Advanced General Aviation Transport Experiments

A – Basis and B – Basis Design Allowables for Epoxy – Based Prepreg

TORAY 7781 Finish 558/#2510 Fiberglass Fabric [US Units]

AGATE-WP3.3-033051-133

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J. Tomblin, J. Sherraden, W. Seneviratne, K. S. Raju
National Institute for Aviation Research
Wichita State University
Wichita, KS 67260-0093

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1. INTRODUCTION

This material characterization program was performed to characterize the lamina properties of Toray Composites (America), Fiberglass Style 7781 Finish 558/#2510, 295 g/m^2, fiberglass woven fabric, herein designated FGF7781-071. The FGF7781-071 prepreg material system designation shall be used to refer the material in this report. The material qualification was conducted under FAA project number TC1616SE-A through Lancair Company that wanted to use the aforementioned material prepreg system on their LC40 aircraft.

This report contains the test results obtained from the tests conducted for the material qualification of FGF7781-071 in accordance with FAA Document DOT/FAA/AR-00/47: *Material Qualification and Equivalency for Polymer Matrix Composite Material Systems* and Toray Composites (America), Inc. (TCA) Material Process Specification, TCSPF-T-FG03, Revision 1 dated February 4, 2000. Toray Composites (America), Inc. (TCA), Integrated Technologies (Intec), National Institute for Aviation Research (NIAR) and Rose Consulting performed the testing on the unexposed and exposed prepreg materials for lamina baseline test properties in accordance with ASTM test methods, SACMA test methods, and TCA test work instructions.

Three batches of FGF7781-071 and the corresponding mixed resins were tested for baseline test properties. The data reported herein will be used to set material acceptance criteria for future material production and material receipt. The Raw Test Data, Inspection Records, Fabrication Records, Processing Records and all other relevant documents of this report, TCQAL-T-1014, are archived at Toray Composites (America), Inc., and it is available only upon request.

The physical and chemical tests were performed on the mixed resins, the uncured prepreg materials and cured prepreg laminates. The mixed resins were evaluated for cured neat resin density. The uncured prepreg samples were evaluated for resin content, fiber areal weight, volatile content, gel time, flow, IR (Infrared Spectroscopy), HPLC (High Performance Liquid Chromatography) and DSC (Differential Scanning Calorimetry). The cured prepreg laminates were tested for fiber volume, resin volume, void content, cured ply thickness and Tg (glass transition temperature) by DMA (Dynamic Mechanical Analyzer).

TCA Test Laboratories performed all the physical and chemical tests on the mixed resins, the uncured prepreg materials and cured prepreg laminates, except for fiber volume, resin volume and void content that Intec performed and cured laminate glass transition temperature, dry and wet conditions, that Rose Consulting performed.

TCA Test Laboratories performed the fabrication of all the test panels and test specimens, ultrasonic inspection, chemical and humidity conditioning, except for 0° and 90° Compressive Strength specimens that NIAR tabbed and machined.

Also, the TCA Test Laboratories performed the attachment of strain gauges and mechanical testing, except for specimens tested at –65 °F (Dry) that Intec performed. Moreover, TCA Test Laboratories performed the fluid sensitivity on one qualification batch by testing in-plane (iosipescu) shear strength only.

All TCA and Intec test equipments were calibrated with standards traceable to the NIST.

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. These properties are considered to provide the initial base of the "building block" approach. Additional coupon level tests and sub-element tests may be required to fully substantiate the full-scale design.

The test methods and results contained in this document are consistent with MIL-HDBK-17-1E,2D,3E - Military Handbook for Polymer Matrix Composites. All material, specimens, fixtures and test results contained within this document were traceable and conformed by the Federal Aviation Administration (FAA). It should be noted that before application of the basis values presented in this document to design, demonstration of the ability to consistently produce equivalent material properties as that evaluated during this program should be substantiated through an acceptable test program.

1.2. Symbols Used

ν_{12}^{tu}	major Poisson's ratio, tension
$\mu\varepsilon$	micro-strain
E_1^c	compressive modulus, longitudinal
E_1^t	tensile modulus, longitudinal
E_2^c	compressive modulus, transverse
E_2^t	tensile modulus, transverse
F_{12}^{su}	in – plane shear strength
F_{13}^{su}	apparent interlaminar shear strength
F_1^{cu}	compressive strength, longitudinal
F_1^{tu}	tensile strength, longitudinal
F_2^{cu}	compressive strength, transverse
F_2^{tu}	tensile strength, transverse
G_{12}^s	in – plane shear modulus

Superscripts

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

Subscripts

1	1 – axis; longitudinal (parallel to warp direction of reinforcement)
2	2 – axis; transverse (parallel to fill direction of reinforcement)
12	in – plane shear
13	interlaminar shear (apparent)

1.3. Acronyms and Definitions

A – Basis	95% lower confidence limit on the first population percentile
AGATE	Advanced General Aviation Transport Experiments
ASTM	American Society for Testing and Materials
B – Basis	95% lower confidence limit on the tenth population percentile
C. V.	coefficient of variation
CTD	cold temperature dry
CPT	cured ply thickness
DMA	dynamic mechanical analysis
Dry	specimen tested with an “as fabricated” moisture content
ETD	elevated temperature dry
ETW	elevated temperature wet
FAR	Federal Aviation Regulations
FAW	fiber areal weight
Gr/Ep	graphite/epoxy
NASA	National Aeronautics and Space Administration
RTD	room temperature dry
SACMA	Suppliers of Advanced Composite Materials Association
SRM	SACMA Recommended Method
T_g	glass transition temperature
t_{ply}	cured ply thickness
wet	specimen tested with an equilibrium moisture content per section 1.5.2

1.4. References

ASTM Standards

D 792-91 "Standard Test Method for Density and Specific Gravity of Plastics by Displacement," American Society for Testing and Materials, Philadelphia, PA 1991.

D2344 "Standard Test Method for Apparent Interlaminar Shear Strength of Parallel Fiber Composites by Short-Beam Method," American Society for Testing and Materials, Philadelphia, PA.

D2734 "Standard Test Method for Void Content of Reinforced Plastics," American Society for Testing and Materials, Philadelphia, PA 1994

D3039 "Standard Test Method for Tensile Properties of Polymeric Matrix Composite Materials," American Society for Testing and Materials, Philadelphia, PA 1995.

D3171-90 "Standard Test Method for Fiber Content of Resin-Matrix Composites by Matrix Digestion," American Society for Testing and Materials, Philadelphia, PA 1990

D3530-90 "Standard Test Method for Volatiles Content of Epoxy Matrix Prepreg" American Society for Testing and Materials, Philadelphia, PA 1990

D3531-76 "Standard Test Method for Resin Flow of Carbon Fiber-Epoxy Prepreg," American Society for Testing and Materials, Philadelphia, PA.

D3532 "Standard Test Method for Gel Time of Carbon Fiber-Epoxy Prepreg," American Society for Testing and Materials, Philadelphia, PA.

D4065-93 "Standard Practice for Determining and Reporting Dynamic Mechanical Properties of Plastics," American Society for Testing and Materials, Philadelphia, PA 1993.

D4473 " Standard Practice for Determining Cure Behavior of Thermosetting Resins Using dynamic Mechanical Procedures," American Society for Testing and Materials, Philadelphia, PA.

D5379-98 "Shear Properties of Composite Materials by the V-Notched Beam Method," American Society for Testing and Materials, Philadelphia, PA 1998.

E168 "General Techniques of Infrared Quantitative Analysis," American Society for Testing and Materials, Philadelphia, PA 1992.

E1252 "Standard Practice for General Techniques for Qualitative Infrared Analysis," American Society for Testing and Materials, Philadelphia, PA 1995.

E1356 "Glass Transition Termperature by Differential Scanning Calorimetry or Differential Thermal Analysis," American Society for Testing and Materials, Philadelphia, PA 1995.

SACMA Standards

SRM-1R-94 "Compressive Properties of Oriented Fiber-Resin Composites," Suppliers of Advanced Composite Materials Association, 1994.

SRM-18R-94 "Glass Transition Temperature (Tg) Determination by DMA of Oriented Fiber-Resin Composites," Suppliers of Advanced Composite Materials Association, 1994.

