to reproduce the original material properties; a process known as equivalency. More information about

this equivalency process including the test statistics and its limitations can be found in Section 6 of DOT/FAA/AR-03/19 and Section 8.4.1 of CMH-17-1G. The applicability of equivalency process must be evaluated on program-by-program basis by the applicant and certifying agency. The applicant and certifying agency must agree that the

Superscripts

c	compression
cu	compression ultimate
s	shear
su	shear ultimate
t	tension
tu	tension ultimate

Subscripts

1	axis; longitudinal / warp direction (parallel to warp direction of reinforcement)
2	axis; transverse / fill direction (parallel to fill direction of reinforcement)
12	in-plane

Acronyms and Definitions

ASTM	American Society for Testing and Materials
B – Basis	95% lower confidence limit on the tenth population percentile
CV	Coefficient of variation
CTD	cold temperature dry
CPT	cured ply thickness
ETD	elevated temperature dry
ETW	elevated temperature wet
Gr/Ep	graphite/epoxy
norm	normalized
RTD	room temperature dry
SACMA	Suppliers of Advanced Composite Materials Association
SRM	SACMA Recommended Method
Tply	thickness divided by the number of plies provides the thickness average per specimen
wet	specimen with an “equilibrium” moisture content
T, RH	temperature, relative humidity

1.3 NIAR–Specimen Naming Format

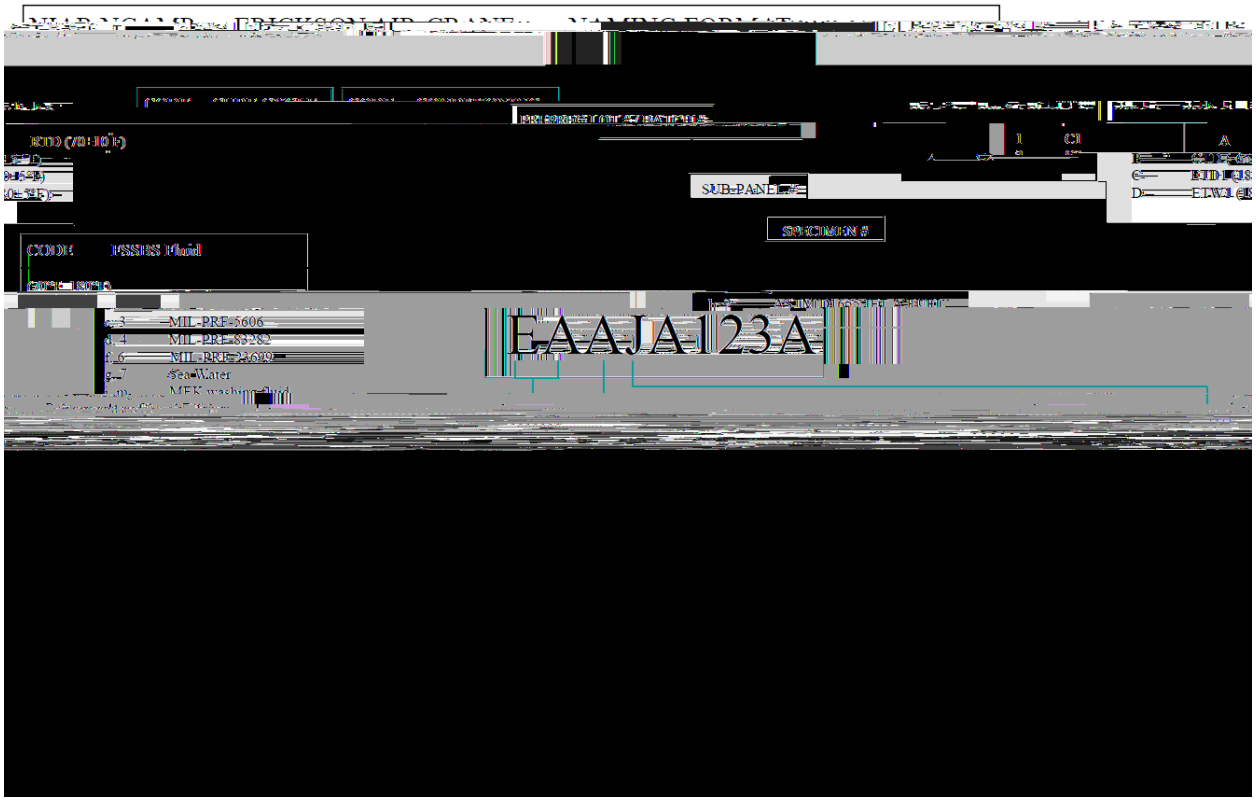


Figure 1-1: Naming Format

1.5 Methodology

1.5.1 Process Definition

For each combination of test, batch and condition, the specimens were selected from minimum two separate panels cured separately as shown in Figure 1-2 unless otherwise specified.

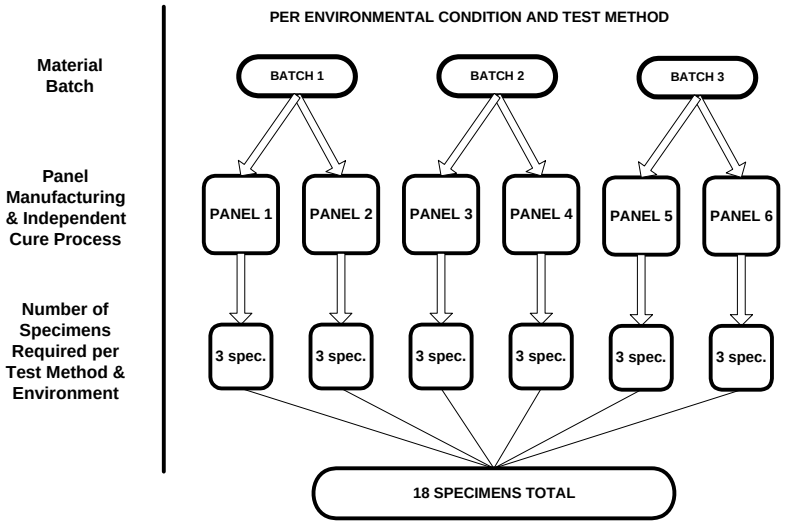


Figure 1-2: Specimen Selection Methodology

All panels were fabricated in accordance with Erickson Air-Crane (EAC) Process Specification ES0098 which is equivalent to NCAMP Process Specification NPS 81250 baseline “C” Cure Cycle, caul plate is used.

In order to facilitate individual specimen trace ability, individual specimen numbering and/or skewed lines were written or drawn across each sub-panel as shown in Figure 1-3.

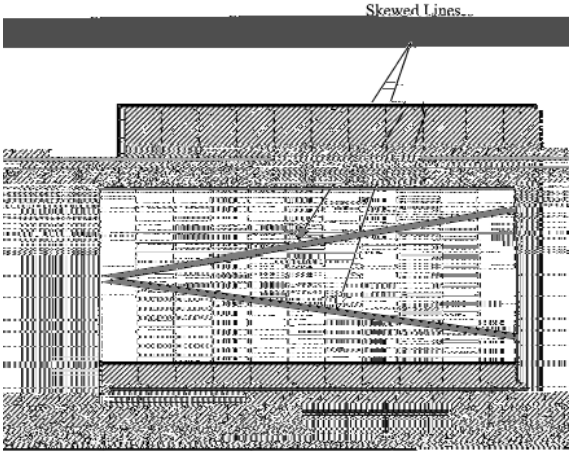


Figure 1-3: Specimen Traceability Line

1.5.2 Specimen & Testing Details

1.5.2.1 Tabbing

Longitudinal Tension coupons were tabbed (beveled) with Henkel Loctite EA 9394 and ±45° Glass tabstock.

1.5.2.2 Specimen Dimensions & Test Configuration

For SBS specimens, a span of 4T was used where T was the average thickness of six qualification panels. The same T was used to compute the width and length of the specimen.

Unless otherwise specified, a tolerance of ±5°F applied to all temperature conditions specified in this document.

1.5.2.3 Specimen Strain Device Used

Corresponding Gage ID can be obtained from Appendix 1 of EAC2029 Rev C.

Uniaxial gages were used on:

- All CTD Tension specimens
- Two RTD Tension specimens for obtaining full stress strain curves
- All conditions of combined loading compression specimens

Biaxial gages were used on:

- All conditions of IPS specimens

Uniaxial Extensometers were used on:

- All RTD and ETW Tension specimens

1.5.3 Test Matrix

The table below shows the lay-ups and test matrices used for lamina level testing.

1.5.4 Cured Laminate Physical Testing

The properties in **Table 1-2 Physical Testing Matrix**

Table 1-2 **Physical Testing Matrix**
2 were determined for each panel used for test coupons with the exception of Tg by DMA which were conducted on one laminate per batch from each oven cure conducted where that batch is present. The tests were performed by the National Institute for Aviation Research (NIAR) Composites Laboratory under the supervision of NCAMP.

Property	**Condition/Method** (Note 1)	**Min Replicates per panel**
Cured Ply Thickness	ASTM D3171-06 (Method II)	All data from mechanical test specimens
Laminate Density	ASTM D792-08	3
Fiber Volume, % by Volume	ASTM D3171-06 (Note 2)	3
Resin Content, % by Weight	ASTM D3171-06 (Note 2)	3
Ultrasonic Through Transmission, C-Scan	CP6121 (Note 3)	1
Glass Transition Temperature, Tg by DMA flexural loading	Dry and Wet – ASTM D7028	1 Dry, 1 Wet

Table 1-2 Physical Testing Matrix

Note 1: Where the applicable standard allows variations in specimen form or test method, the specific parameters to be used will be specified in the test work instructions and reported in the final test report.

Note 2: Method II, except for laminates of materials where actual fiber weight is not accurately known prior to impregnation, as in the case for unidirectional materials. For these materials, in order to verify Method II is accurate, a minimum of 12 samples per batch shall be tested by Method I, Procedure B.

Note 3: CP6121 is equivalent to MIL-HDBK-787A. Five MHz is preferred for solid laminates. Panels with anomaly should be segregated. Microscopy images may be taken from questionable areas. NIAR must be involved in the review of all C-scans.

1.5.5 Environmental Conditioning

The following tests were performed by t

1.5.6 Non-ambient Testing

The chamber was of adequate size so that all test fixtures and load frame grips were contained within the chamber.

For elevated temperature testing, the temperature chamber, test fixture, and grips were preheated to the specified temperature. Each specimen was heated to the required test temperature as verified by a thermocouple in direct contact with and taped to the specimen gage section. The heat-up time of the specimen did not exceed 5 minutes, unless otherwise specified in individual test summary sheets. The test was started 5^{1}_{0} minutes after the specimen reached the test temperature. During the test, the temperature, as measured on the specimen, was within 5°F of the required test temperature.

For subzero temperature testing, each specimen was cooled to the required test temperature as verified by a thermocouple in direct contact with and taped to the specimen gage section. The test started 5^{1}_{0} minutes after the specimen reached the test temperature. During the test, the temperature, as measured on the specimen, was within 5°F of the required test temperature.

For wet specimens, the moisture loss was determined by subjecting representative specimens to the same amount of time required to heat-up and fail the specimens. For filled-hole or bearing specimens, fasteners were removed prior to conducting moisture loss measurements. For tabbed specimens, representative coupons without tabs and having the same number of plies were used to conduct the moisture loss measurements. A minimum of one specimen or representative coupon was used to measure the moisture loss for every combination of test temperature and stacking sequence.

1.5.7 Fluid Sensitivity Screening

Data is not available

1.5.8 Normalization Procedures

Most lamina level tension and compression strength and modulus properties, and all laminate level properties were normalized according to nominal cured ply thickness. Lamina level properties that were not normalized include 90º tensile strength and modulus (unidirectional only), 90º compressive strength and modulus (unidirectional only), in-plane shear strength and modulus, Poisson's ratio, SBS, and ILT. After normalizing, data scatter reduced or remained the same. If data scatter increased significantly after normalizing, the reason was investigated. Wherever properties are normalized, both measured and normalized data were reported.

For unidirectional materials the fiber areal weight cannot be measured in advance of impregnation, hence Method I of ASTM D3171, utilizing acid digestion, will be used to verify the CPT method in accordance with note (2) of Table 1-2.

Method I Fiber Volume (%vol) is 49.158 and Method 2 Fiber Volume (%vol) is 49.059. By comparing Fiber Volume values obtained from Method I and Method II, the values are deemed close enough therefore the FAW is close to the nominal of ~284 gsm. Based on the FAW data from TenCate (Avg ~284 gsm) and our Method I Phys test data (Avg. void content ~ 2.124%) it is appropriate to use the CPT Method for normalization.

The theoretically calculated cured ply thickness was 0.0090 inches. The experimentally measured cured ply thickness of 0.0092 inches has been used as the nominal cured ply thickness (CPT) for normalization purpose. This has been done at the request of the material supplier. The following normalization formula was used:

Normalized Value = Measured Value x Measured CPT / Nominal CPT.

1.5.9 Conformity

The 3-batch qualification panels have been fabricated according to the requirements of the test plan and conformed by an FAA DAR. The test specimens and test setup have also been conformed by an FAA DAR.

Testing was witnessed by an FAA DER. Mechanical testing was carried out at the National Institute for Aviation Research, Wichita State University.

1.5.10 Material Pedigree Information

The PMC Data Collection Template includes the material pedigree information required, such as material and batch information, as well as panel fabrication record, environmental conditioning, test equipment, and test procedures.

2 Test Results

2.1 Lamina Level Test Summary

Prepreg Material:	TenCate BT250E-6 S2 Unitape Gr 284gsm 33% RC			**TenCate BT250E-6 S2 Unitape Gr 284gsm 33% RC Lamina Properties Summary**	
Material Specification:	NMS 250/3				
Process Specification:	NPS 81250				
Fiber:	S2 Glass Unitape	**Resin:**	TenCate BT250E-6		
Tg(dry):	291.67 °F	**Tg(wet):**	252.92 °F	**Tg METHOD:**	ASTM D7028

	Batch 1	Batch 2	Batch 3		
Date of fiber manufacture	February 4, 2010	December 8, 2010	April 29, 2011	**Date of testing**	Nov 2011 - Apr 2012
Date of resin manufacture *	March 8, 2011	May 10, 2011	May 10, 2011	**Date of data submittal**	April 2, 2012
Date of prepreg manufacture	March 16, 2011	May 27, 2011	May 31, 2011		
Date of composite manufacture		Jun 2011 - Jul 2011			

LAMINA MECHANICAL PROPERTY SUMMARY
Data reported as: Normalized & Measured
(Normalized by CPT=0.0092 inch)

	CTD Mean		RTD Mean		ETD Mean		ETW Mean	
	Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**
F_1^{tu} [ksi]	236.189	230.241	216.906	216.829			116.001	113.267
E_1^t [Msi]	6.618	6.460	6.489	6.488			6.483	6.335
ν_{12}^t		0.291		0.278				0.327
F_2^{tu} [ksi]		6.716		6.179				3.299
E_2^t [Msi]		1.867		1.648				0.870
F_1^{cu} [ksi] from UNC0 ****	164.089	161.713	150.827	151.564			40.120	38.751
E_1^c [Msi]	6.677	6.585	6.568	6.619			6.511	6.422
F_2^{cu} [ksi]		30.364		24.005				12.195
E_2^c [Msi]		1.972		1.791				1.169
UNC0 Strength [ksi]	91.957	91.014	78.244	79.169	60.342	61.480	46.565	46.082
UNC0 Modulus [Msi]	3.564	3.530	3.407	3.457	3.174	3.228	3.077	3.106
$F_{12}^{s0.2\%}$ [ksi]		7.126		5.597				3.142
$F_{12}^{s5\%strain}$ [ksi]		10.422		8.162				4.609
G_{12}^s [Msi]		0.652		0.547				0.326
SBS [ksi]		10.574		8.578		7.104		4.929

*** Three unique resin lots were used, two of the resin lots were produced on the same day.**

**** Derived from cross-ply.**

Table 2-1: Lamina Summary Data

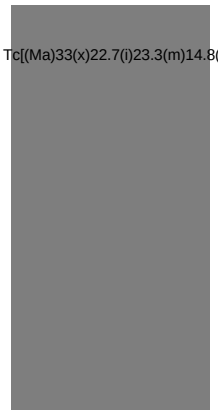
2.2 Individual Test Summaries

2.2.1 Longitudinal Tension Properties (LT)

Material:

Resin content:	32.78 % wt	**Comp. density:**	1.820 g/cc
Fiber volume:	49.54 % vol		
Ply count:	5		
Test method:	ASTM D 3039-08		
Normalized by:	0.0092 in. CPT		

	Normalized	Measured	Normalized	Measured	Normalized	Measured
Mean	236.189	230.241	216.906	216.829	116.001	113.267
Minimum	200.685	195.928	184.445	181.550	99.063	99.315
Maximum	272.237	260.081	236.882	236.542	128.155	125.6964 Tc[(Ma)33(x)22.7(i)23.3(m)14.8(u)27.1(2)0210.(0.V(5) (5)-10.3(



2.2.3 Longitudinal Compression Properties (LC)

Material:

Resin content: 33.02 % wt **:**

2.2.4 Transverse Compression Properties (TC)

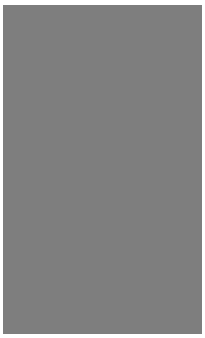
Material:

Resin content: 33.58 % wt **Comp. density:** 1.786 g/cc
Fiber volume: 48.03 % vol
Ply count: 12

Test method: ASTM D 6641-09

Normalized by: NA

		CTD				ETW	
		-65				180	
		Dry				Equilbrium	
						160 F,85%	
				EACZX XXXA		EACZX XXXD	
		Normalized	Measured	Normalized	Measured	Normalized	Measured
F_2^{cu} [ksi]	**Mean**		30.364		24.005		12.195
	Minimum		26.509		21.685		10.850
	Maximum		33.656		26.279		14.054
	C.V.(%)		6.107		5.436		6.209
	No. Specimens			21		22	
	No. Prepreg Lots			3		3	
E_2^c [Msi]	**Mean**		1.972		1.791		1.169
	Minimum		1.907		1.692		1.097
	Maximum		2.157		1.885		1.237
	C.V.(%)		3.652		3.101		3.665
	No. Specimens			18		21	
	No. Prepreg Lots			3		3	

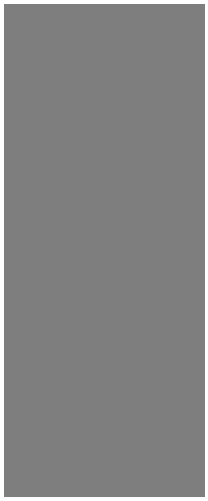


2.2.5 In-Plane Shear Properties (IPS)

Material:

Resin content:	33.04 % wt	**Comp. density:**	1.802 g/cc
Fiber volume:	48.84 % vol		
Ply count:	16		
Test method:	ASTM D 3518-07		
Normalized by:	NA		

	Normalized	Measured	Normalized	Measured	Normalized	Measured
Mean		7.126		5.597		3.142
Minimum						
MMaeanMMaean						



2.2.6 “33/0/67” Unnotched Compression 0 Properties (UNC0)

Material:

Resin content: 33.98 % wt

2.2.7 Lamina Short-Beam Strength Properties (SBS)

Material:

Resin content: 31.69 % wt
Fiber volume: 50.00 % vol
Ply count: 27

Comp. density: 1.808 g/cc

Test method: ASTM D 2344-06

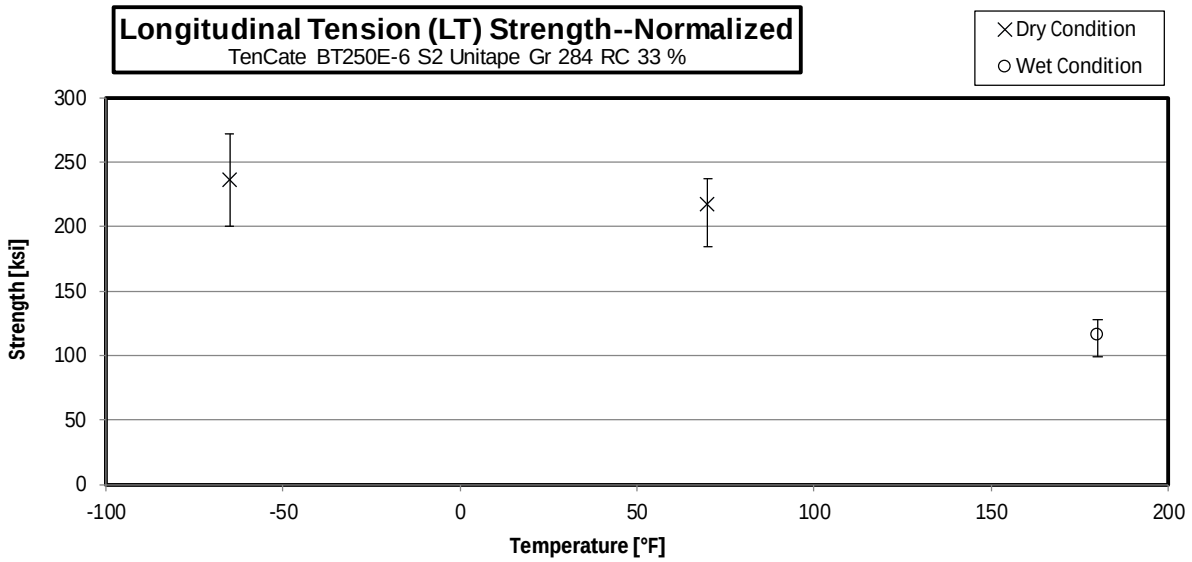
Normalized by: NA

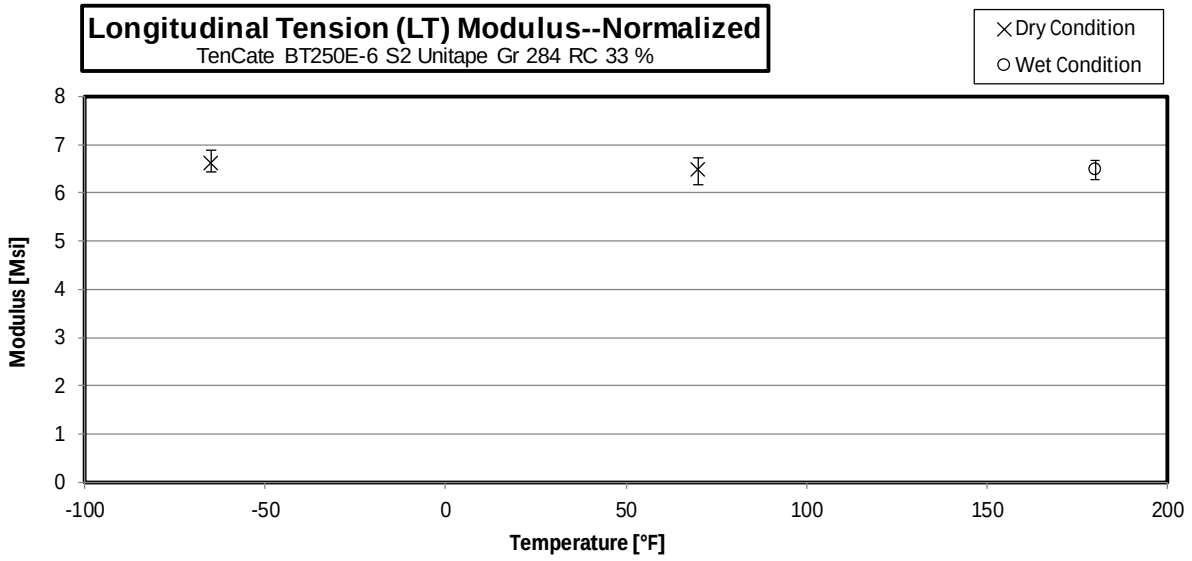
		CTD							
		-65							
		Dry				Dry			
		EACQX XXXB		EACQX XXXA		EACQX XXXC		EACQX XXXD	
		Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**
SBS [ksi]	**Mean**		10.574		8.578		7.104		4.929
	Minimum		8.744		7.243		6.267		4.259
	Maximum		12.347		9.852		7.844		5.486
	C.V.(%)		9.689		8.767		6.766		8.349
	No. Specimens	21		21		22		21	
	No. Prepreg Lots	3		3		3		3	

3. Individual Test Charts

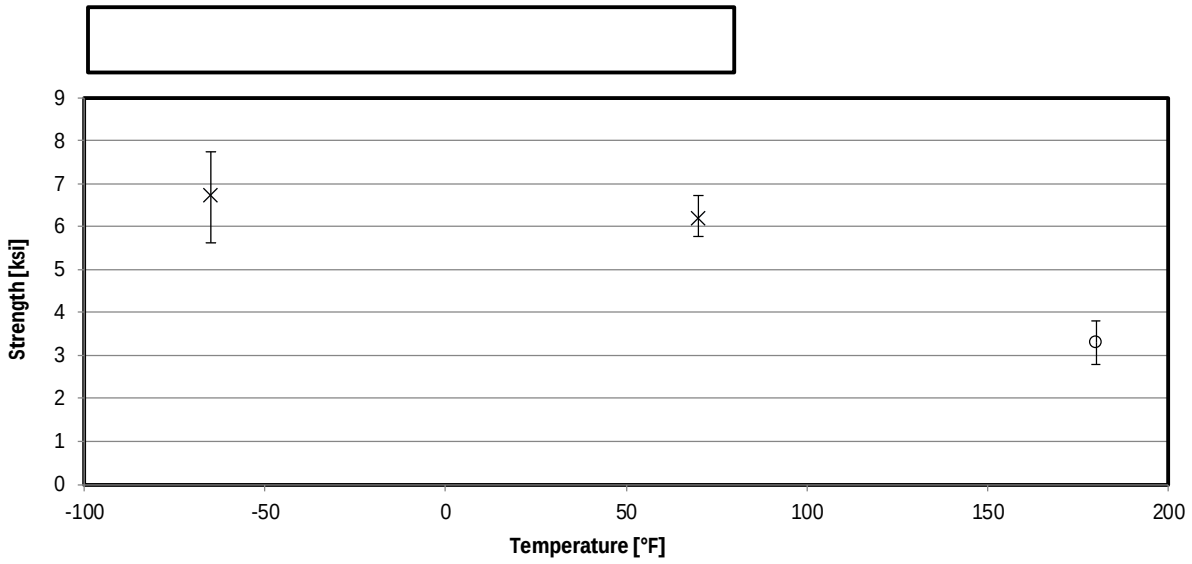
These charts combine all three batches of data and plot the minimum and maximum modulus and strength range based on the test temperature.

3.1 Longitudinal Tension Properties (LT)

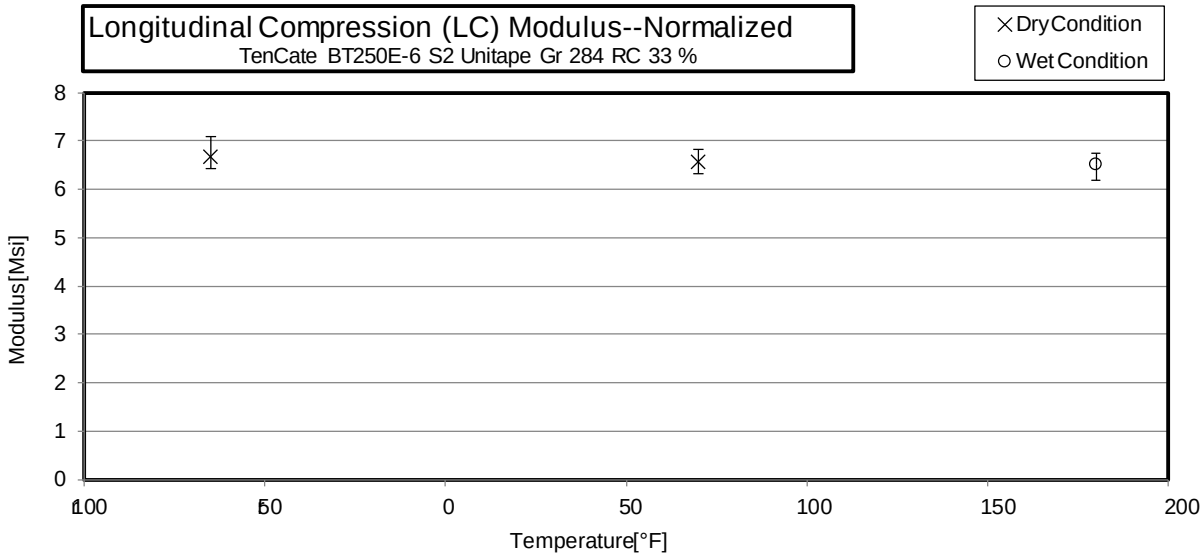




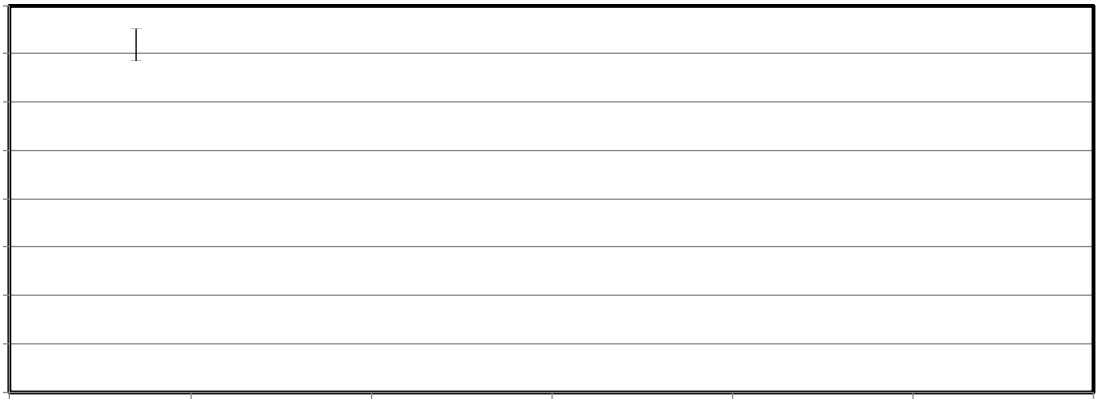
3.2 Transverse Tension Properties (TT)