SRM-19R-94 "Viscosity characteristics of Matrix Resins," Suppliers of Advanced Composite Materials Association, 1994.

SRM-20R-94 "High Performance Liquid Chromatography of Thermoset Resins," Suppliers of Advanced Composite Materials Association, 1994.

SRM-22R-94 "Determining the Resin Flow of Preimpregnated "B" Staged Material," Suppliers of Advanced Composite Materials Association, 1994.

SRM-23R-94 "Determination of Resin Content and Fiber Areal Weight of Thermoset Prepreg with Destructive Technique," Suppliers of Advanced Composite Materials Association, 1994.

SRM-25R-94 "Onset Temperature and Peak Temperature for Composite System Resins Using Differential Scanning Calorimetry (DSC)," Suppliers of Advanced Composite Materials Association, 1994.

Toray Documents

TCSPF-T-FG03 "Material and Process Specification," Revision 1, Toray Composites (America), Inc., Puyallup, WA, February 4, 2000.

TCWIN-U-C002 "Fourier Transform Infrared Analysis," Toray Composites (America), Inc., Puyallup, WA, 1998.

TCWIN-U-C003 "Differential Scanning Calorimetry," Toray Composites (America), Inc., Puyallup, WA, 1998.

TCWIN-U-C004 "High Performance Liquid Chromatography," Toray Composites (America), Inc., Puyallup, WA, 1998.

TCWIN-U-M003 "Lay-up/Vacuum Debulking," Toray Composites America), Inc., Puyallup, WA, 1998.

TCWIN-U-M006 "Autoclave Curing," Toray Composites (America), Inc., Puyallup, WA, 1998.

TCWIN-U-M008 "Panel Tabbing," Toray Composites (America), Inc., Puyallup, WA, 1998.

TCWIN-U-M101 "Tensile Specimen Machining," Toray Composites (America), Inc., Puyallup, WA, 1998.

TCWIN-U-M102 "Compression Specimen Machining," Toray Composites (America), Inc., Puyallup, WA, 1998.

TCWIN-U-M103 "Compression Modulus Specimen Machining," Toray Composites (America), Inc., Puyallup, WA, 1998.

TCWIN-U-M111 "90 Degree Tensile Specimen Machining," Toray Composites (America), Inc., Puyallup, WA, 1998.

TCWIN-U-M201 "Tensile Testing," Toray Composites (America), Inc., Puyallup, WA, 1998.

TCWIN-U-M204 "Compressive Strength Testing," Toray Composites (America), Inc., Puyallup, WA, 1998.

TCWIN-U-M206 "Compressive Modulus Testing," Toray Composites (America), Inc., Puyallup, WA, 1998.

TCWIN-U-M214 "Strain Gauge Attachment," Toray Composites (America), Inc., Puyallup, WA, 1998.

TCWIN-U-M215 "Laminate Density/Fiber Volume Testing," Toray Composites (America), Inc., Puyallup, WA, 1998.

TCWIN-U-M216 "Strain Gauge Calibration," Toray Composites (America), Inc., Puyallup, WA, 1998.

TCWIN-U-P001 "Volatile Content," Toray Composites (America), Inc., Puyallup, WA, 1998.

TCWIN-U-P004 "Resin Content/Fiber Areal Weight," Toray Composites (America), Inc., Puyallup, WA, 1998.

TCWIN-U-P007 "Gel Time," Toray Composites America), Inc., Puyallup, WA, 1998.

TCWIN-U-P008 "Flow," Toray Composites (America), Inc., Puyallup, WA, 1998

Other Documents

FAA Document DOT/FAA/AR-00/47: Material Qualification and Equivalency for Polymer Matrix Composite Material Systems, J.S. Tomblin, Y.C. Ng and K.S. Raju, 2001.

MIL-HDBK-17 1E, 2D, 3E – Military Handbook for Polymer Matrix Composites

1.5. Methodology

1.5.1. Test Matrix

Testing was performed according to the test methods delineated in the test matrix, with modifications as referenced in FAA Document DOT/FAA/AR-00/47: *Material Qualification and Equivalency for Polymer Matrix Composite Material Systems*. The test matrix for properties included in this document is listed on the next page, with the following notation cited in each column:

 # x #

where the first # represents the required number of prepreg batches, defined as: Prepreg containing T700 12K graphite fibers from one mill roll, impregnated with one batch of resin in one continuous manufacturing operation with traceability to all components. The second # represents the required number of replicates per prepreg batch. For example, “3 x 6” refers to three prepreg batches of material and six specimens per prepreg batch for a total requirement of 18 test specimens.

Table 1.5.1: Minimum Recommended Test Matrix and Standards Used for Testing

TEST	METHOD	NO. OF REPLICATES PER TEST CONDITION			
		CTD[1]	RTD[2]	ETW[3]	ETD[4]
0^o (warp) Tension Strength	ASTM D3039-95	1x4	3x4	3x4	3x4
0^o (warp) Tension Modulus, Strength and Poisson's Ratio	ASTM D3039-95	1x2	3x2	3x2	3x2
90^o (fill) Tension Strength	ASTM D3039-95	1x4	3x4	3x4	3x4
90^o (fill) Tension Modulus and Strength	ASTM D3039-95	1x2	3x2	3x2	3x2
0^o (warp) Compression Strength	SACMA SRM 1-94	1x6	3x6	3x6	3x6
0^o (warp) Compression Modulus	SACMA SRM 1-94	1x2	3x2	3x2	3x2
90^o (fill) Compression Strength	SACMA SRM 1-94	1x6	3x6	3x6	3x6
90^o (fill) Compression Modulus	SACMA SRM 1-94	1x2	3x2	3x2	3x2
In-Plane Shear Strength	ASTM D5379-93	1x4	3x4	3x4	3x4
In-Plane Shear Modulus and Strength	ASTM D5379-93	1x2	3x2	3x2	3x2
Short Beam Shear	ASTM D2344-89	1x6	3x6	3x6	3x6
Fiber Volume	ASTM D3171-90	One sample per panel			
Resin Volume	ASTM D3171-90	One sample per panel			
Void Content	ASTM D2734-94	One sample per panel			
Cured Neat Resin Density	---	Supplied by manufacturer for material			
Glass Transition Temperature	SACMA SRM 18-94	3 dry, 3 wet per prepreg batch			

Notes :

1 CTD: One prepreg batch of material tested (test temperature = -65 ± 5^o F, moisture content = as fabricated, soak time at –65 was 5 min.)

2 RTD: Three prepreg batches of material tested (test temperature = 70 ± 10^o F, moisture content = as fabricated)

3 ETW: Three prepreg batches of material tested (test temperature = 180 ± 5^o F, moisture content = equilibrium per section 1.5.2, soak time at 180 was 2 min.)

4 ETD: Three prepreg batches of material tested (test temperature = 180 ± 5^o F, moisture content = as fabricated, soak time at 180 was 2 min.)

1.5.2. Environmental Conditioning

All 'wet' conditioned samples were exposed to elevated temperature and humidity conditions to establish moisture saturation of the material. Specimens were exposed to 85 ± 5 % relative humidity and 145 ± 5 °F until an equilibrium moisture weight gain of traveler, or witness coupons (1" x 1" x specimen thickness) was achieved. ASTM D5229 and SACMA SRM 11 were used as guidelines for environmental conditioning and moisture absorption.

Effective moisture equilibrium was achieved when the average moisture content of the traveler specimen changed by less than 0.05% for two consecutive readings within a span of 7 ± 0.5 days and was expressed by:

$$\frac{W_i - W_{i-1}}{W_b} < 0.0005$$

where W_i = weight at current time
W_{i-1} = weight at previous time
W_b = baseline weight prior to conditioning

It is common to see small fluctuations in an unfitted plot of the weight gain vs. time curve. There were no fluctuations that made significant errors in results or caused rejection in the moisture equilibrium criteria. Once the traveler coupons passed the criteria for two consecutive readings, the samples were removed from the environmental chamber and placed in a sealed bag with a moist paper or cotton towel for a maximum of 14 days until mechanical testing. Strain gauged specimens were removed from the controlled environment for a maximum of 2 hours for application of gages in ambient laboratory conditions.

1.5.3. Fluid Sensitivity Screening

Although epoxy-based materials historically have not been shown to be sensitive to fluids other than water or moisture, the influence of some fluids other than water or moisture on the mechanical properties were characterized. These fluids fell into two exposure classifications. The first class was considered to be in contact with the material for an extended period of time, and the second class was considered to be wiped on and off (or evaporate) with relatively short exposure times.

To assess the degree of sensitivity of fluids other than water or moisture, Table 1.5.2 shows the fluids which were used in this qualification plan.

Table 1.5.2: Fluid Types Used for Sensitivity Studies

Fluid Type	Specification	Exposure Classification
Jet Fuel (JP-4)	MIL-T-5624	Extended Period
Hydraulic Fluid (Tri-N-butyl phosphate ester)	MIL-H-5606G	Extended Period
Solvent (Methyl Ethyl Ketone)	Laboratory Grade	Extended Period

To assess the influence of various fluids types, a test method sensitive to matrix degradation was used as an indicator of fluid sensitivity and compared to the unexposed results at both room temperature dry and elevated temperature dry conditions. Table 1.5.3 describes the fluid sensitivity-testing matrix with respect to the fluids defined in Table 1.5.2. Engineering judgment and statistical tests were used to assess the degree of material degradation. The results of this screening are included following the data sheets in section 3.2.2.

Table 1.5.3: Material Qualification Program for Fluid Resistance

Fluid Type	Test Method	Test Temp. (^{o} F)	Exposure[1]	Number of Replicates[2]
Jet Fuel JP-4	ASTM D5379[3]	180	See note 4	5
Hydraulic Fluid	ASTM D5379[3]	180	See note 5	5
Solvent (MEK)	ASTM D5379[3]	Ambient	See note 5	5

Notes :

1 Soaking in fluid at ambient temperature (immersion).
2 Only a single batch of material is required.
3 Shear strength only.
4 Immersion duration = 500 hours ± 50 hours
5 Immersion duration = 60 to 90 minutes

1.5.4. Normalization Procedures

The normalization procedure attempts to reduce variability in fiber-dominated material properties by adjusting raw test values to a specified fiber volume content. Only the following properties were normalized:

- 0° (warp) & 90° (fill) Tensile Strength and Modulus
- 0° (warp) & 90° (fill) Compression Strength and Modulus

The normalization procedure was adopted from MIL-HDBK-17-1E, section 2.4.3.3. The procedure, which was used to normalize the data, is based on two primary assumptions:

- The relationship between fiber volume fraction and ultimate laminate strength is linear over the entire range of fiber/resin ratios. (It neglects the effects of resin starvation at high fiber contents.)

- Fiber volume is not commonly measured for each test sample, so this method accounts for the fiber volume variation between individual test specimens by utilizing a relationship between fiber volume fraction and laminate cured ply thickness. This relationship is virtually linear in the 0.45 to 0.65 fiber volume fraction range.

Additional information is detailed in FAA Document DOT/FAA/AR-00/47: *Material Qualification and Equivalency for Polymer Matrix Composite Material Systems.* For all normalized data contained in this document, the test values are normalized by cured ply thickness according to:

$$Normalized\ Value = Test\ Value \times \frac{CPT_{specimen}}{CPT_{normalizing}}$$

where:

$$CPT_{specimen} = \frac{Average\ Sample\ Thickness}{\#\ of\ plies}$$

1.5.5. Statistical Analysis

When compared to metallic materials, fiber reinforced composite materials exhibit a high degree of material property variability. This variability is due to many factors, including but not limited to: raw material and prepreg manufacture, material handling, part fabrication techniques, ply stacking sequence, environmental conditions, and testing techniques. This inherent variability drives up the cost of composite testing and tends to render smaller data sets than those produced for metallic materials. This necessitates the usage of statistical techniques for determining reasonable design allowables for composites.

The analyses and design allowable generation for both A and B basis values were performed using the procedure detailed in section 5.3 of FAA Document DOT/FAA/AR-00/47: *Material Qualification and Equivalency for Polymer Matrix Composite Material Systems*.

1.5.6. Material Performance Envelope and Interpolation

Using the B-basis numbers, a material performance envelope may be generated for the material system by plotting these values as a function of temperature. Figure 1.5.1 shows an example material performance envelope using B-basis values.

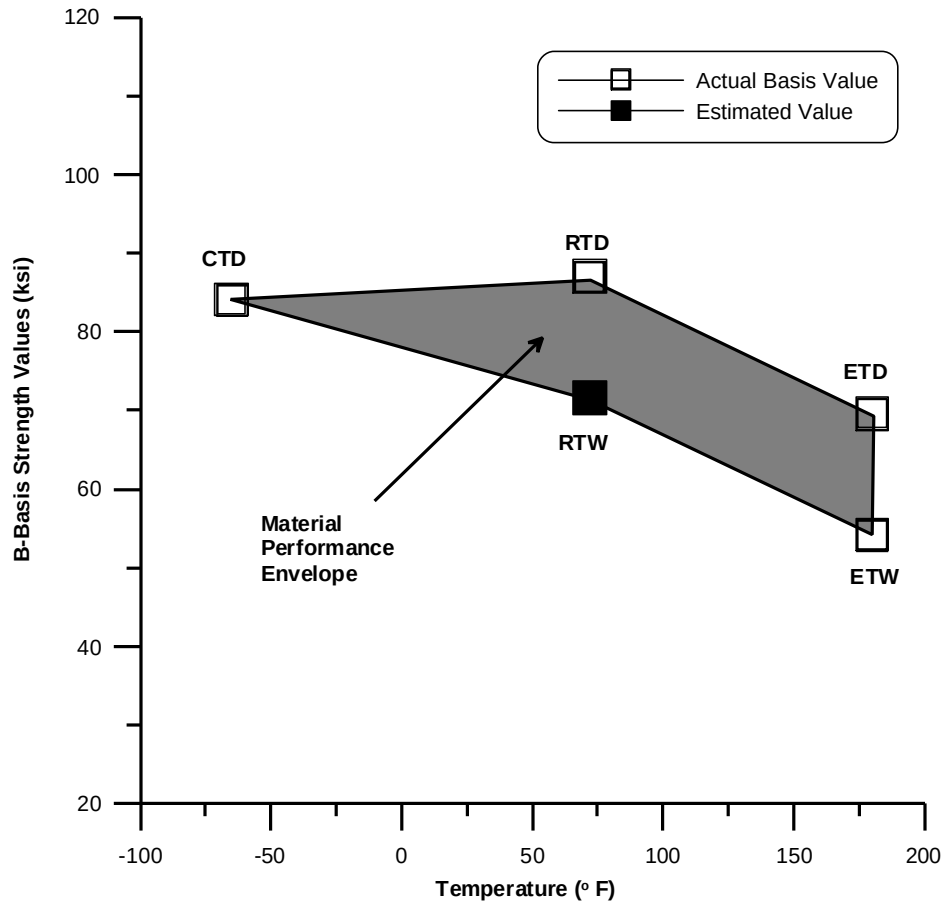


Figure 1.5.1 Material performance envelope.

Since each specific aircraft application of the qualified material may have different Material Operational Limits (MOL) than those tested in the material qualification (which is usually the upper limit), some applications may require a reduced MOL. In this case, simple linear interpolation may be used to obtain the corresponding basis values at the new application MOL.