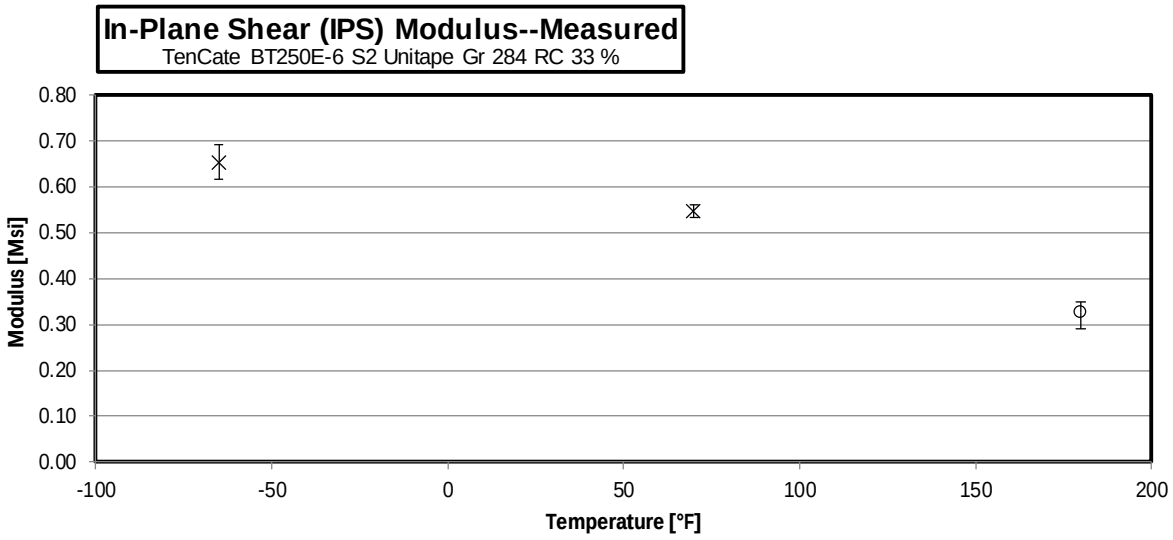


3.3 Longitudinal Compression Properties (LC)

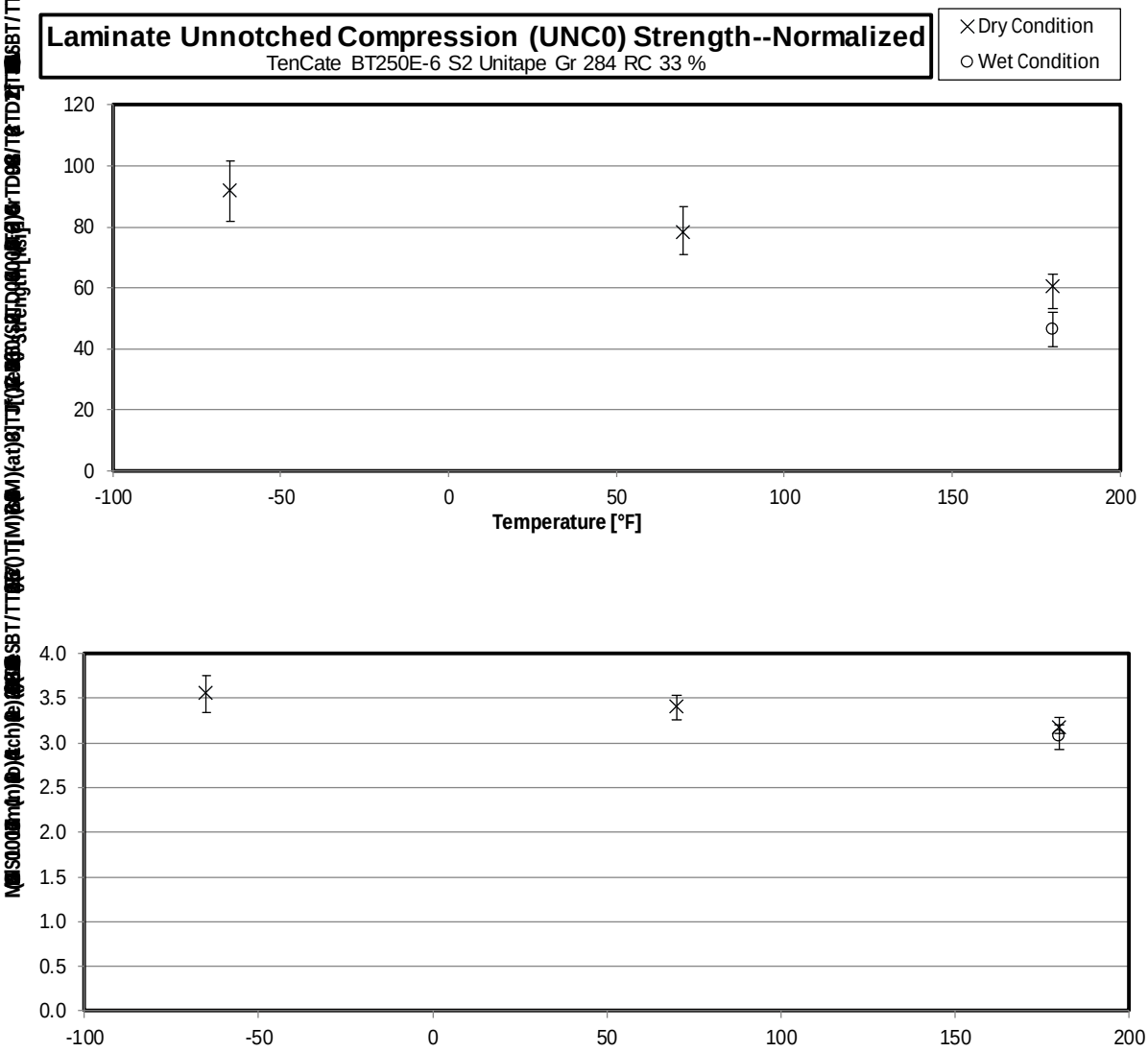


3.5 In-Plane Shear Properties (IPS)




In-Plane Shear (IPS) Modulus--Measured
TenCate BT250E-6 S2 Unitape Gr 284 RC 33 %
Modulus [Msi]
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-100
-50
0
50
100
150
200
Temperature [°F]

3.3 "33/0/67" Unnotched Compression 0 Properties (UNC0)



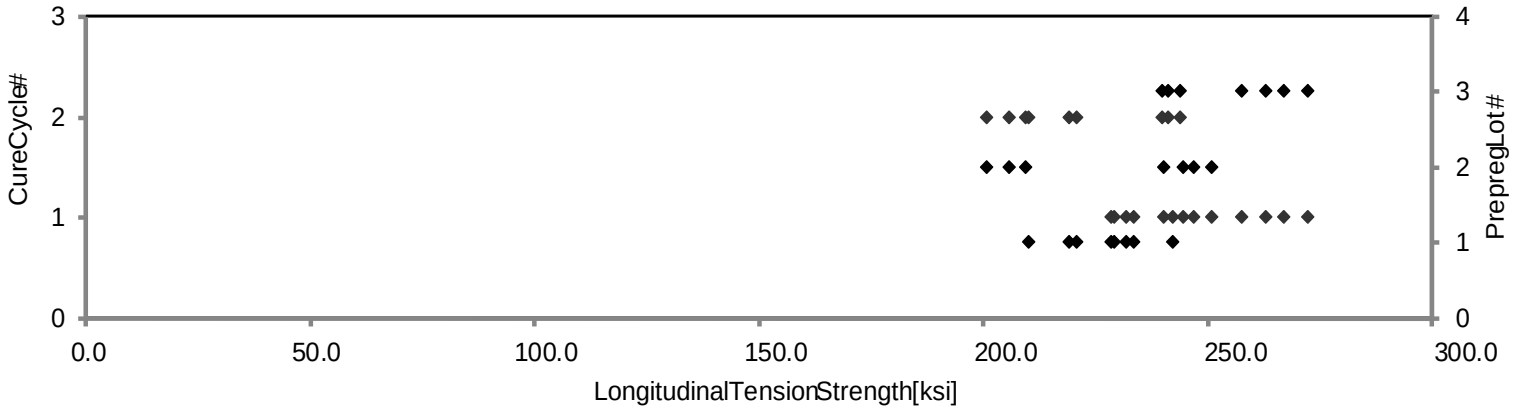
3.7 Lamina Short-Beam Shear Properties (SBS)

4. Individual Test Data

4.1 Longitudinal Tension Properties (LT)

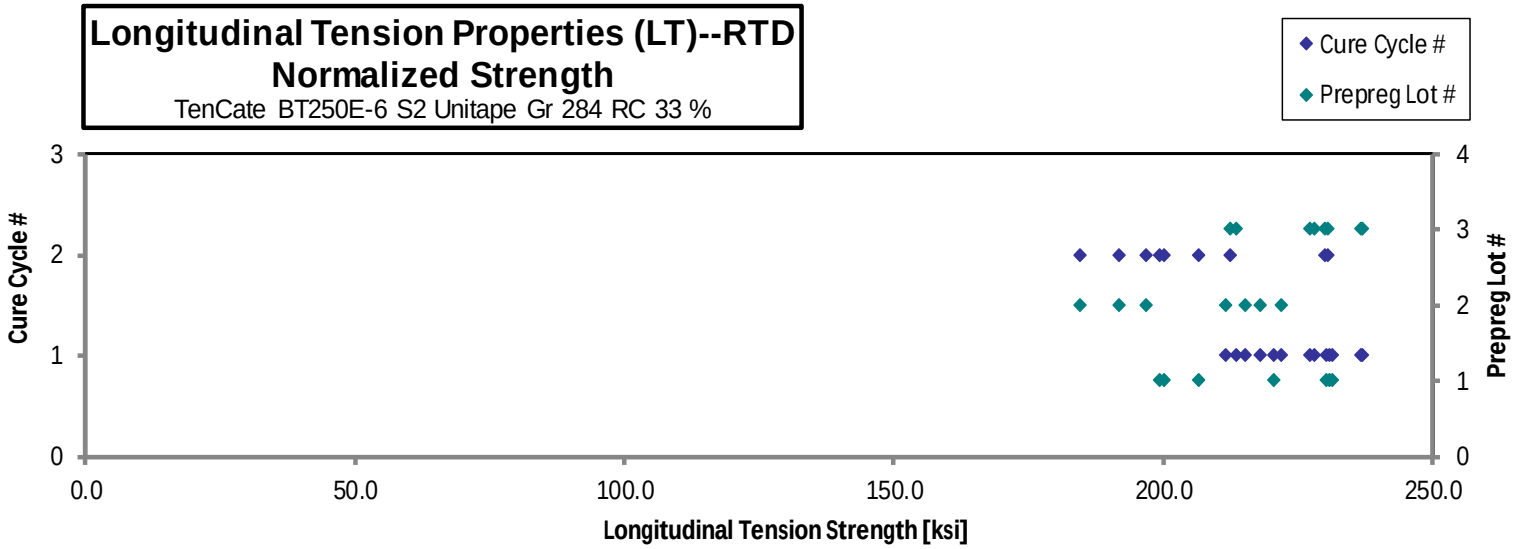
normalizing t_{ply} [in]
0.0092

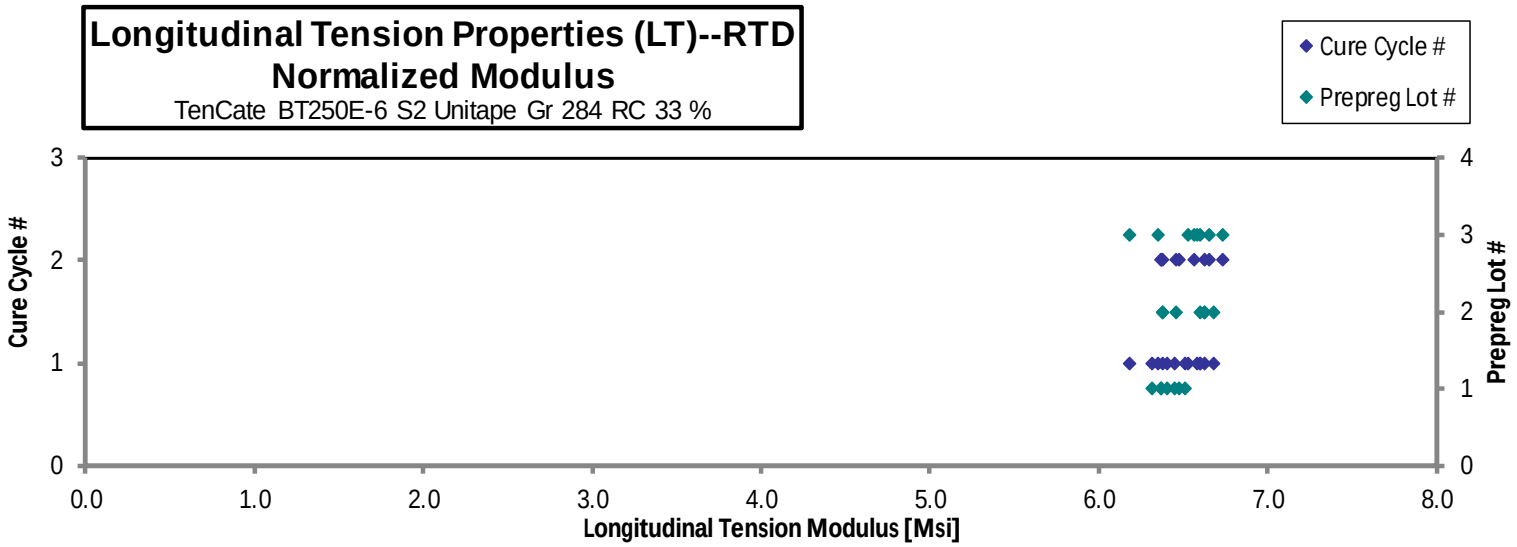
Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Strength [ksi]	Modulus [Msi]	Poisson's Ratio	Avg. Specimen Thickness [in]	# Plies in Laminate	Failure Mode	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]


CureCycle#
PrepregLot#
LongitudinalTensionStrength[ksi]
0
1
2
3
4
0.0
50.0
100.0
150.0
200.0
250.0
300.0

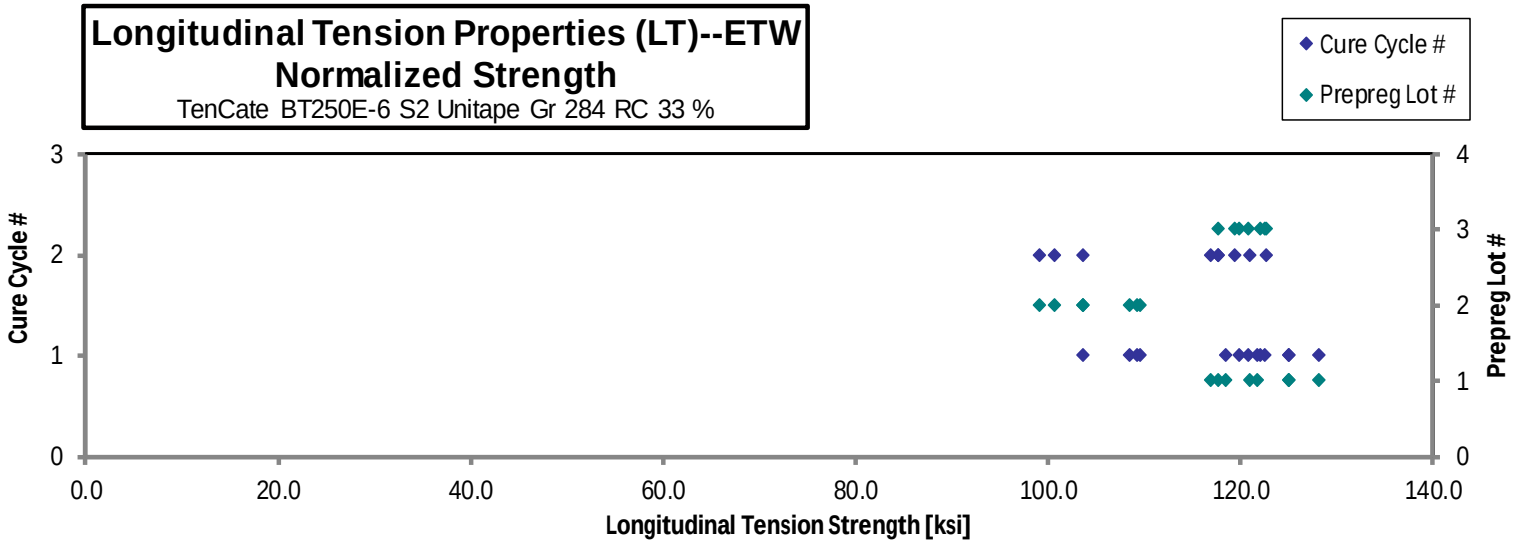
normalizing t_{ply} [in]
0.0092

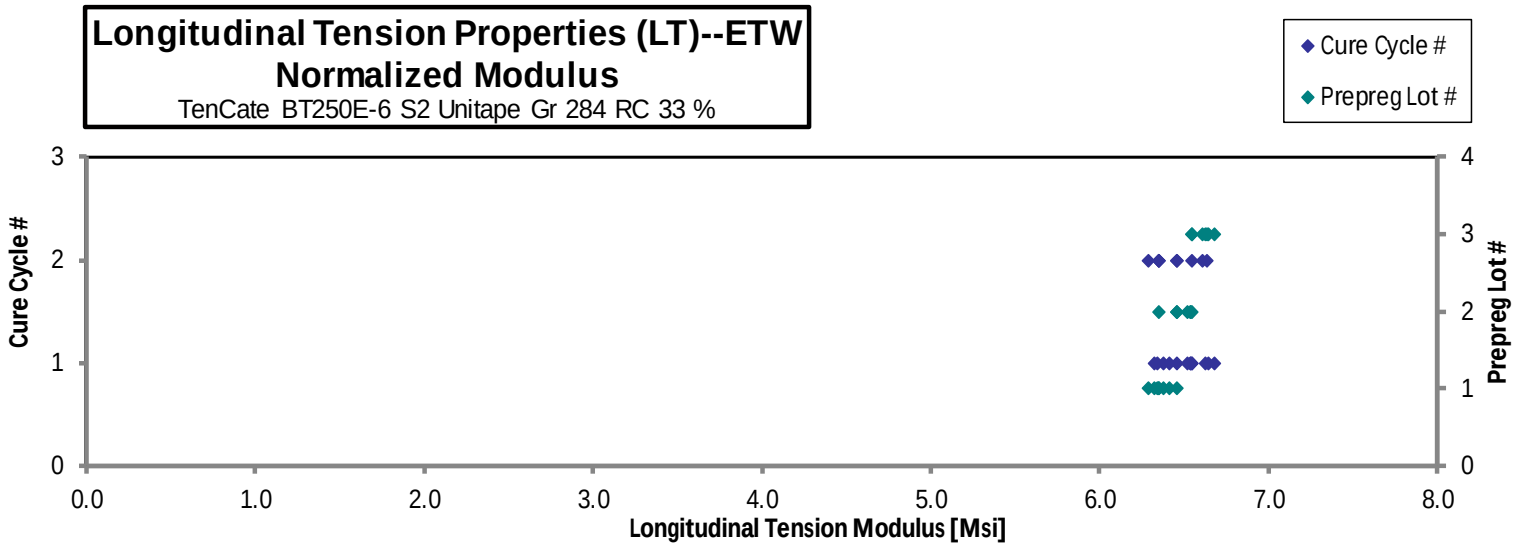
Specimen Number	EAC Batch #


Longitudinal Tension Properties (LT)--RTD
Normalized Strength
TenCate BT250E-6 S2 Unitape Gr 284 RC 33 %
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
50.0
100.0
150.0
200.0
250.0
Longitudinal Tension Strength [ksi]