This interpolation may be accomplished using the following simple relationships assuming $T_{RTD} < T_{MOL} < T_{ETD}$:

For the corresponding MOL "dry" basis value, the "interpolated" basis value using the qualification data is

$$B_{MOL} = B_{RTD} - \frac{(B_{RTD} - B_{ETD})(T_{RTD} - T_{MOL})}{(T_{RTD} - T_{ETD})}$$

where B_{MOL} = new application basis value interpolated to T_{MOL}
B_{RTD} = basis RTD strength value
B_{ETD} = basis ETD strength value
T_{RTD} = RTD test temperature
T_{ETD} = ETD test temperature
T_{MOL} = new application MOL temperature

For the corresponding MOL "wet" basis value, an estimated Room Temperature Wet (RTW) value must be calculated. This may be accomplished by the simple relation

$$B_{RTW} = B_{RTD} - (B_{ETD} - B_{ETW})$$

The "interpolated" wet basis value using the qualification data may then be obtained by

$$B_{MOL} = B_{RTW} - \frac{(B_{RTW} - B_{ETW})(T_{RTW} - T_{MOL})}{(T_{RTW} - T_{ETW})}$$

where: B_{MOL} = new application basis value interpolated to T_{MOL}
B_{RTW} = estimated basis RTW strength value
B_{ETW} = basis ETW strength value
T_{RTW} = RTW (i.e., RTD) test temperature
T_{ETW} = ETW test temperature
T_{MOL} = new application MOL temperature

These equations may also be used for interpolated mean strengths as well as A-basis values with the appropriate substitutions. It should be noted that because unforeseen material property drop-offs with respect to temperature and environment can occur, *extrapolation* to a higher MOL should not be attempted without additional testing and verification. In addition, the interpolation equations shown above are practical for materials obeying *typical* mechanical behavior. In most cases, some minimal amount of testing may also be required to verify the interpolated values.

1.5.6.1. Interpolation Example

This section provides an example of linear interpolations to a specific application environment less than the tested upper material limit used in qualification.

Assuming a specific application environment of 150^{o} F, Figure 1.5.2 depicts the linear interpolation of the B-basis design allowable to this environment. Using the above equations along with the nominal testing temperatures (see Table 1.5.1), the interpolated basis values at 150^{o} F become

ETD : B_{MOL} = 75.106 ksi

ETW : B_{MOL} = 59.746 ksi

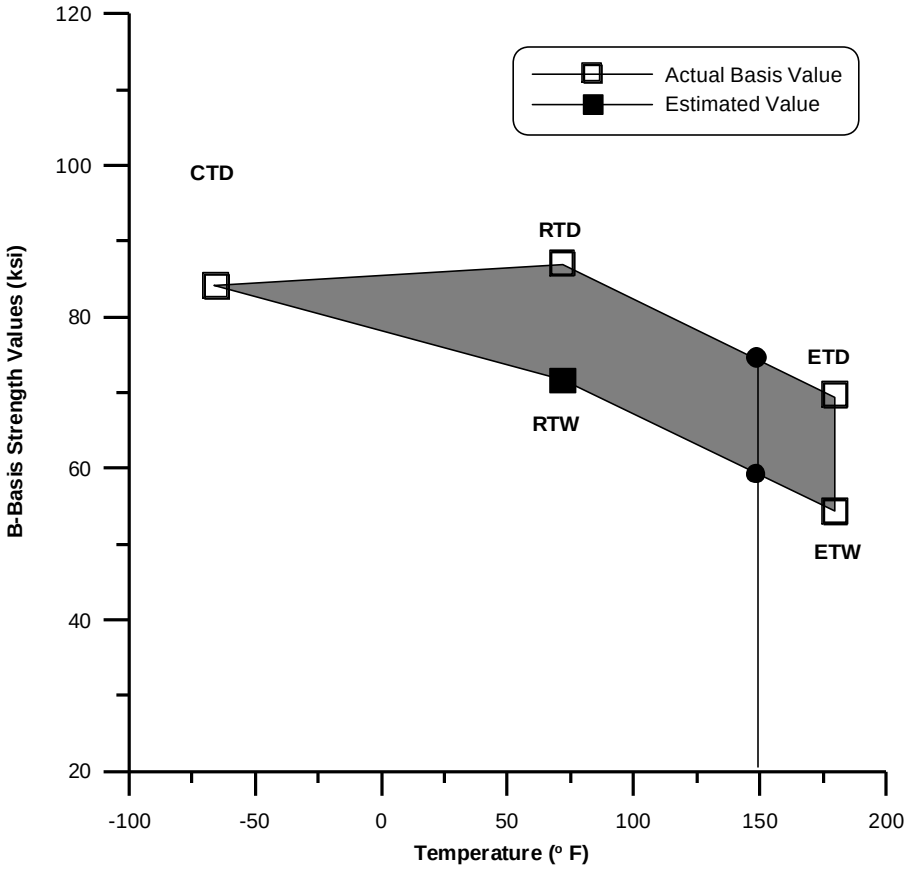


Figure 1.5.2 Example of 150^{o} F interpolation for B-basis values.

2. TORAY 7781 FINISH 558/#2510 PROCEDURES AND PREPREG PROPERTIES

2.1. GENERAL

All of the testing described in the report took place at Toray Composites (America), Inc. in Tacoma, Washington, except for the following tests:

Test Laboratory	*Test Property*
Integrated Technologies (Intec), Bothell, WA	*-65°F (Dry) mechanical tests (0° & 90° Tension, 0° & 90° Comp. Modulus and In-plane Shear)*
Rose Consultant, Half Moon Bay, CA	*cured laminate transition glass temperature, Tg*

2.1.1. Materials

The Fiberglass Style 7781 Finish 558/#2510, FGF7781-07I, Plain Weave Fabric prepreg batches were manufactured by the hot melt method of resin impregnation. Advanced Glassfiber Yarns, Llc of Aiken, South Carolina manufactured the fiberglass fiber. BGF Industries of Altavista, Virginia performed the weaving of the fiberglass fabric. The resin mixing and impregnation were done by Toray Composites (America), Inc. at the Frederickson, WA facilities.

This material qualification program characterized the physical, chemical and mechanical properties of FGF7781-07I prepreg material, namely; batches AF991102, AF991103 and AF991104. The prepreg batches were manufactured with two lots of fiberglass fabric and three batches of resin matrix. The FGF7781-07I batches were manufactured to nominal uncured resin content of 38 % (by weight) and a fiber areal weight (FAW) of 295 grams per square meter.

2.1.2. Lay-up/Bagging

TCA Test Laboratories manufactured all the mechanical test laminates by laying up plies of the FGF7781-07I prepreg material in the desired orientations, and by vacuum bag cure. Both the ply orientation and vacuum bag assembly for cure were in accordance with Advanced General Aviation Transport Experiments (AGATE) “Material Qualification Methodology for Epoxy-Based Prepreg Composite Material System”, dated February 1999, TCA Material Process Specification, TCSPF-T-FG03, Revision 1 dated February 4, 2000, and TCA work instructions. Figure 2-1 describes the vacuum bag assembly for cure of the test laminates. The test laminates were vacuum debulked in accordance with TCA work instructions, TCWIN-U-M003.

2.1.3. Cure

The test panels were cured in accordance with TCWIN-Q-M006 and per Figure 2-2. For the specimen selection methodology and batch traceability of each test property, batch replicates were sampled from at least two different panels covering at least two independent cycles per Figure 2-3. Test specimens were selected from each individual test panel. The test specimens were extracted from panel areas that were good, visually and based on non-destructive inspection techniques.

2.1.4. Non-Destructive Inspection (NDI)

Laminates fabricated for mechanical testing were non-destructively inspected using a Sonix/KrautKramer Branson Ultrasonic equipment at 5MHz pulse.