Longitudinal Tension Properties (LT)--RTD
Normalized Modulus
TenCate BT250E-6 S2 Unitape Gr 284 RC 33 %
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
Longitudinal Tension Modulus [Msi]

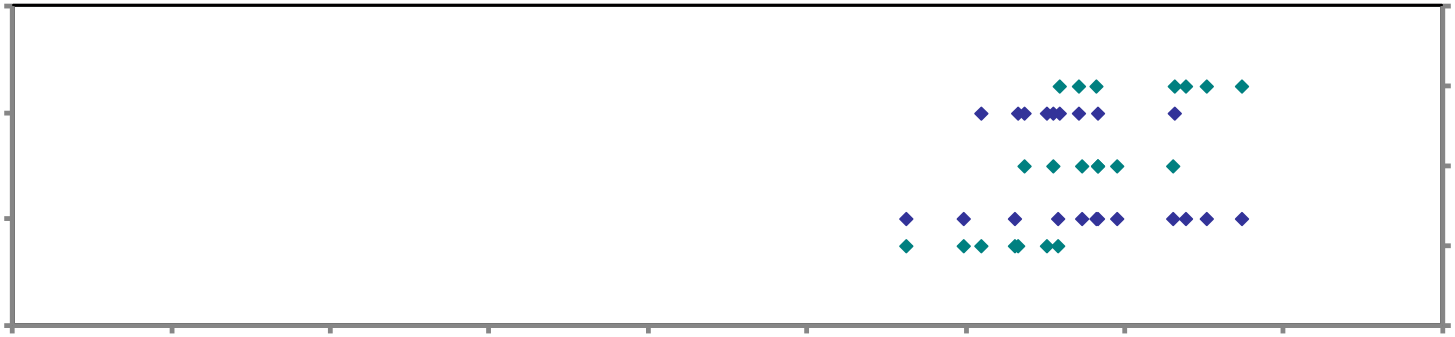
normalizing
t


Longitudinal Tension Properties (LT)--ETW
Normalized Strength
TenCate BT250E-6 S2 Unitape Gr 284 RC 33 %
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
Longitudinal Tension Strength [ksi]

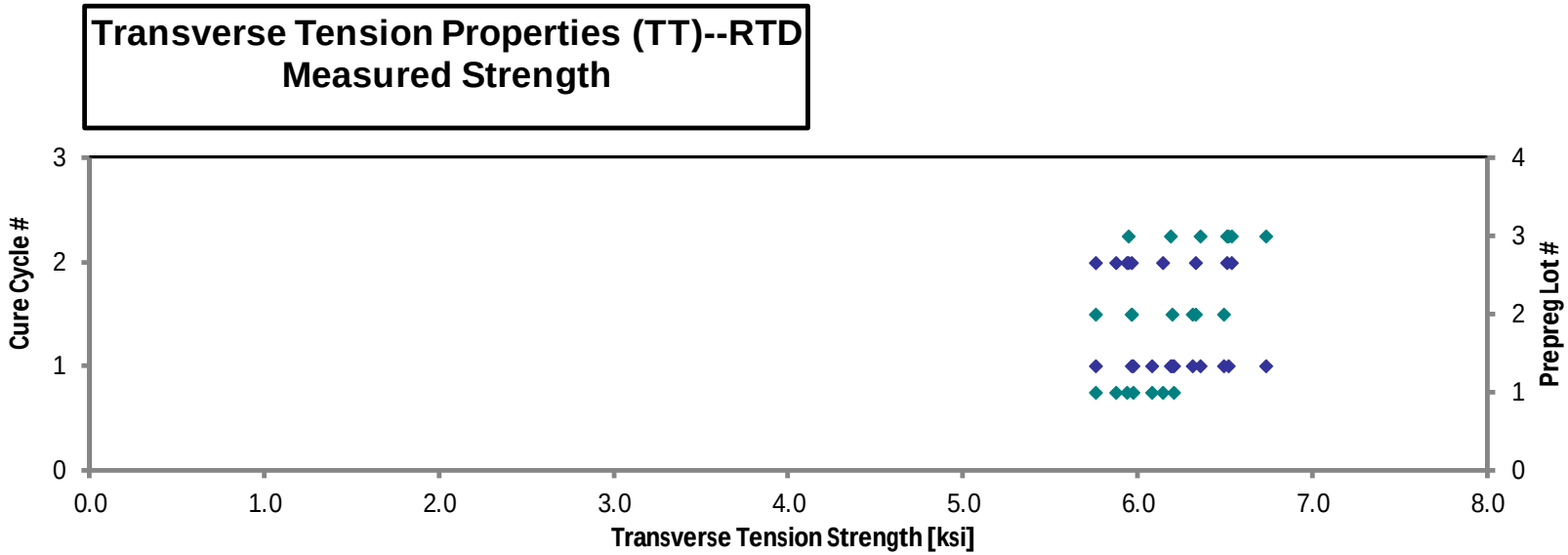

Longitudinal Tension Properties (LT)--ETW
Normalized Modulus
TenCate BT250E-6 S2 Unitape Gr 284 RC 33 %
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
Longitudinal Tension Modulus [Msi]

4.2 Transverse Tension Properties (TT)

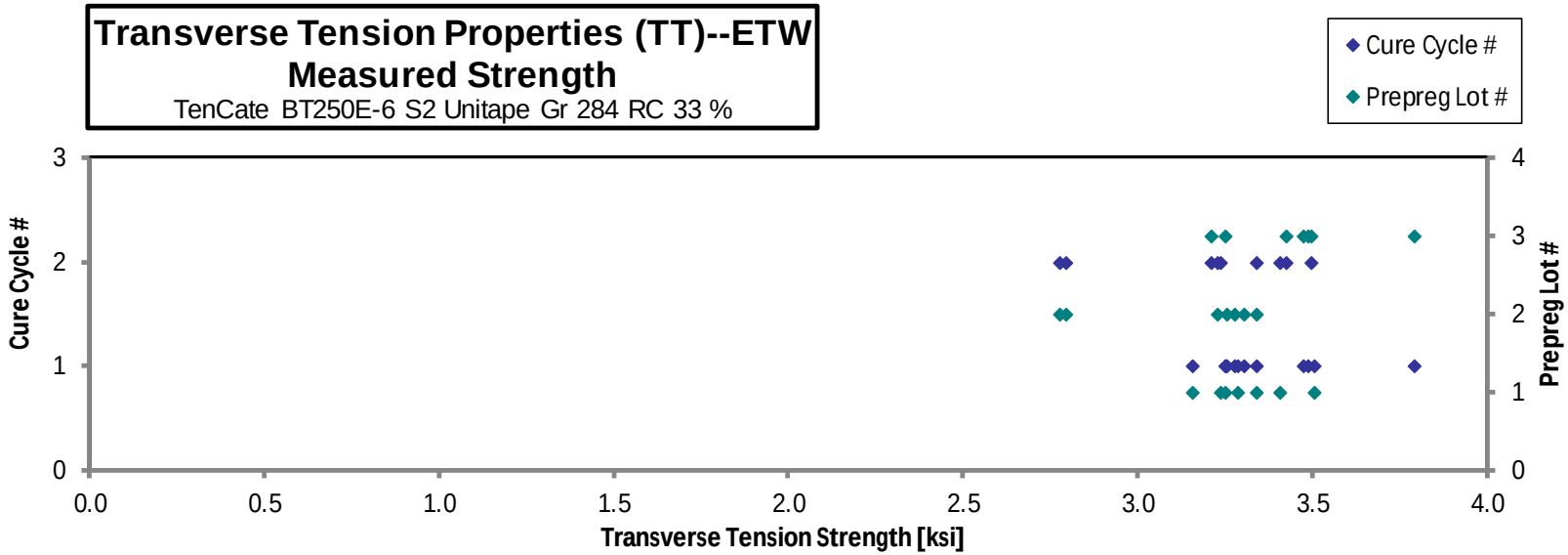
Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Avg. t_{ply} [in]	Failure Mode
EACUA116B	A	C17650e(de)135569.62240062 Te0								

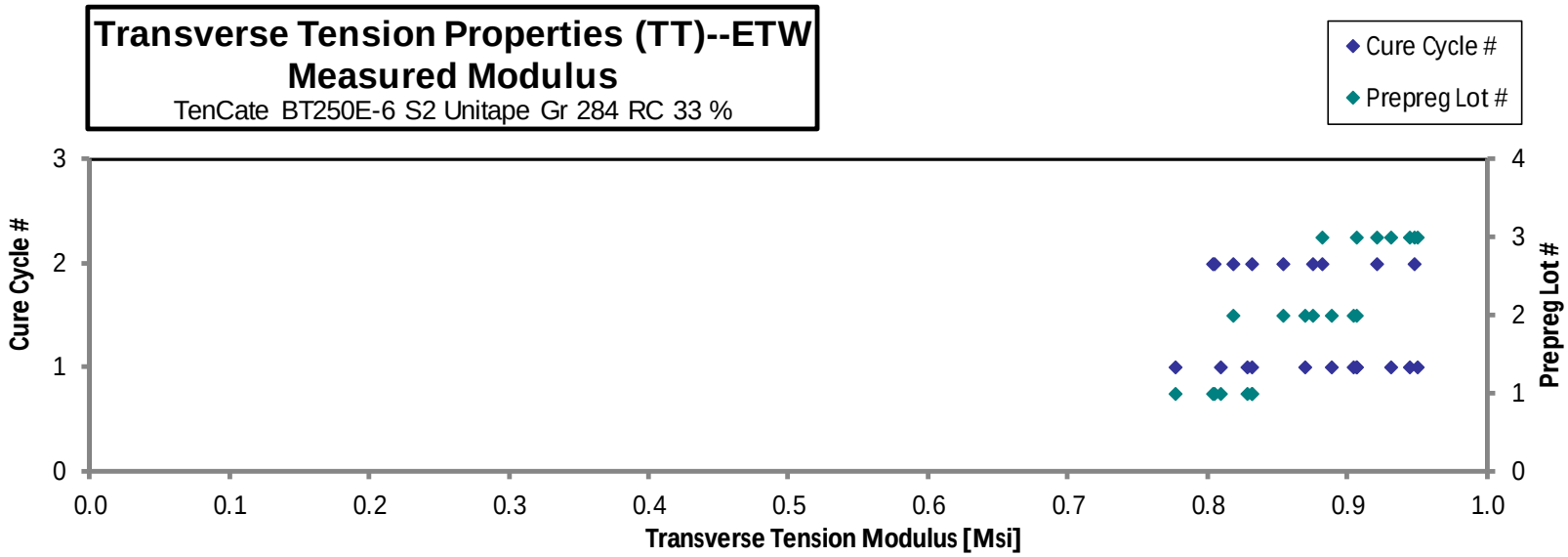


Specimen Number


Transverse Tension Properties (TT)--RTD
Measured Strength
Cure Cycle #
Prepreg Lot #
Transverse Tension Strength [ksi]
0
1
2
3
4
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0

Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Avg. t_{ply} [in]	Failure Mode
EACUA11BD	A	C1	1	1	3.250	0.809	0.111	12	0.0092	LGM
EACUA11CD	A	C1	1	1	3.156	0.777	0.113	12	0.0094	LGM
EACUA11DD	A	C1	1	1	3.505	0.828	0.114	12	0.0095	LGM
EACUA11ED	A	C1	1	1	3.286	0.831	0.113	12	0.0095	LGM
EACUA219D	A	C2	1	2	3.407	0.831	0.110	12	0.0092	LWB
EACUA21AD	A	C2	1	2	3.237	0.805	0.111	12	0.0093	LGM
EACUA21BD	A	C2	1	2	3.338	0.804	0.112	12	0.0094	LGM
EACUB11BD	B	C1	2	1	3.302	0.869	0.109	12	0.0091	LGM
EACUB11CD	B	C1	2	1	3.341	0.907	0.110	12	0.0092	LGM
EACUB11DD	B	C1	2	1	3.255	0.904	0.110	12	0.0092	LGM
EACUB11ED	B	C1	2	1	3.275	0.889	0.111	12	0.0092	LWT
EACUB219D	B	C2	2	2	3.229	0.875	0.110	12	0.0092	LWT
EACUB21AD	B	C2	2	2	2.794	0.818	0.111	12	0.0092	LGM


Transverse Tension Properties (TT)--ETW
Measured Strength
TenCate BT250E-6 S2 Unitape Gr 284 RC 33 %
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
Transverse Tension Strength [ksi]
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
0
1
2
3
4


Transverse Tension Properties (TT)--ETW
Measured Modulus
TenCate BT250E-6 S2 Unitape Gr 284 RC 33 %
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
Transverse Tension Modulus [Msi]
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
0
1
2
3
4

4.3 Longitudinal Compression Properties (LC)

Longitudinal Compression Properties (LC)--CTD
Modulus
TenCate BT250E-6 S2 Unitape Gr 284 RC 33 %

normalizing t_{ply} [in]
0.0092

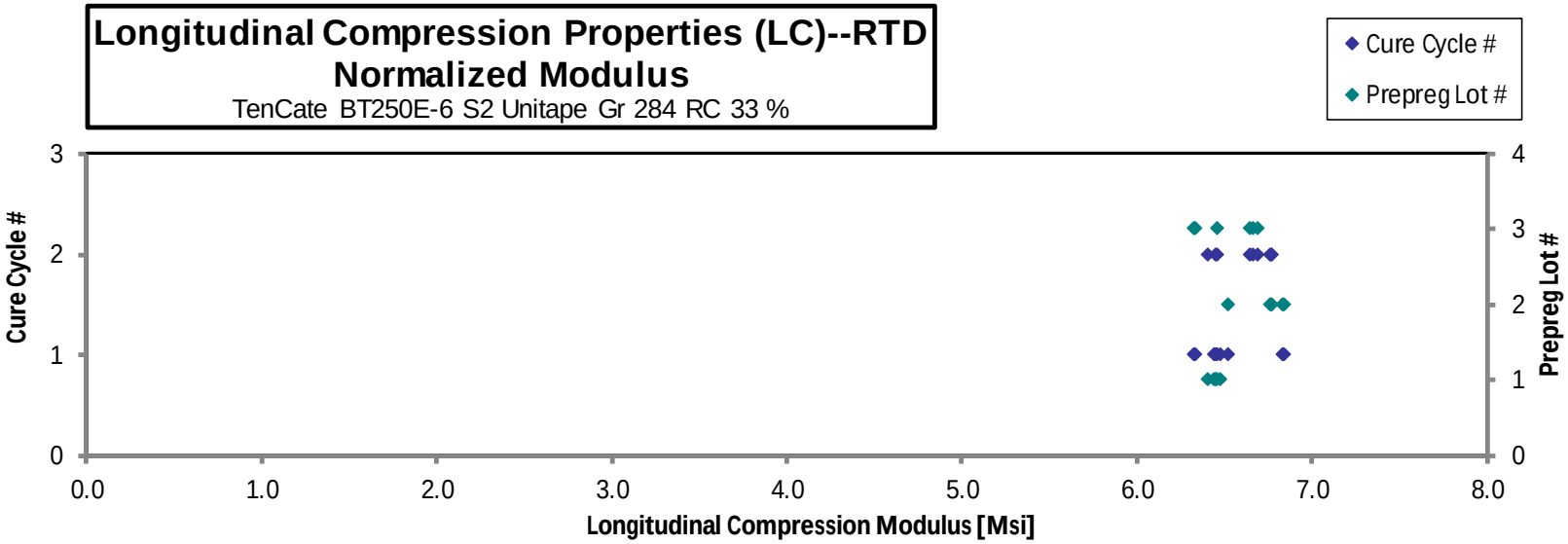
Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Failure Mode	Avg. t_{ply} [in]	$Modulus_{norm}$ [Msi]
EACLA116B	A	C1	1	1	6.542	0.111	12	N/A	0.0093	6.577
EACLA117B	A	C1	1	1	6.457	0.111	12	N/A	0.0093	6.504
EACLA118B	A	C1	1	1	6.409	0.111	12	N/A	0.0093	6.445
EACLA215B	A	C2	1	2	6.382	0.112	12	N/A	0.0094	6.488
EACLA216B	A	C2	1	2	6.523	0.113	12	N/A	0.0094	6.663
EACLA217B	A	C2	1	2	6.699	0.108	12	N/A	0.0090	6.523
EACLB116B	B	C1	2	1	6.629	0.113	12	N/A	0.0094	6.759
EACLB117B	B	C1	2	1	6.486	0.112	12	N/A	0.0094	6.602
EACLB118B	B	C1	2	1	6.330	0.112	12	N/A	0.0094	6.434
EACLB215B	B	C2	2	2	6.879	0.112	12	N/A	0.0094	6.996
EACLB216B	B	C2	2	2	6.470	0.112	12	N/A	0.0093	6.572
EACLB217B	B	C2	2	2	6.990	0.110	12	N/A	0.0092	6.972
EACLC116B	C	C1	3	1	6.431	0.113	12	N/A	0.0094	6.568
EACLC117B	C	C1	3	1	6.450	0.114	12	N/A	0.0095	6.635
EACLC118B	C	C1	3	1	6.597	0.113	12	N/A	0.0094	6.759
EACLC215B	C	C2	3	2	6.467	0.114	12	N/A	0.0095	6.693
EACLC216B	C	C2	3	2	6.827	0.115	12	N/A	0.0096	7.099
EACLC217B	C	C2	3	2	6.969	0.109	12	N/A	0.0091	6.894