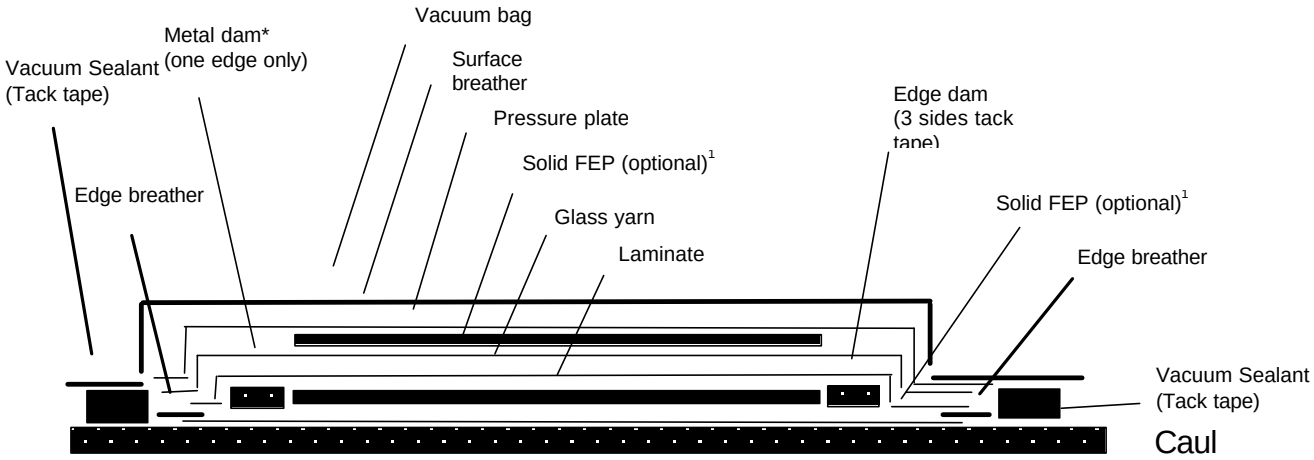
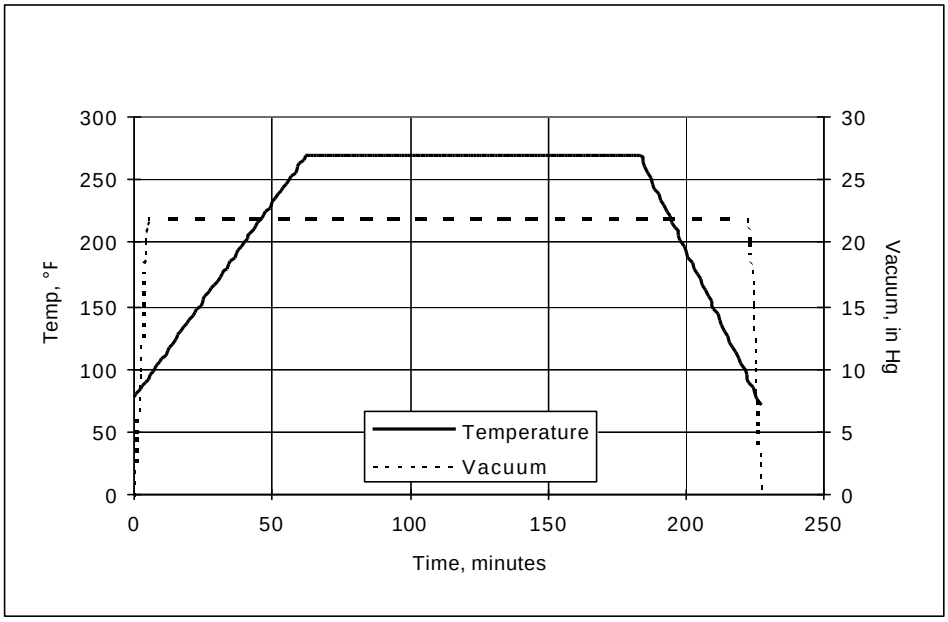


Figure 2-1. Vacuum Bagging Stack Sequence

[1] The solid FEP may not be necessary when the caul plate is treated with a release agent, for example, Frekote release agent.



Notes:

(1) *Apply 22 inches Hg minimum vacuum to the vacuum bag assembly and check for leak before beginning the cure cycle. The leak rate shall be less than 2.0 inches Hg over 5 minutes.*

(2) *Apply the temperature ramp from ambient to 270 ± 10 °F at a rate of 3.0 ± 1.0 °F per minute.*

(3) Maintain the cure temperature at 270 ± 10 °F for 120 ~ 150 minutes.

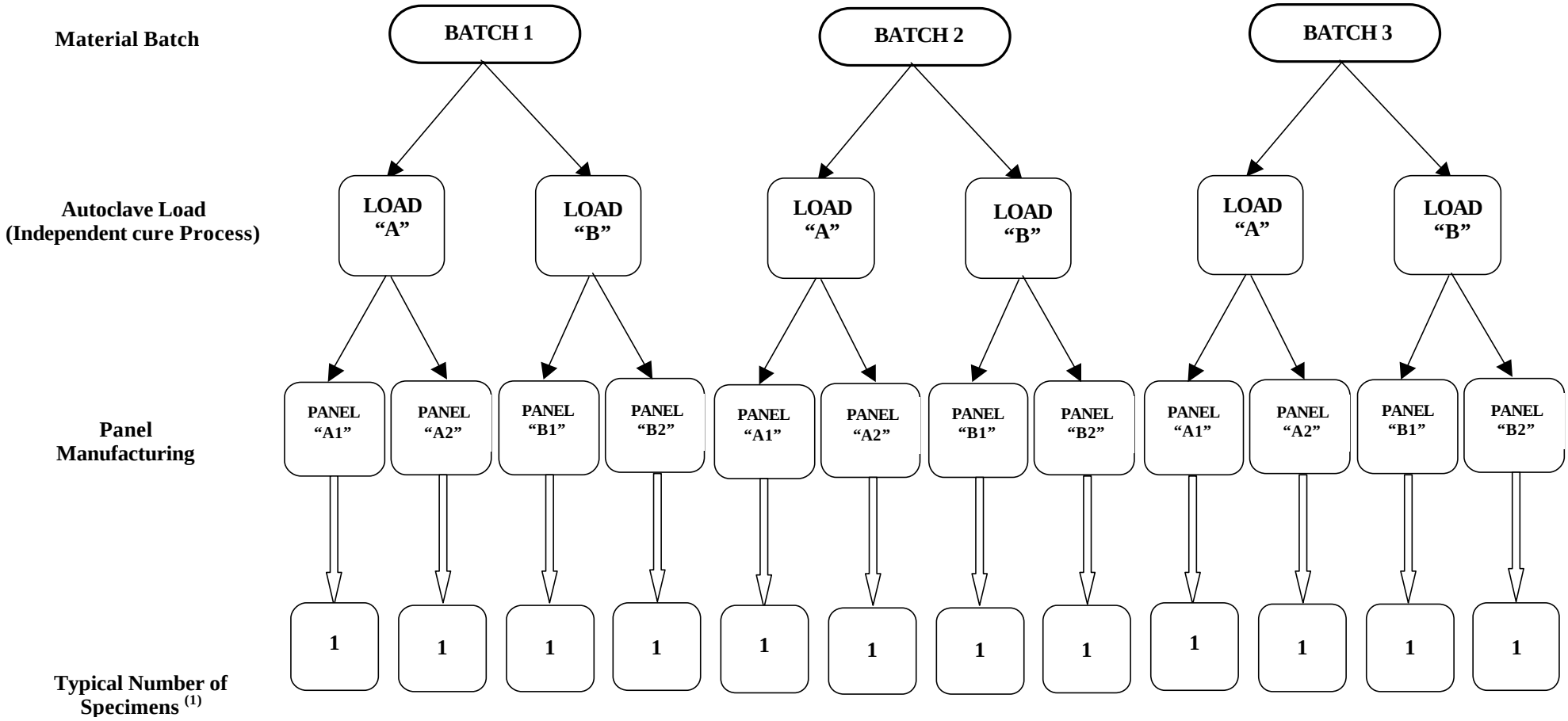
(4) Cool down the temperature to 170 °F or lower at a rate of 4.5 ± 0.5 °F per minute before removing the vacuum.

(5) Remove the bagged laminates from the autoclave and de-bag for inspection.

FIGURE 2-2. #2510 CURE CYCLE

FIGURE 2-3: SPECIMEN SELECTION METHODOLOGY AND BATCH TRACEABILITY

PER ENVIRONMENTAL CONDITION AND TEST METHOD



(1) 6 specimens for Tension, Compression Strength, In-plane Shear and Interlaminar Shear
2 specimens for Compression Modulus

2.1.5. Tabbing

Tabs were used to ensure the accuracy of the tensile and compressive strength specimens. Tabs were applied to the tension and compression strength specimens in accordance with Section 3.1.4 of the AGATE " Material Qualification Methodology for Epoxy-Based Prepreg Composite Material System", dated February 1999, with the following exceptions;

1.) AF 163-2 film adhesive used to bond the tabs to the test specimens described below was further cured by placing the test specimens in a temperature chamber at 180 °F for 24 hours. This was because the AF163 was not fully cured, initially, at 180°F for 5 hours. The 180°F cure temperature was selected because it was the maximum temperature allowed by the AGATE methodology, described in section 3.1.4, since the cure temperature of the P707AG-15 was 270 ± 10°F

a.) 0° (warp) & 90° (fill) tension specimens for testing at -65°F (Dry), 75°F (Dry), 180°F (Dry) and 180°F (Wet).

2.) Hysol EA9628 film adhesive used to bond the tabs to the specimens described below was cured up to 260 °F for up to 120 minutes.

a.) 0° (warp) & 90° (fill) compressive strength tested -65°F (Dry), 75°F (Dry), 180°F (Dry) and 180°F (Wet).

The same material or strain compatible material tabs as the test coupon were used for compressive strength specimens. Fiberglass tabs were used for tension specimens. To retard the absorption of moisture into the tabs and bond lines of the tension specimens tested at hot/wet condition, the tab section (including the edges) were masked with a room-temperature curing "Plasti Dip" rubber coating prior to humidity conditioning. The rubber coat was peeled off just before testing. The National Institute for Aviation Research (NIAR) of Wichita State University bonded the tabs and machined the 0° (warp) & 90° (fill) compressive strength specimens that were tested at 180°F (Wet).

2.1.6. FAA Test Coupon Conformity and Test Witness

The material traceability and test specimen conformity were performed for the cured laminate mechanical test properties of the program. For the physical properties, material traceability was verified by TCA inspection section only.

2.1.6.1. Test Coupon Conformity

A conformity traveler accompanied each group of test specimens for cured lamina mechanical properties. The conformity traveler recorded the materials and process definition, completion and verification by inspection of each process, that included lay-up, cure cycle, tabbing and final coupon dimensions. The FAA Designated Airworthiness Representative (DAR) performed the test specimen conformity and reviewed the completeness of traveler conformity records. Finally, the FAA DAR

prepared a statement of conformity, FAA 8130-3 tags for all the test panels and test specimens, prior to environmental conditioning and testing of the test specimens. The conformity of all the test panels was performed December 21, 1999. However, additional test panels, specifically for compressive strength test, were fabricated and conformed on April 12, 2000 and August 1, 2000 due to problems in the testing process, for example, tabbing and machining of specimens. The conformed additional test panels, for compressive strength test, were replacements for previously fabricated test panels. The conformity of all the test specimens was performed February 8, 2000, except 0° compressive strength that was performed February 23, 2000. However, the additional compressive strength specimens were conformed April 14, 2000 and April 21, 2000, to replace the test specimen with "out-of-mode" failure, for example, tab failure due to adhesive failure.

2.1.6.2. Test Witness

The FAA Designated Engineering Representative (DER) witnessed all the cured lamina mechanical test property testing of at least one batch of the prepreg material for the program. TCA personnel that were authorized to witness on behalf of the FAA DER witnessed the rest of the tests. The test dates of the lamina mechanical test properties were described in the tables of test results.

2.2. Prepreg Documentation by Prepreg Lot

Prepreg Documentation	**Prepreg Manufacturer & Product ID: Toray Composites FGF7781-07I** **Material Identification (weave, form, class, etc.): Fiberglass/Epoxy 8HS Woven Fabric** **Impregnation Method: Hot Melt**		
Prepreg Batch or Lot #	AF991102	AF991103	AF991104
Batch (Lot) ID as labeled on samples	**911-081**	**911-082**	**911-083**
Date of Manufacture	11/24/1999	11/24/1999	11/24/1999
Expiration Date	11/24/2001	11/24/2001	11/24/2001
Resin Content [%]	39.0%	38.0%	37.8%
Reinforcement Areal Weight & Test Method	292 g/m^2 SACMA SRM 23R-94	296 g/m^2 SACMA SRM 23R-94	291 g/m^2 SACMA SRM 23R-94
Resin Flow & Test Conditions	24.5% @ 250°F	23.0% @ 250°F	23.5% @ 250°F
Gel Time & Test Conditions	9.9 minutes @ 250°F	10.0 minutes @ 250°F	10.7 minutes @ 250°F
Volatile Content	0.17%	0.16%	0.17%
Reinforcement Documentation	**Fiber/Fabric Manufacturer & Product ID: BGF Industries, Inc Style 7781 Finish 558** **Precursor Type: E-glass** **Nominal Filament Count:** **Finish/Sizing Type and %: 558 (0.1%)** **Nominal tow or yarn count/inch: /inch** **Twist:**		
Fabric Batch or Lot #	920351	920351	920352
Date of Manufacture	11/1999	11/1999	11/1999
Average Fiber Density per Lot & Test Method	2.565 g/cc	2.565 g/cc	2.565 g/cc
Matrix Documentation	Resin Manufacturer & Product ID: Toray Composites #2510		
Matrix Batch or Lot #	1-BRS	1-BRW	1-BRX
Date of Manufacture	11/17/1999	11/21/1999	11/22/1999
Average Neat Resin Density by Lot & Test Method	1.265 g/cc ASTM D792	1.265 g/cc ASTM D792	1.260 g/cc ASTM D792

Notes: (1)Test methods to determine resin content, reinforcement areal weight, resin flow, gel time, and volatile content are defined in TORAY Material Specifications (see reference section). (2) These information and test results were submitted to NIAR by TORAY Composites (AMERICA), Inc.

2.3. Data Documentation

MATERIAL IDENTIFICATION		
R	material identification	Style 7781/#2510 8-harness Fiberglass Fabric
R	material class	Fiberglass/Epoxy
PREPREG ANALYSIS		
R	ply manufacturer	Toray Composites (America), Inc
R	date of manufacture	11/1999
R	material lot number	AF991102, AF991103, AF991104
R	commercial designation	FGF7781-07I
R	material form	8-harness Fiberglass Woven Fabric Prepreg
R	reinforcement areal weight	285 – 305 g/m^2
	reinforcement areal weight test method	Solvent Extraction
R	resin content	35 – 41 %
REINFORCEMENT ANALYSIS		
F	precursor type	Silica
R	commercial designation	Style 7781 Finish 558
R	manufacturer	BGF Industries, Inc.
R	date of manufacture	11/1999
R	lot number	920351, 920352
R	surface treatment (Y/N)	Y
R	surface finish (sizing) identification	558
R	density (Average per lot)	2.565 g/cm^3
	density test method	
R	nominal filament count	1/tow
R	nominal tow or yarn count/inch	3.0
R	twist	No Twist
R	fiber areal weight (when applicable)	285 – 305 g/m^2
	fiber areal weight test method	SRM 23
MATRIX MATERIAL ANALYSIS		
R	commercial designation	#2510
R	manufacturer	Toray Composites (America), Inc
R	date of manufacture	11/1999
R	lot number (R – not prepregged, F – prepregged)	1-BRS, 1-BRW, 1-BRX
R	nominal density and test method	1.263 g/cc ASTM D792
PROCESSING INFORMATION		
F	part (panel) manufacturer	Toray Composites (America), Inc
R	date of manufacture (date completed)	12/1999 – 7/2000
cure cycle (for each state)		
R	process stage type	Cure Cycle
R	process time	120 +10/-0 minutes
R	process temperature	270 ± 3 °F
R	process pressure	none
R	other critical control parameters	minimum 22 inHg vacuum