Average	**6.585**	
Standard Dev.	**0.204**	
Coeff. of Var. [%]	**3.102**	
Min.	**6.330**	
Max.	**6.990**	
Number of Spec.	**18**	

$Average_{norm}$	**0.0093**	**6.677**
Standard $Dev._{norm}$		**0.199**
Coeff. of Var. $[\%]_{norm}$		**2.974**
Min.	**0.0090**	**6.434**
Max.	**0.0096**	**7.099**
Number of Spec.	**18**	**18**

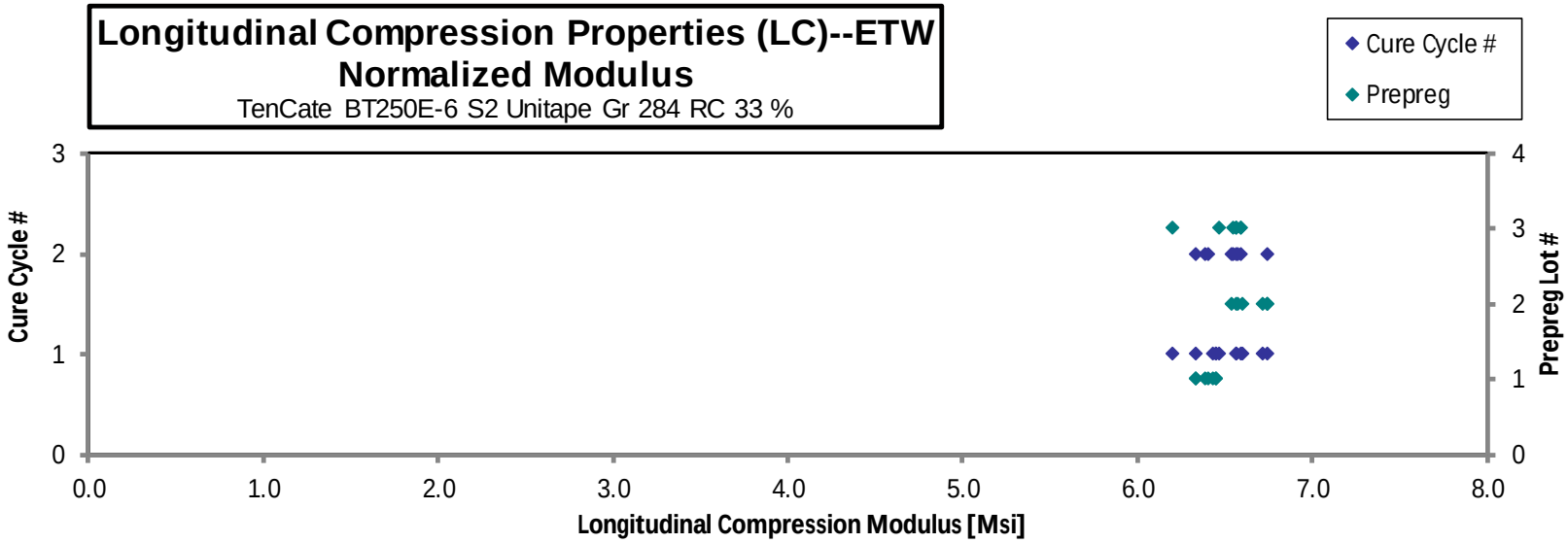
normalizing t_{ply} [in]
0.0092

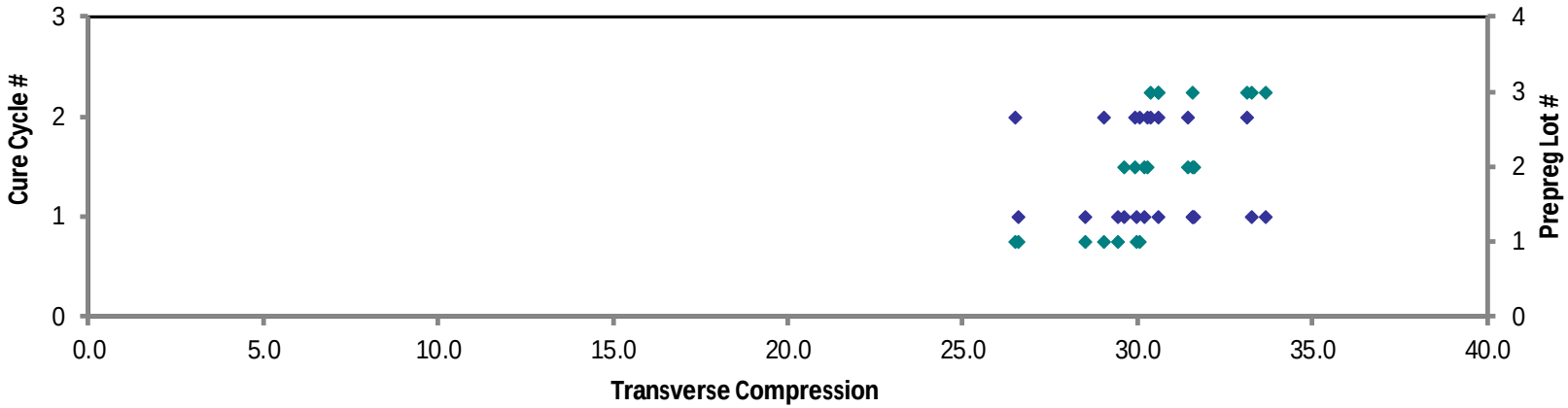
Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Failure Mode	Avg. t_{ply} [in]	$Modulus_{norm}$ [Msi]
EACLA111A	A	C1	1	1	6.672	0.107	12	N/A	0.0089	6.445
EACLA112A	A	C1	1	1	6.606	0.108	12	N/A	0.0090	6.476
EACLA113A	A	C1	1	1	6.485	0.110	12	N/A	0.0091	6.440
EACLA211A	A	C2	1	2	6.624	0.108	12	N/A	0.0090	6.451
EACLA212A	A	C2	1	2	6.517	0.109	12	N/A	0.0091	6.443
EACLA213A	A	C2	1	2	6.379	0.111	12	N/A	0.0092	6.400
EACLB111A	B	C1	2	1	6.647	0.108	12	N/A	0.0090	6.517
EACLB112A	B	C1	2	1	6.857	0.110	12	N/A	0.0092	6.826
EACLB113A	B	C1	2	1	6.759	0.112	12	N/A	0.0093	6.839
EACLB211A	B	C2	2	2	6.804	0.110	12	N/A	0.0091	6.758
EACLB212A	B	C2	2	2	6.766	0.110	12	N/A	0.0092	6.766
EACLB213A	B	C2	2	2	6.731	0.111	12	N/A	0.0092	6.766


Longitudinal Compression Properties (LC)--RTD
Normalized Modulus
TenCate BT250E-6 S2 Unitape Gr 284 RC 33 %
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
Longitudinal Compression Modulus [Msi]
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
0
1
2
3
4

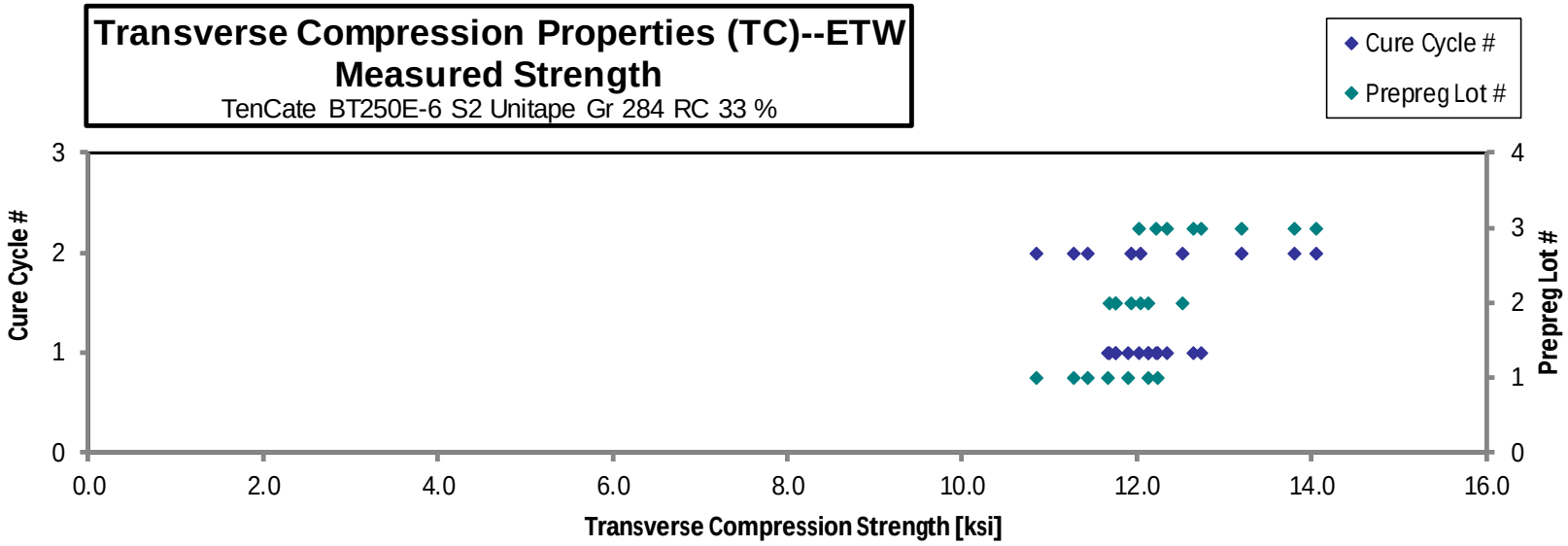
normalizing t_{ply} [in]
0.0092

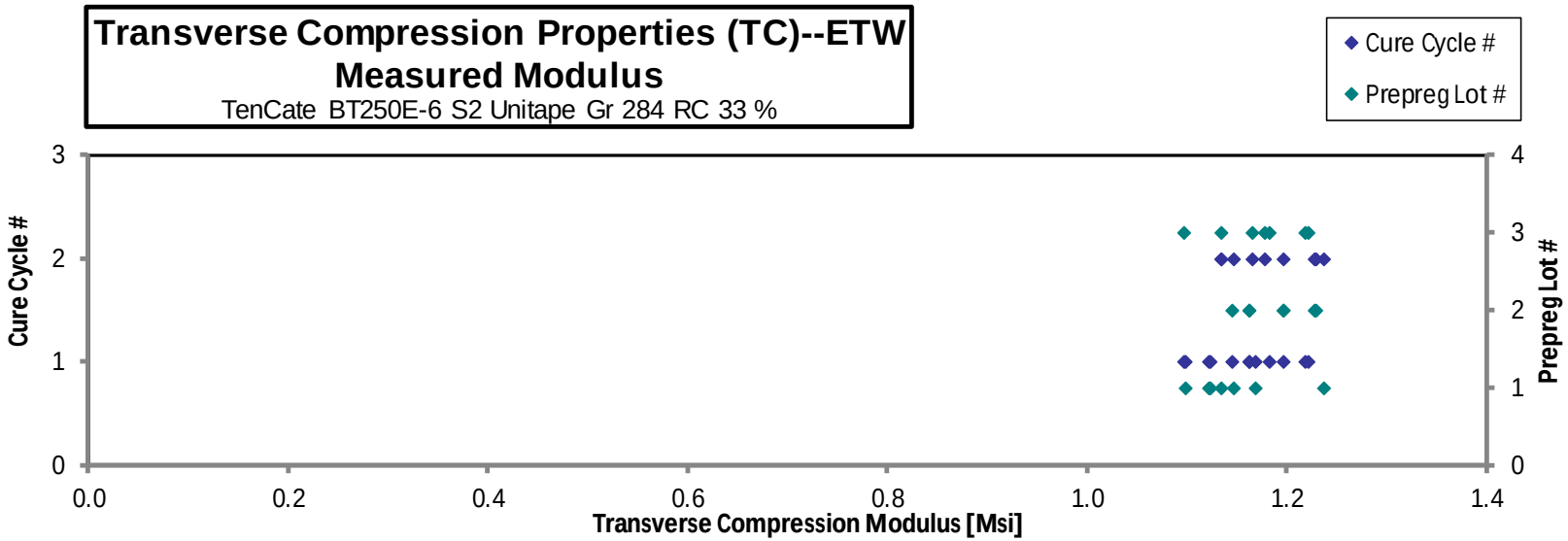
Specimen2


Longitudinal Compression Properties (LC)--ETW
Normalized Modulus
TenCate BT250E-6 S2 Unitape Gr 284 RC 33 %
Cure Cycle #
Prepreg
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
Longitudinal Compression Modulus [Msi]


Cure Cycle #
Prepreg Lot #
Transverse Compression
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
0
1
2
3
4

Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Avg. t_{ply} [in]	Failure Mode
EACZA111A	A	C1	1	1	23.443	1.818	0.107	12	0.0089	BGM


Transverse Compression Properties (TC)--ETW
Measured Strength
TenCate BT250E-6 S2 Unitape Gr 284 RC 33 %
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
Transverse Compression Strength [ksi]


Transverse Compression Properties (TC)--ETW
Measured Modulus
TenCate BT250E-6 S2 Unitape Gr 284 RC 33 %
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
Transverse Compression Modulus [Msi]

4.5 In-Plane Shear Properties (IPS)

In-Plane Shear Properties (IPS)--CTD
Strength & Modulus
TenCate BT250E-6 S2 Unitape Gr 284 RC 33 %

Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	0.2% Offset Strength [ksi]	Strength at 5% Strain [ksi]	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Avg. t_{ply} [in]
EACNA116B	A	C1	1	1	6.858	10.162	0.658	0.149	16	0.0093
EACNA117B	A	C1	1	1	6.914	10.174	0.660	0.148	16	0.0092
EACNA118B	A	C1	1	1	6.988	10.339	0.667	0.146	16	0.0091
EACNA119B	A	C1	1	1	6.916	10.254	0.667	0.145	16	0.0091
EACNA215B*	A	C2	1	2	6.950		0.662	0.149	16	0.0093
EACNA216B*	A	C2	1	2	6.906		0.652	0.148	16	0.0093
EACNA217B*	A	C2	1	2	7.090		0.684	0.144	16	0.0090
EACNB116B	B	C1	2	1	7.055	10.300	0.639	0.147	16	0.0092
EACNB117B*	B	C1	2	1	7.189		0.652	0.149	16	0.0093
EACNB118B*	B	C1	2	1	7.099		0.645	0.148	16	0.0092
EACNB119B*	B	C1	2	1	7.367		0.690	0.143	16	0.0089
EACNB215B*	B	C2	2	2	7.078		0.644	0.148	16	0.0092
EACNB216B*	B	C2	2	2	7.161		0.644	0.148	16	0.0093
EACNB217B*	B	C2	2	2	7.262		0.670	0.145	16	0.0091
EACNC116B*	C	C1	3	1	7.347		0.638	0.151	16	0.0095
EACNC117B	C	C1	3	1	7.148	10.778	0.628	0.151	16	0.0094
EACNC118B*	C	C1	3	1	7.200		0.628	0.150	16	0.0094
EACNC119B	C	C1	3	1	7.527	10.946	0.680	0.144	16	0.0090
EACNC215B*	C	C2	3	2	7.181		0.617	0.153	16	0.0095
EACNC216B*	C	C2	3	2	7.144		0.625	0.153	16	0.0096
EACNC217B*	C	C2	3	2	7.269		0.645	0.147	16	0.0092

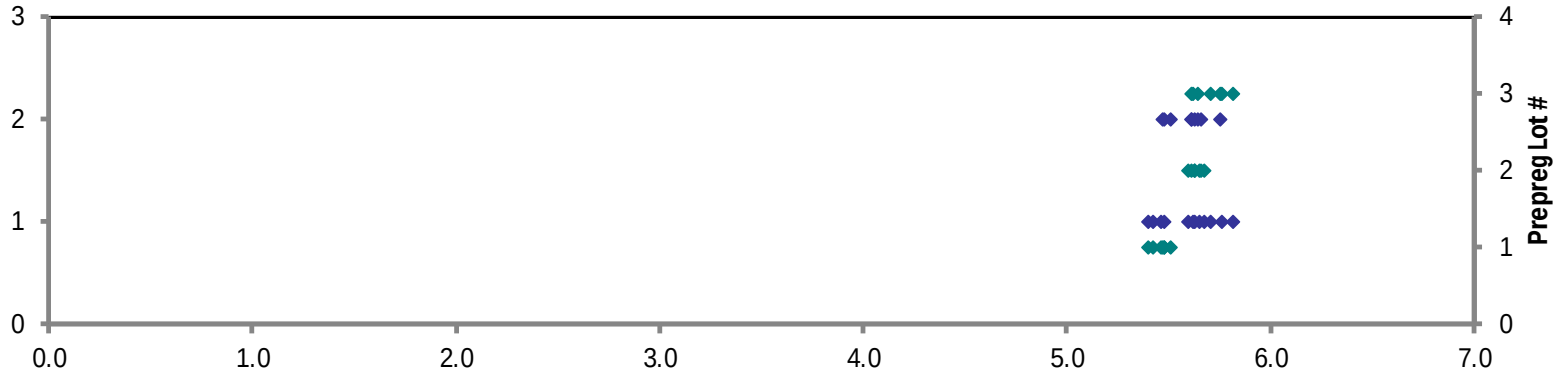
*Strength at 5% strain is not available because strain gage failed prior to reaching 5% strain.

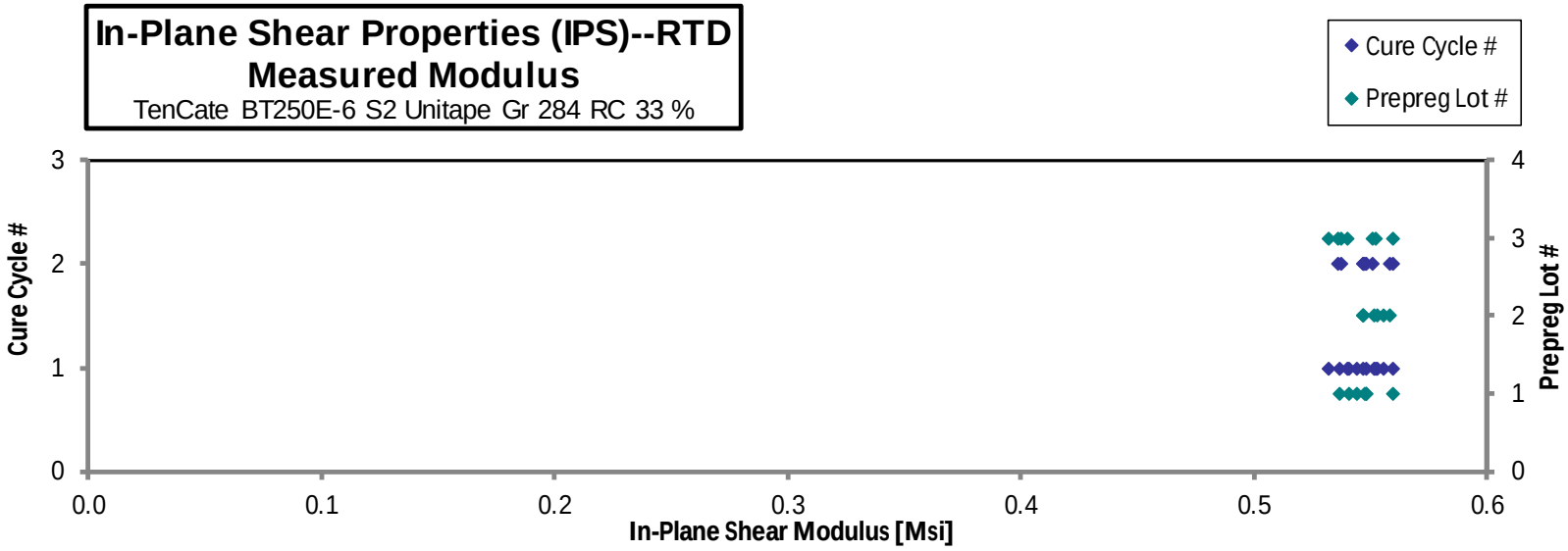
Average	**7.126**	**10.422**	**0.652**	**Average**	**0.0092**
Standard Dev.	**0.172**	**0.311**	**0.020**	**Standard Dev.**	
Coeff. of Var. [%]	**2.410**	**2.986**	**3.054**	**Coeff. of Var. [%]**	
Min.	**6.858**	**10.162**	**0.617**	**Min.**	**0.0089**
Max.	**7.527**	**10.946**	**0.690**	**Max.**	**0.0096**
Number of Spec.	**21**	**7**	**21**	**Number of Spec.**	**21**

In-Plane Shear Properties (IPS)--RTD
Strength & Modulus
TenCate BT250E-6 S2 Unitape Gr 284 RC 33 %

Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	0.2% Offset Strength [ksi]	Strength at 5% Strain [ksi]	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Avg. t_{ply} [in]
EACNA111A	A	C1	1	1	5.475	7.921	0.548	0.145	16	0.0090
EACNA112A	A	C1	1	1	5.461	7.923	0.544	0.146	16	0.0091
EACNA113A	A	C1	1	1	5.419	7.892	0.540	0.148	16	0.0092
EACNA114A	A	C1	1	1	5.394	7.960	0.536	0.149	16	0.0093
EACNA211A	A	C2	1	2	5.511	7.987	0.559	0.143	16	0.0089
EACNA212A	A	C2	1	2	5.472	8.033	0.548	0.145	16	0.0091
EACNA213A	A	C2	1	2	5.471	8.073	0.548	0.147	16	0.0092
EACNB111A	B	C1	2	1	5.672	8.103	0.556	0.143	16	0.0090
EACNB112A	B	C1	2	1	5.648	8.108	0.551	0.146	16	0.0091
EACNB113A	B	C1	2	1	5.629	8.111	0.553	0.147	16	0.0092
EACNB114A	B	C1	2	1	5.595	8.084	0.547	0.148	16	0.0092
EACNB211A	B	C2	2	2	5.660	8.034	0.558	0.146	16	0.0091
EACNB212A	B	C2	2	2	5.629	8.098	0.547	0.147	16	0.0092
EACNB213A	B	C2	2	2	5.611	8.114	0.547	0.148	16	0.0093
EACNC112A	CC1	3	1	5.756	8.494	0.552	0.147	160.0092		
EACNC113A	CC1	3	1	5.706	8.485	0.540	0.149	160.0093		
EACNC114A	CC1	3	1	5.620	8.401	0.532	0.151	160.0095		
EACNC211A	CC2	3	2	5.641	8.382	0.537	0.149	160.0093		
EACNC212A	CC2	3	2	5.750	8.432	0.551	0.148	160.0093		
EACNC213A	CC2	3	2	5.606	8.332	0.536	0.152	160.0095		

Average	**5.597**	**8.162**	**0.547**	**Average**	**0.0092**	
Standard Dev.	**0.116**	**0.202**	**0.008**	**Standard Dev.**		
Coeff. of Var. [%]	**2.070**	**2.477**	**1.461**	**Coeff. of Var. [%]**		
Min.	**5.394**	**7.892**	**0.532**	**Min.**	**0.0089**	
Max.	**5.811**	**8.494**	**0.560**	**Max.**	**0.0095**	
Number of Spec.	**21**	**21**	**21**	**Number of Spec.**	**21**	

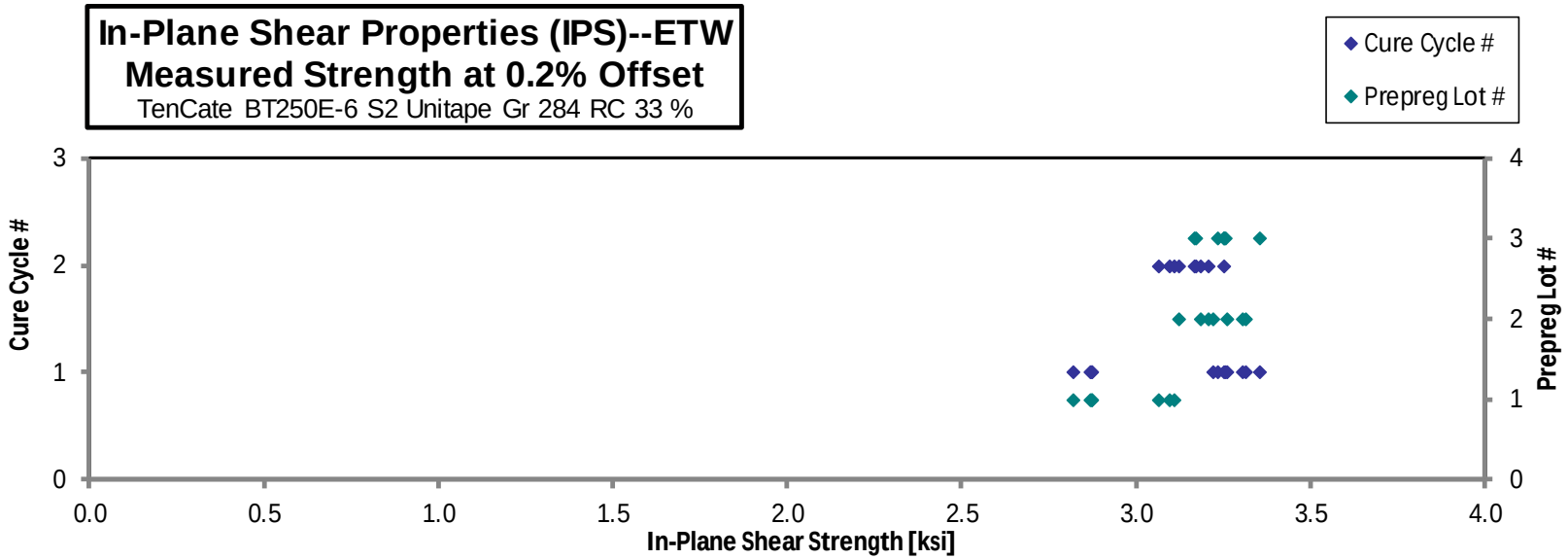

3
2
1
0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
4
3
2
1
0
Prepreg Lot #

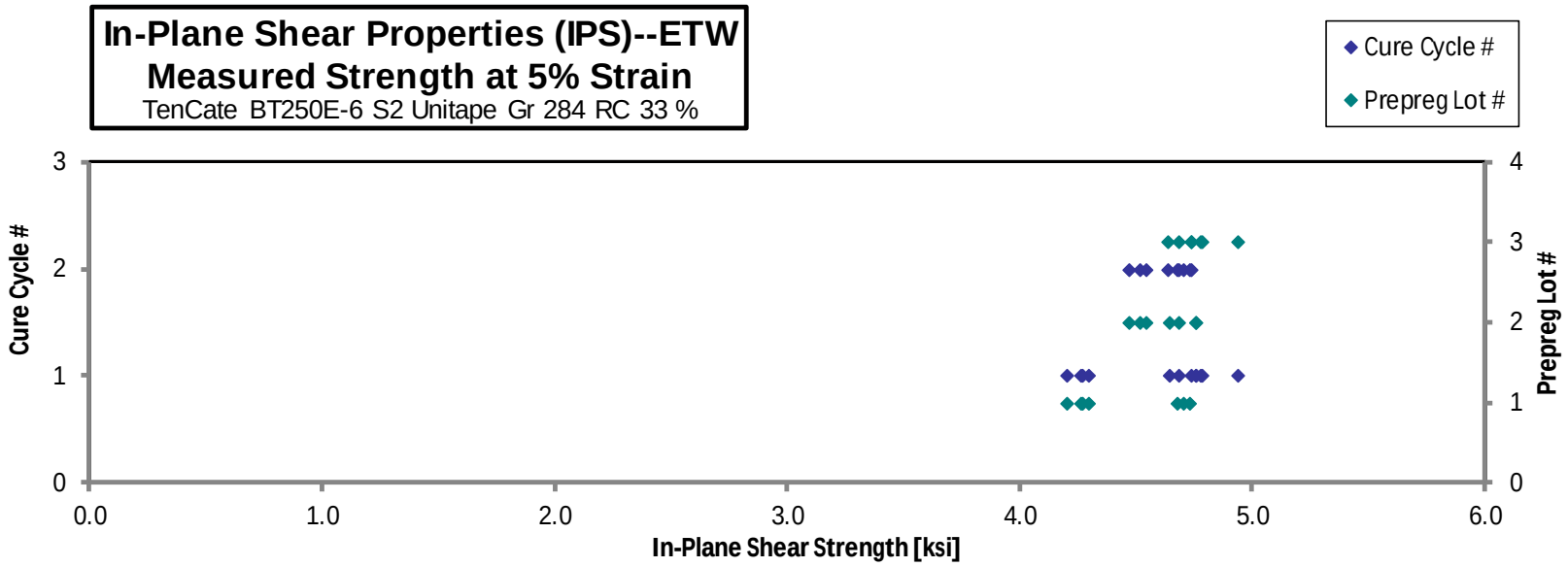

In-Plane Shear Properties (IPS)--RTD
Measured Modulus
TenCate BT250E-6 S2 Unitape Gr 284 RC 33 %
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
0.1
0.2
0.3
0.4
0.5
0.6
In-Plane Shear Modulus [Msi]

In-Plane Shear Properties (IPS)--ETW
Strength & Modulus
TenCate BT250E-6 S2 Unitape Gr 284 RC 33 %

Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	0.2% Offset Strength [ksi]	Strength at 5% Strain [ksi]	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Avg. t_{ply} [in]
EACNA11BD	A	C1	1	1	2.872	4.297	0.296	0.148	16	0.0092
EACNA11CD	A	C1	1	1	2.874	4.261	0.296	0.149	16	0.0093
EACNA11DD	A	C1	1	1	2.821	4.199	0.292	0.149	16	0.0093
EACNA11ED	A	C1	1	1	2.867	4.267	0.298	0.149	16	0.0093
EACNA219D	A	C2	1	2	3.095	4.703	0.316	0.148	16	0.0092
EACNA21AD	A	C2	1	2	3.108	4.730	0.318	0.148	16	0.0092
EACNA21BD	A	C2	1	2	3.065	4.675	0.315	0.149	16	0.0093
EACNB11BD	B	C1	2	1	3.304	4.756	0.348	0.147	16	0.0092
EACNB11CD	B	C1	2	1	3.218	4.640	0.336	0.148	16	0.0093
EACNB11DD	B	C1	2	1	3.312	4.753	0.345	0.149	16	0.0093
EACNB11ED	B	C1	2	1	3.258	4.685	0.343	0.149	16	0.0093
EACNB219D	B	C2	2	2	3.207	4.545	0.340	0.148	16	0.0092
EACNB21AD	B	C2	2	2	3.124	4.472	0.328	0.149	16	0.0093
EACNB21BD	B	C2	2	2	3.186	4.516	0.337	0.149	16	0.0093
EACNC11BD	C	C1	3	1	3.232	4.736	0.333	0.148	16	0.0093
EACNC11CD	C	C1	3	1	3.354	4.940	0.344	0.149	16	0.0093
EACNC11DD	C	C1	3	1	3.250	4.782	0.332	0.150	16	0.0094
EACNC11ED	C	C1	3	1	3.254	4.777	0.335	0.149	16	0.0093
EACNC219D	C	C2	3	2	3.251	4.738	0.335	0.149	16	0.0093
EACNC21AD	C	C2	3	2	3.171	4.685	0.327	0.151	16	0.0094
EACNC21BD	C	C2	3	2	3.165	4.637	0.324	0.151	16	0.0095