LAMINA ANALYSIS		
R	form (panel, tube, etc.)	Panel
R	ply count	10 – warp & fill tensile; 12 – warp & fill comp strength; 12 – warp & fill comp modulus; 12 – IPS; 10 – ILSS
R	lay-up code	$(warp)_{10}$ – warp tensile; $(fill)_{10}$ – fill tensile; $(warp)_{12}$ – warp comp strength; $(fill)_{12}$ – fill comp strength; $(warp)_{12}$ – warp comp modulus; $(fill)_{12}$ – fill comp modulus; $(warp/fill)_{3S}$ – IPS; $(warp)_{10}$ – ILSS
R	fiber volume	44.9% Average
F	void content	3.3% Average
	density	1.806g/cc Average
R	glass transition temperature (wet, nominal)	261°F
R	glass transition temperature (dry, nominal)	290°F
R	glass transition temperature test method	DMA E'
SPECIMEN PREPARATION		
R	specimen orientation	fill, warp, fill/warp
F	tab adhesive curing temperature (nominal)	up to 260°F
MECHANICAL TESTING		
R	number of specimens	See data files
R	test procedure (citing all deviations from standard procedures including reporting requirements)	ASTM D 3039 (Tensile), SACMA SRM 1 (Comp), ASTM D 5379 (IPS), ASTM D 2344 (ILSS)
R	date of applicable standard	1995(Ten), 1994(Comp), 1993(IPS), 1989(ILSS)
R	date of testing	2/2000 – 7/2000
R	specimen thickness for each specimen	nominal: 0.1040"(warp & fill tensile), 0.1248"(warp & fill comp strength), 0.1248" (warp & fill comp modulus), 0.1248" (IPS), 0.1040" (ILSS)
R	specimen conditioning method	DOT/FAA/AR-00/47 Section 3.2, Sept. 2000
R	conditioning temperature	145 ± 5°F
R	conditioning humidity	85 ± 5%
R	conditioning time	until saturation (9 to 14 weeks)
R	conditioning environment (if not lab air)	for fluid sensitivity: Jet Fuel, Hydraulic Fluid & MEK (IPS only)
R	fastener type (if any)	N/A
R	fastener torque-up conditions (if any)	N/A
R	test temperature	-65 ± 5°F, 75 ± 5°F, 180 ± 5°F
F	moisture content	Dry : 0.1 - 0.4 % Wet : 1.1 – 1.6%
R	soak time at test conditions	-65°F: 5 – 6 minutes 180°F: 2 – 3 minutes
R	failure mode identification and location	Per specimen
R	all non-normalized (raw) data	Per specimen
R	method of calculating modulus	1000 – 3000 microstrain (Tens) 1000 – 3000 microstrain (Comp) 2500 – 6500 microstrain (IPS)
	nominal ply thickness	0.0104 in.
	nominal fiber density	2.565 g/cm^3
	nominal fiber areal weight	295 g/m^2

R – Required for all data
F – Required for fully-approved data
These requirements are current for MIL-HDBK-17-1E, which supercedes for any discrepancies.

3. TORAY 7781 FINISH 558/#2510 LAMINA PROPERTIES

3.1. Test Results

3.1.1. Summary

MATERIAL:	Toray Composites Style 7781/#2510 8-harness Fiberglass Fabric	**7781 FG/#2510 Summary**
PREPREG:	Toray Composites FGF7781-07I	
FIBER:	BGF Industries, Inc. Style 7781 Finish 558	**RESIN:** Toray Composites #2510
T_g (dry): 290 °F	**T_g (wet):** 261 °F	**T_g METHOD:** DMA (SRM 18-94)
PROCESSING:	Vacuum bag cure (minimum 22 in-Hg): 270 ± 3 °C for 120 +10/-0 minutes	

Date of fiber manufacture	11/1999	**Date of testing**	02/2000 – 07/2000
Date of resin manufacture	11/1999	**Date of data submittal**	04/2002 – 07/2002
Date of prepreg manufacture	11/1999	**Date of analysis**	07/2002 – 09/2002
Date of composite manufacture	12/1999		

LAMINA MECHANICAL PROPERTY SUMMARY
Data Reported as: Measured
(Normalized by CPT= 0.0104 in)

	CTD		RTD		ETD		ETW	
	B-Basis	**Mean**	**B-Basis**	**Mean**	**B-Basis**	**Mean**	**B-Basis**	**Mean**
F_1^{tu} (ksi)	76.372 (75.315)	82.028 (81.053)	60.629 (60.207)	64.484 (64.145)	60.846 (60.934)	64.715 (64.919)	46.158 (46.273)	49.093 (49.299)
E_1^t (Msi)	---	3.750 (3.696)	---	3.448 (3.424)	---	3.312 (3.323)	---	3.134 (3.149)
ν_{12}^{tu}	---	0.163	---	0.140	---	0.128	---	0.115
F_2^{tu} (ksi)	57.696 (57.880)	62.640 (62.778)	47.354 (46.976)	50.832 (50.385)	50.879 (50.838)	54.616 (54.527)	39.478 (39.492)	42.377 (42.358)
E_2^t (Msi)	---	3.513 (3.517)	---	3.332 (3.299)	---	3.148 (3.146)	---	2.925 (2.927)
F_1^{cu} (ksi)	80.590 (78.767)	90.463 (88.358)	69.254 (69.051)	76.492 (76.225)	57.075 (57.114)	63.040 (63.047)	45.727 (46.123)	50.506 (50.915)
E_1^c (Msi)	---	3.773 (3.866)	---	3.842 (3.823)	---	3.831 (3.819)	---	3.524 (3.520)
F_2^{cu} (ksi)	71.457 (71.737)	78.981 (78.791)	60.034 (60.361)	65.436 (65.437)	49.167 (49.431)	53.591 (53.588)	39.110 (39.772)	42.572 (43.063)
E_2^c (Msi)	---	3.674 (3.688)	---	3.621 (3.613)	---	3.575 (3.570)	---	3.371 (3.371)
F_{12}^{su} (ksi)	21.870	23.739	17.187	18.446	14.300	15.348	10.854	11.649
G_{12}^s (Msi)	---	0.720	---	0.634	---	0.538	---	0.457
F_{13}^{su**} (ksi)	---	---	7.564	8.712	---	---	---	---

** *Apparent* interlaminar shear strength

3.1.2. Individual Test Summaries

3.1.2.1. Tension, 1-axis

Tension, 1-axis
Gl/Ep
TCA 7781/#2510 Glass Fabric
$[0]_{10}$

Material: Toray - TCA 7781/#2510 Glass Fabric

Resin content: 35 - 41 wt%
Fiber volume: 43 - 47 %
Ply thickness: 0.0100 - 0.0109 in.
Ply range: 10 plies

Comp. density: 1.78 - 1.84 g/cc
Void content: 2.2 - 4.1 %

Test method: D3039-95

Modulus calculation: linear fit from 1000 - 3000με

Normalized by: 0.0104 in. ply thickness

		CTD		RTD		ETD		ETW	
Test Temperature [°F]		-65		75		180		180	
Moisture Conditioning		dry		dry		dry		equilibrium	
Equilibrium at T, RH		as fabricated		as fabricated		as fabricated		145 F, 85%	
Source code									
		Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**
	Mean	81.053	82.028	64.145	64.484	64.919	64.715	49.299	49.093
	Minimum	76.360	78.027	56.124	54.551	63.566	62.410	46.638	46.076
	Maximum	84.062	87.434	66.604	67.017	65.595	66.953	51.721	52.249
	C.V.(%)	3.784	4.497	3.411	4.448	1.010	2.135	3.236	3.139
F_1^{tu}	**B-value**	75.315	76.372	60.207	60.629	60.934	60.846	46.273	46.158
(ksi)	**A-value**	72.101	73.204	57.593	58.069	58.289	58.278	44.264	44.209
	No. Specimens	6		18		18		18	
	No. Prepreg Lots	1		3		3		3	
	Mean	3.696	3.750	3.424	3.448	3.323	3.312	3.149	3.134
	Minimum	3.537	3.580	3.383	3.299	3.273	3.153	3.100	3.042
	Maximum	3.849	3.910	3.471	3.589	3.379	3.403	3.201	3.183
E_1^t	**C.V.(%)**	3.913	3.864	0.779	2.245	0.978	2.137	1.059	1.630
(Msi)									
	No. Specimens	4		12		12		12	
	No. Prepreg Lots	1		3		3		3	
	Mean		0.163		0.140		0.128		0.115
n_{12}^t	**No. Specimens**	4		12		12		12	
	No. Prepreg Lots	1		3		3		3	