Average	**3.142**	**4.609**	**0.326**	**Average**	**0.0093**
Standard Dev.	**0.159**	**0.202**	**0.018**	**Standard Dev.**	
Coeff. of Var. [%]	**5.054**	**4.390**	**5.383**	**Coeff. of Var. [%]**	
Min.	**2.821**	**4.199**	**0.292**	**Min.**	**0.0092**
Max.	**3.354**	**4.940**	**0.348**	**Max.**	**0.0095**
Number of Spec.	**21**	**21**	**21**	**Number of Spec.**	**21**

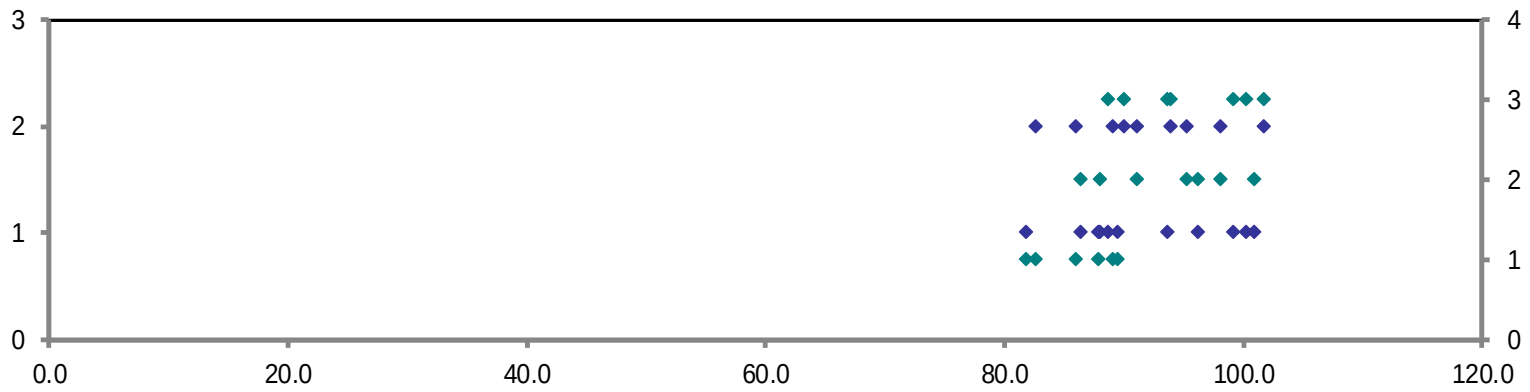

In-Plane Shear Properties (IPS)--ETW
Measured Strength at 0.2% Offset
TenCate BT250E-6 S2 Unitape Gr 284 RC 33 %
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
In-Plane Shear Strength [ksi]
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0


In-Plane Shear Properties (IPS)--ETW
Measured Strength at 5% Strain
TenCate BT250E-6 S2 Unitape Gr 284 RC 33 %
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
In-Plane Shear Strength [ksi]
0.0
1.0
2.0
3.0
4.0
5.0
6.0

4.6 "33/0/67" Unnotched Compression 0 Properties (UNC0)

normalizing t_{ply} [in]
0.0092

Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Failure Mode	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
EACRA117B	A	C1	1	1	*	3.424	0.140	15		0.0093		3.464
EACRA11BB	A	C1	1	1	80.863	3.310	0.139	15	BGM/ END CRUSH	0.0093	81.720	3.345
EACRA11CB	A	C1	1	1	88.813	3.425	0.139	15	BGM	0.0093	89.481	3.451
EACRA11DB	A	C1	1	1	87.494		0.138	15	BGM	0.0092	87.804	
EACRA215B	A	C2	1	2	89.755	3.603	0.137	15	BGM	0.0091	88.974	3.571
EACRA216B	A	C2	1	2	83.173	3.535	0.137	15	BGM	0.0091	82.608	3.511
EACRA217B	A	C2	1	2	85.897	3.563	0.138	15	BGM	0.0092	85.975	3.566
EACRB116B	B	C1	2	1	87.959	3.589	0.138	15	BGM	0.0092	87.959	3.589
EACRB117B	B	C1	2	1	95.724	3.476	0.139	15	BGM	0.0092	96.114	3.490
EACRB118B	B	C1	2	1	100.396	3.483	0.139	15	BGM	0.0092	100.914	3.501
EACRB119B	B	C1	2	1	85.726		0.139	15	BAB	0.0093	86.285	
EACRB215B	B	C2	2	2	96.396	3.603	0.136	15	BAB	0.0091	95.269	3.561
EACRB216B	B	C2	2	2	98.650	3.577	0.137	15	BAT	0.0091	98.096	3.557
EACRB217B	B	C2	2	2	90.897	3.567	0.138	15	BGM	0.0092	91.012	3.571
EACRC116B	C	C1	3	1	90.249	3.545	0.143	15	BGM	0.0095	93.609	3.677
EACRC117B	C	C1	3	1	96.095	3.432	0.144	15	BGM	0.0096	100.238	3.580
EACRC118B	C	C1	3	1	95.217	3.603	0.144	15	BGM	0.0096	99.098	3.750
EACRC119B	C	C1	3	1	85.607		0.143	15	BGM	0.0095	88.569	
EACRC215B	C	C2	3	2	100.409	3.574	0.140	15	BGM	0.0093	101.655	3.618
EACRC216B	C	C2	3	2	88.598	3.630	0.140	15	BGM	0.0093	89.922	3.684
EACRC217B	C	C2	3	2	92.353	3.596	0.140	15	BGM	0.0093	93.834	3.654


3
2
1
0
4
3
2
1
0
0.0
20.0
40.0
60.0
80.0
100.0
120.0

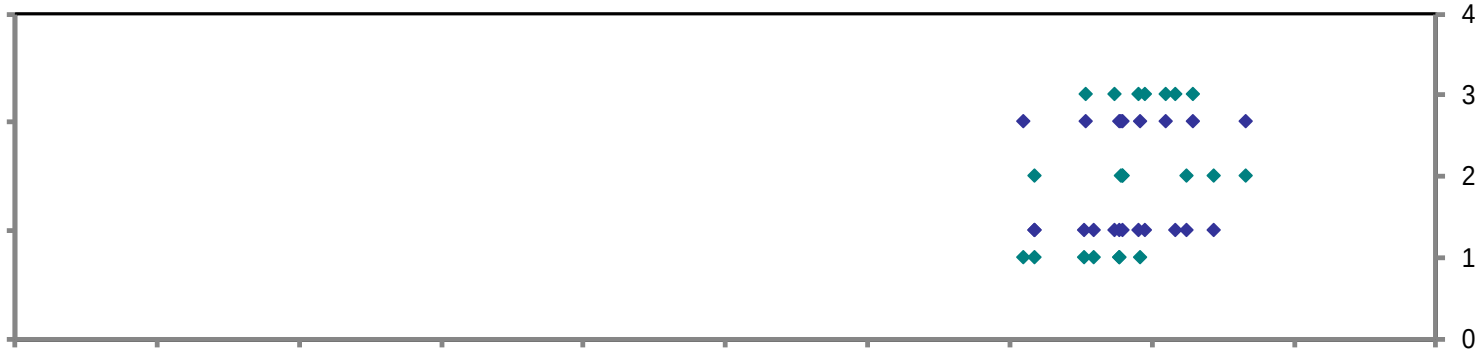
Laminate Unnotched Compression Properties (UNC0)--RTD
Strength & Modulus
TenCate BT250E-6 S2 Unitape Gr 284 RC 33 %

normalizing t_{ply} [in]: 0.0092

Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Failure Mode	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
EACRA112A	A	C1	1	1	77.768	3.467	0.135	15	BGM	0.0090	75.901	3.384
EACRA113A	A	C1	1	1	76.533	3.339	0.136	15	BGM	0.0090	75.222	3.281
EACRA114A	A	C1	1	1	78.288	3.354	0.137	15	BGM	0.0091	77.657	3.327
EACRA116A*	A	C1	1	1	71.628		0.138	15	HGM	0.0092	71.731	
EACRA211A	A	C2	1	2	73.835	3.396	0.132	15	BGM	0.0088	70.852	3.259
EACRA212A	A	C2	1	2	81.733	3.457	0.134	15	BGM	0.0089	79.098	3.345
EACRA213A	A	C2	1	2	80.080	3.434	0.134	15	BGM	0.0089	77.679	3.331
EACRB111A	B	C1	2	1	86.955	3.469	0.134	15	BGM	0.0089	84.293	3.363
EACRB112A	B	C1	2	1	73.295	3.444	0.135	15	BGM	0.0090	71.669	3.367
EACRB113A	B	C1	2	1	83.609	3.502	0.136	15	BGM	0.0091	82.420	3.453
EACRB114A*	B	C1	2	1	78.760		0.136	15	BGM	0.0091	77.868	
EACRB211A	B	C2	2	2	81.517	3.606	0.132	15	BGM	0.0088	77.936	3.448
EACRB212A	B	C2	2	2	89.496	3.607	0.134	15	BGM	0.0089	86.577	3.489
EACRB213A	B	C2	2	2	79.362	3.562	0.135	15	BGM	0.0090	77.759	3.490
EACRC111A	C	C1	3	1	80.955	3.446	0.139	15	BGM	0.0093	81.608	3.474
EACRC112A	C	C1	3	1	77.885	3.458	0.141	15	BGM	0.0094	79.486	3.529
EACRC113A	C	C1	3	1	77.044	3.362	0.142	15	BGM	0.0094	79.026	3.448
EACRC114A*	C	C1	3	1	75.085		0.142	15	BGM	0.0095	77.275	
EACRC211A	C	C2	3	2	75.639	3.428	0.137	15	BGM	0.0092	75.331	3.414
EACRC212A	C	C2	3	2	82.782	3.439	0.138	15	BGM	0.0092	82.827	3.441
EACRC213A	C	C2	3	2	80.310	3.459	0.139	15	BGM	0.0093	80.914	3.485

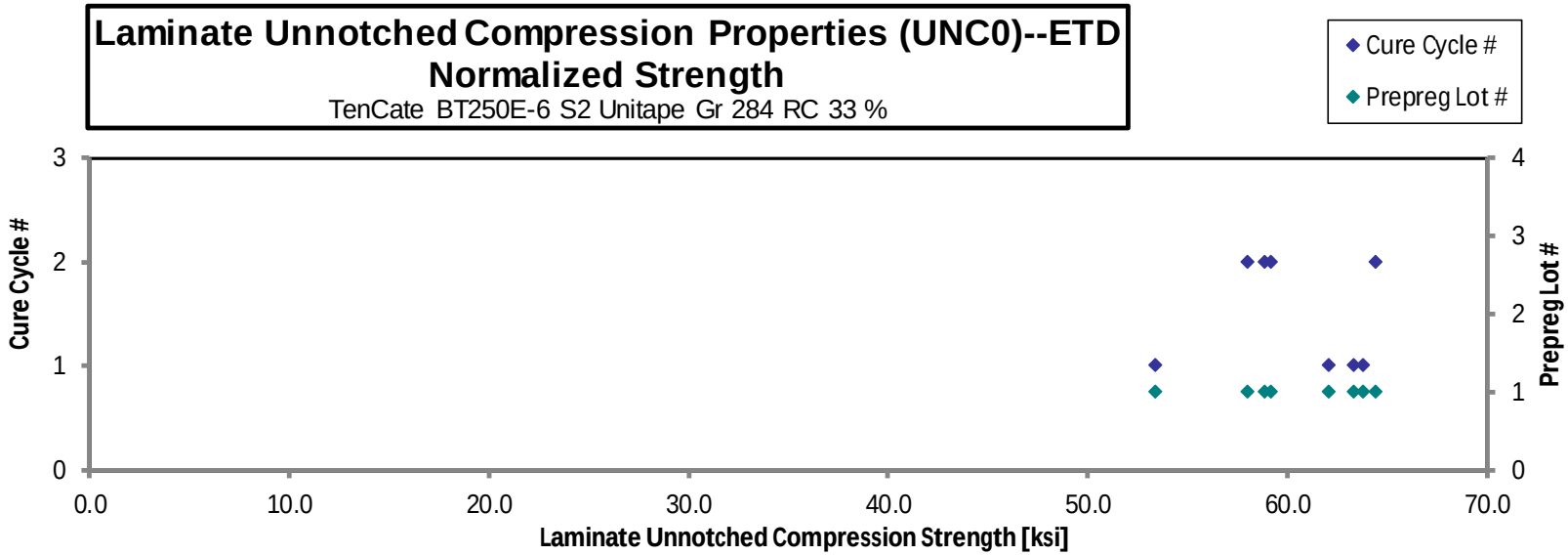
* Specimen was not gaged and tested for strength only.

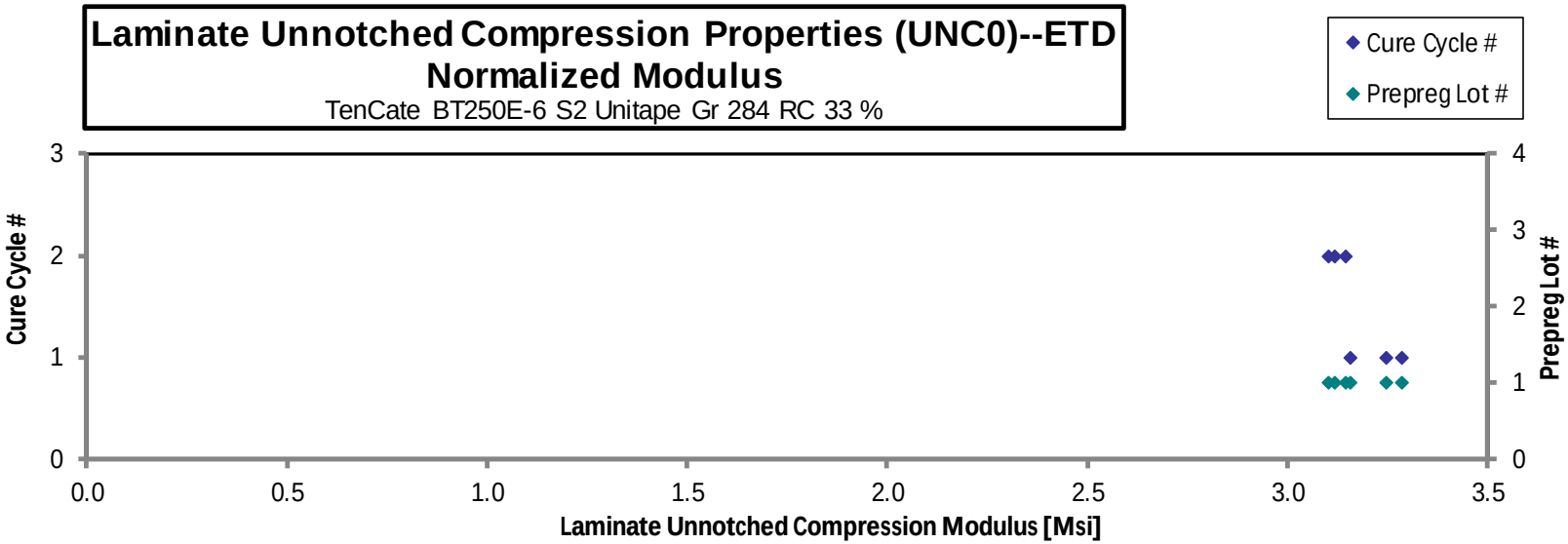
Average	**79.169**	**3.457**	**$Average_{norm}$**	**0.0091**	**78.244**	**3.407**
Standard Dev.	**4.373**	**0.076**	**Standard $Dev._{norm}$**		**4.070**	**0.078**
Coeff. of Var. [%]	**5.524**	**2.190**	**Coeff. of Var. $[\%]_{norm}$**		**5.201**	**2.292**
Min.	**71.628**	**3.339**	**Min.**	**0.0088**	**70.852**	**3.259**
Max.	**89.496**	**3.607**	**Max.**	**0.0095**	**86.577**	**3.529**
Number of Spec.	**21**	**18**	**Number of Spec.**	**21**	**21**	**18**

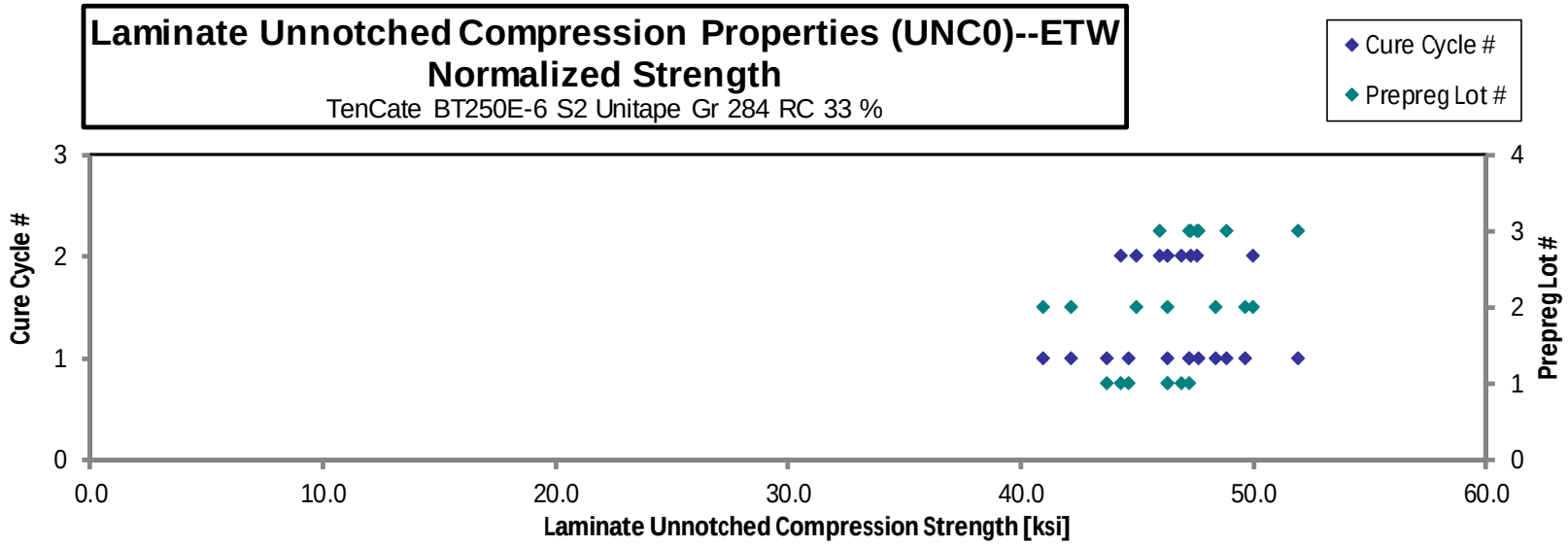

4
3
2
1
0

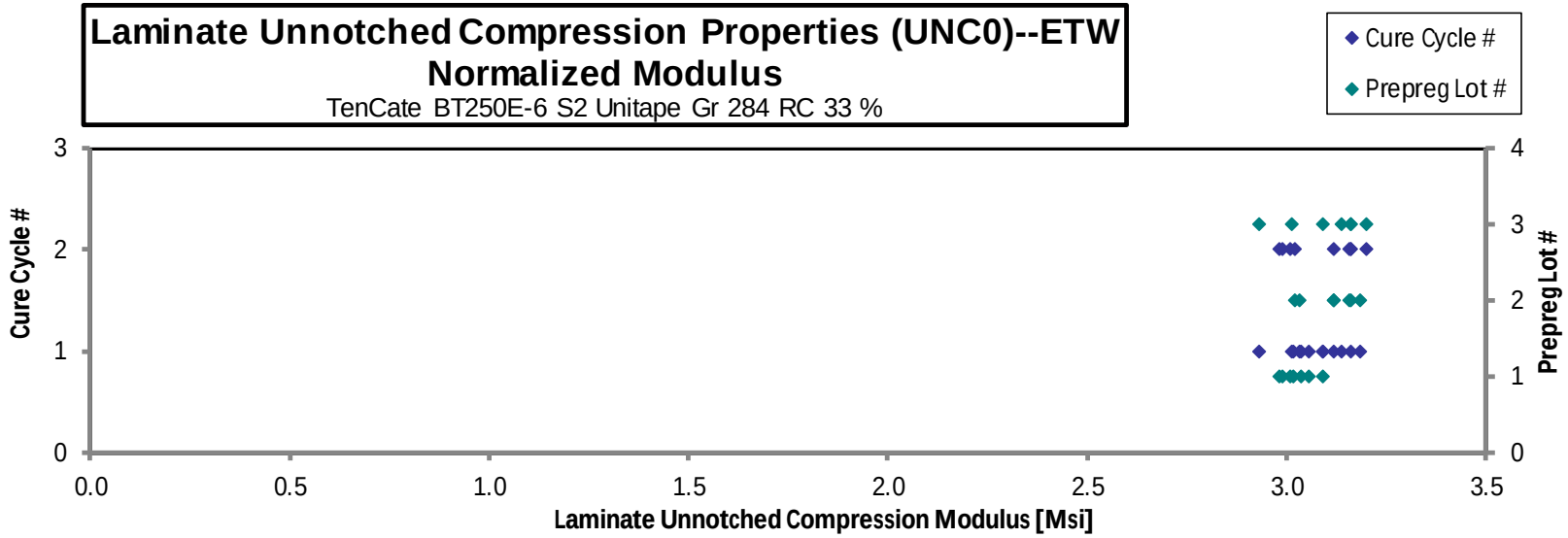
normalizing t_{ply} [in]
0.0092

Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Failure Mode	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
EACRA11EC	A	C1	1	1	65.542	3.404	0.133	15	BGM	0.0089	63.268	3.286
EACRA11FC	A	C1	1	1	65.371	3.234	0.135	15	BGM/ CIT	0.0090	63.784	3.156
EACRA11GC	A	C1	1	1	63.267	3.310	0.135	15	BGM	0.0090	62.007	3.244
EACRA11HC*	A	C1	1	1	54.025		0.136	15	HIT/ BGM	0.0091	53.355	
EACRA219C	A	C2	1	2	58.843	3.085	0.139	15	BAT	0.0092	59.131	3.100
EACRA21AC	A	C2	1	2	58.162	3.080	0.140	15	BAT/ HIT	0.0093	58.847	3.116
EACRA21BC	A	C2	1	2	60.040	3.256	0.133	15	BAT/ HIT	0.0089	57.951	3.142

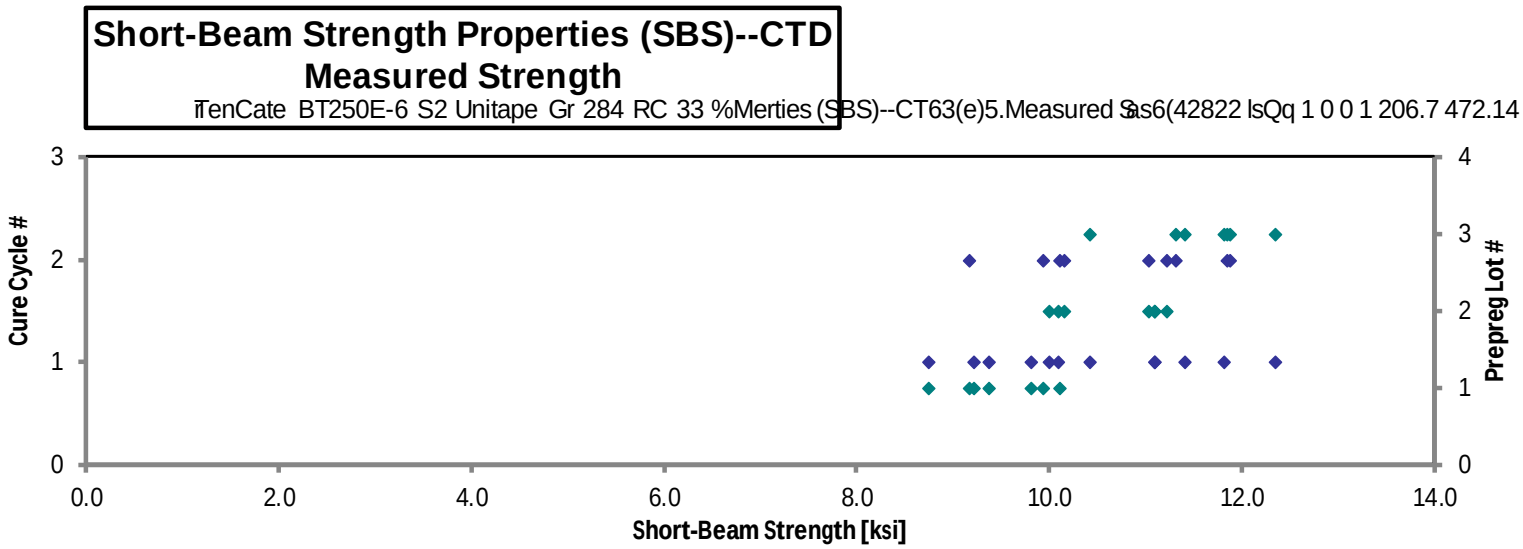

Laminate Unnotched Compression Properties (UNC0)--ETD
Normalized Strength
TenCate BT250E-6 S2 Unitape Gr 284 RC 33 %
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
Laminate Unnotched Compression Strength [ksi]


Laminate Unnotched Compression Properties (UNC0)--ETD
Normalized Modulus
TenCate BT250E-6 S2 Unitape Gr 284 RC 33 %
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Laminate Unnotched Compression Modulus [Msi]


Laminate Unnotched Compression Properties (UNC0)--ETW
Normalized Strength
TenCate BT250E-6 S2 Unitape Gr 284 RC 33 %
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
10.0
20.0
30.0
40.0
50.0
60.0
Laminate Unnotched Compression Strength [ksi]


Laminate Unnotched Compression Properties (UNC0)--ETW
Normalized Modulus
TenCate BT250E-6 S2 Unitape Gr 284 RC 33 %
Cure Cycle #
Prepreg Lot #
Cure Cycle #
Prepreg Lot #
0
1
2
3
4
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Laminate Unnotched Compression Modulus [Msi]

4.7 Lamina Short-Beam Strength Properties (SBS)


Short-Beam Strength Properties (SBS)--CTD
Measured Strength
TenCate BT250E-6 S2 Unitape Gr 284 RC 33 %Merties (SBS)--CT63(e)5.Measured Sas6(42822 lsQq 1 0 0 1 206.7 472.14 cm 0 0 m2.28 2.28 l4.62 0 l 0
Cure Cycle #
Prepreg Lot #
Short-Beam Strength [ksi]
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
0
1
2
3
4

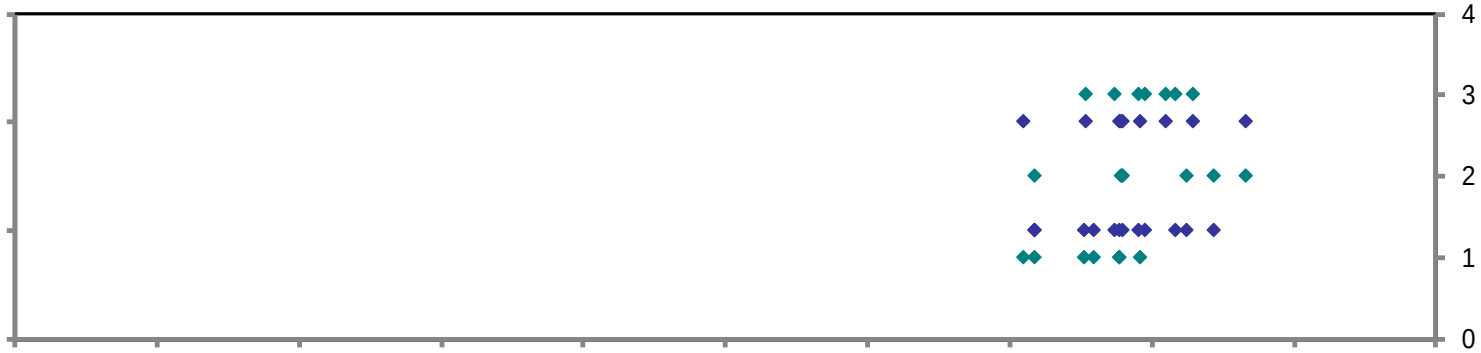
Laminate Unnotched Compression Properties (UNC0)--RTD
Strength & Modulus
TenCate BT250E-6 S2 Unitape Gr 284 RC 33 %

normalizing t_{ply} [in]: 0.0092

Specimen Number	EAC Batch #	EAC Cure Cycle	Prepreg Lot #	Cure Cycle #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickness [in]	# Plies in Laminate	Failure Mode	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
EACRA112A	A	C1	1	1	77.768	3.467	0.135	15	BGM	0.0090	75.901	3.384
EACRA113A	A	C1	1	1	76.533	3.339	0.136	15	BGM	0.0090	75.222	3.281
EACRA114A	A	C1	1	1	78.288	3.354	0.137	15	BGM	0.0091	77.657	3.327
EACRA116A*	A	C1	1	1	71.628		0.138	15	HGM	0.0092	71.731	
EACRA211A	A	C2	1	2	73.835	3.396	0.132	15	BGM	0.0088	70.852	3.259
EACRA212A	A	C2	1	2	81.733	3.457	0.134	15	BGM	0.0089	79.098	3.345
EACRA213A	A	C2	1	2	80.080	3.434	0.134	15	BGM	0.0089	77.679	3.331
EACRB111A	B	C1	2	1	86.955	3.469	0.134	15	BGM	0.0089	84.293	3.363
EACRB112A	B	C1	2	1	73.295	3.444	0.135	15	BGM	0.0090	71.669	3.367
EACRB113A	B	C1	2	1	83.609	3.502	0.136	15	BGM	0.0091	82.420	3.453
EACRB114A*	B	C1	2	1	78.760		0.136	15	BGM	0.0091	77.868	
EACRB211A	B	C2	2	2	81.517	3.606	0.132	15	BGM	0.0088	77.936	3.448
EACRB212A	B	C2	2	2	89.496	3.607	0.134	15	BGM	0.0089	86.577	3.489
EACRB213A	B	C2	2	2	79.362	3.562	0.135	15	BGM	0.0090	77.759	3.490
EACRC111A	C	C1	3	1	80.955	3.446	0.139	15	BGM	0.0093	81.608	3.474
EACRC112A	C	C1	3	1	77.885	3.458	0.141	15	BGM	0.0094	79.486	3.529
EACRC113A	C	C1	3	1	77.044	3.362	0.142	15	BGM	0.0094	79.026	3.448
EACRC114A*	C	C1	3	1	75.085		0.142	15	BGM	0.0095	77.275	
EACRC211A	C	C2	3	2	75.639	3.428	0.137	15	BGM	0.0092	75.331	3.414
EACRC212A	C	C2	3	2	82.782	3.439	0.138	15	BGM	0.0092	82.827	3.441
EACRC213A	C	C2	3	2	80.310	3.459	0.139	15	BGM	0.0093	80.914	3.485

* Specimen was not gaged and tested for strength only.

Average	**79.169**	**3.457**	**$Average_{norm}$**	**0.0091**	**78.244**	**3.407**
Standard Dev.	**4.373**	**0.076**	**Standard $Dev._{norm}$**		**4.070**	**0.078**
Coeff. of Var. [%]	**5.524**	**2.190**	**Coeff. of Var. $[\%]_{norm}$**		**5.201**	**2.292**
Min.	**71.628**	**3.339**	**Min.**	**0.0088**	**70.852**	**3.259**
Max.	**89.496**	**3.607**	**Max.**	**0.0095**	**86.577**	**3.529**
Number of Spec.	**21**	**18**	**Number of Spec.**	**21**	**21**	**18**


4
3
2
1
0