3.1.2.2. Tension, 2-axis

Tension, 2-axis
Gl/Ep
TCA 7781/#2510 Glass Fabric
$[0]_{10}$

Material:	Toray - TCA 7781/#2510 Glass Fabric		
Resin content:	35 - 41 wt%	**Comp. density:**	1.78 - 1.90 g/cc
Fiber volume:	43 - 49 %	**Void content:**	0.0 - 4.2 %
Ply thickness:	0.0101 - 0.0106 in		
Ply range:	10 plies		
Test method:	D3039-95	**Modulus calculation:**	linear fit from 1000 - 3000με
Normalized by:	0.0104 in. ply thickness		

		CTD		RTD		ETD		ETW	
Test Temperature [°F]		-65		75		180		180	
Moisture Conditioning		dry		dry		dry		equilibrium	
Equilibrium at T, RH		as fabricated		as fabricated		as fabricated		145 F, 85%	
Source code									
		Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**
	Mean	62.778	62.640	50.385	50.832	54.527	54.616	42.358	42.377
	Minimum	58.331	57.611	46.083	46.203	52.256	52.979	39.835	40.010
	Maximum	66.553	66.810	54.238	55.134	56.159	56.501	44.299	43.911
	C.V.(%)	5.281	5.630	4.385	4.035	1.630	1.613	2.822	3.311
F_2^{tu}	**B-value**	57.880	57.696	46.976	47.354	50.838	50.879	39.492	39.478
(ksi)	**A-value**	55.136	54.928	44.713	45.045	48.389	48.398	37.590	37.553
	No. Specimens	6		18		18		18	
	No. Prepreg Lots	1		3		3		3	
	Mean	3.517	3.513	3.299	3.332	3.146	3.148	2.927	2.925
	Minimum	3.477	3.460	3.260	3.227	3.099	3.060	2.873	2.875
	Maximum	3.572	3.600	3.339	3.428	3.258	3.277	2.955	2.991
E_2^t	**C.V.(%)**	1.160	1.730	0.640	1.867	1.320	1.781	0.936	1.423
(Msi)									
	No. Specimens	4		12		12		12	
	No. Prepreg Lots	1		3		3		3	

3.1.2.3. Compression, 1-axis

Compression, 1-axis
Gl/Ep
TCA 7781/#2510 Glass Fabric
$[0]_{12}$

Material:	Toray - TCA 7781/#2510 Glass Fabric		
Resin content:	35 - 41 wt%	**Comp. density:**	1.74 - 1.85 g/cc
Fiber volume:	41 - 48 %	**Void content:**	1.9 - 7.5 %
Ply thickness:	0.0099 - 0.0112 in		
Ply range:	12 plies		
Test method:	SRM 1-94	**Modulus calculation:**	linear fit from 1000 - 3000με
Normalized by:	0.0104 in. ply thickness		

		CTD		RTD		ETD		ETW	
Test Temperature [°F]		-65		75		180		180	
Moisture Conditioning		dry		dry		dry		equilibrium	
Equilibrium at T, RH		as fabricated		as fabricated		as fabricated		145 F, 85%	
Source code									
		Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**
	Mean	88.358	90.463	76.225	76.492	63.047	63.040	50.915	50.506
	Minimum	83.755	86.575	67.247	64.216	57.336	57.697	44.988	46.021
	Maximum	98.202	98.281	83.342	84.268	67.058	68.122	56.070	55.185
	C.V.(%)	6.098	4.556	5.425	6.187	3.493	4.715	6.847	5.825
F_1^{cu}	**B-value**	78.767	80.590	69.051	69.254	57.114	57.075	46.123	45.727
	A-value	73.396	75.060	64.289	64.449	53.175	53.115	42.942	42.554
	No. Specimens	6		18		18		18	
	No. Prepreg Lots	2		3		3		3	
	Mean	3.866	3.773	3.823	3.842	3.819	3.831	3.520	3.524
	Minimum	3.819	3.639	3.711	3.526	3.623	3.512	3.463	3.372
	Maximum	3.913	3.906	3.902	4.036	4.088	4.203	3.555	3.643
E_{1c} (Msi)	**C.V.(%)**	1.733	5.004	2.082	4.714	4.444	6.846	1.246	2.634
	No. Specimens	2		6		6		6	
	No. Prepreg Lots	1		3		3		3	

3.1.2.4. Compression, 2-axis

Compression, 2-axis
Gl/Ep
TCA 7781/#2510 Glass Fabric
$[0]_{12}$

Material:	Toray - TCA 7781/#2510 Glass Fabric		
Resin content:	35 - 41 wt%	**Comp. density:**	1.79 - 1.82 g/cc
Fiber volume:	43 - 48 %	**Void content:**	1.6 - 4.8 %
Ply thickness:	0.0101 - 0.0108 in		
Ply range:	12 plies		
Test method:	SRM 1-94	**Modulus calculation:**	linear fit from 1000 - 3000με
Normalized by:	0.0104 in. ply thickness		

		CTD		RTD		ETD		ETW		
Test Temperature [°F]		-65		75		180		180		
Moisture Conditioning		dry		dry		dry		equilibrium		
Equilibrium at T, RH		as fabricated		as fabricated		as fabricated		145 F, 85%		
Source code										
		Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	
	Mean	78.791	78.981	65.437	65.436	53.588	53.591	43.063	42.572	
	Minimum	77.024	77.709	58.551	58.504	48.635	48.596	38.384	37.135	
	Maximum	80.123	80.153	68.895	69.420	57.225	58.405	46.263	45.890	
	C.V.(%)	1.328	1.166	4.341	4.696	4.578	5.113	5.139	5.233	
F_2^{cu}	**B-value**	71.737	71.457	60.361	60.034	49.431	49.167	39.772	39.110	
(ksi)	**A-value**	67.794	67.251	56.998	56.456	46.677	46.237	37.550	36.773	
	No. Specimens	6		18		18		15		
	No. Prepreg Lots	2		3		3		3		
	Mean	3.688	3.674	3.613	3.621	3.570	3.575	3.371	3.371	
	Minimum	3.645	3.654	3.509	3.480	3.390	3.372	3.311	3.270	
	Maximum	3.732	3.693	3.805	3.781	3.810	3.847	3.451	3.447	
E_{2c}	**C.V.(%)**	1.662	0.759	3.034	3.319	4.120	4.715	1.902	2.017	
(Msi)										
	No. Specimens	2		6		6		6		
	No. Prepreg Lots	2		3		3		3		

3.1.2.5. Shear, 12 axis

Shear, 12-axis
Gl/Ep
TCA 7781/#2510 Glass Fabric
$[0/90]_{3s}$

Material:	Toray - TCA 7781/#2510 Glass Fabric				
Resin content:	35 - 41 wt%		**Comp. density:**	1.76 - 1.84 g/cc	
Fiber volume:	43 - 47 %		**Void content:**	2.2 - 5.5 %	
Ply thickness:	0.0098 - 0.0106 in				
Ply range:	12 plies				
Test method:	D5379-93		**Modulus calculation:**	linear fit from 1000 - 6000με	
Normalized by:	N/A				

		CTD		RTD		ETD		ETW			
Test Temperature [°F]		-65		75		180		180			
Moisture Conditioning		dry		dry		dry		equilibrium			
Equilibrium at T, RH		as fabricated		as fabricated		as fabricated		145 F, 85%			
Source code											
		Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**		
	Mean		23.739		18.446		15.348		11.649		
	Minimum		22.770		17.807		14.771		11.489		
	Maximum		24.862		19.236		15.749		11.853		
	C.V.(%)		3.822		2.084		2.122		1.002		
$F1_2^{su}$	**B-value**		21.870		17.187		14.300		10.854		
(ksi)	**A-value**		20.824		16.352		13.605		10.326		
	No. Specimens	6		18		18		18			
	No. Prepreg Lots	1		3		3		3			
	Mean		0.720		0.634		0.538		0.457		
	Minimum		0.680		0.583		0.504		0.420		
	Maximum		0.786		0.747		0.574		0.589		
$G1_{2s}$	**C.V.(%)**		6.377		7.117		4.826		9.678		
(Msi)											
	No. Specimens	4		12		12		12			
	No. Prepreg Lots	1		3		3		3			

3.1.2.6. Shear, 13 axis

Shear, 13-axis
Gl/Ep
TCA 7781/#2510 Glass Fabric
$[0]_{10}$

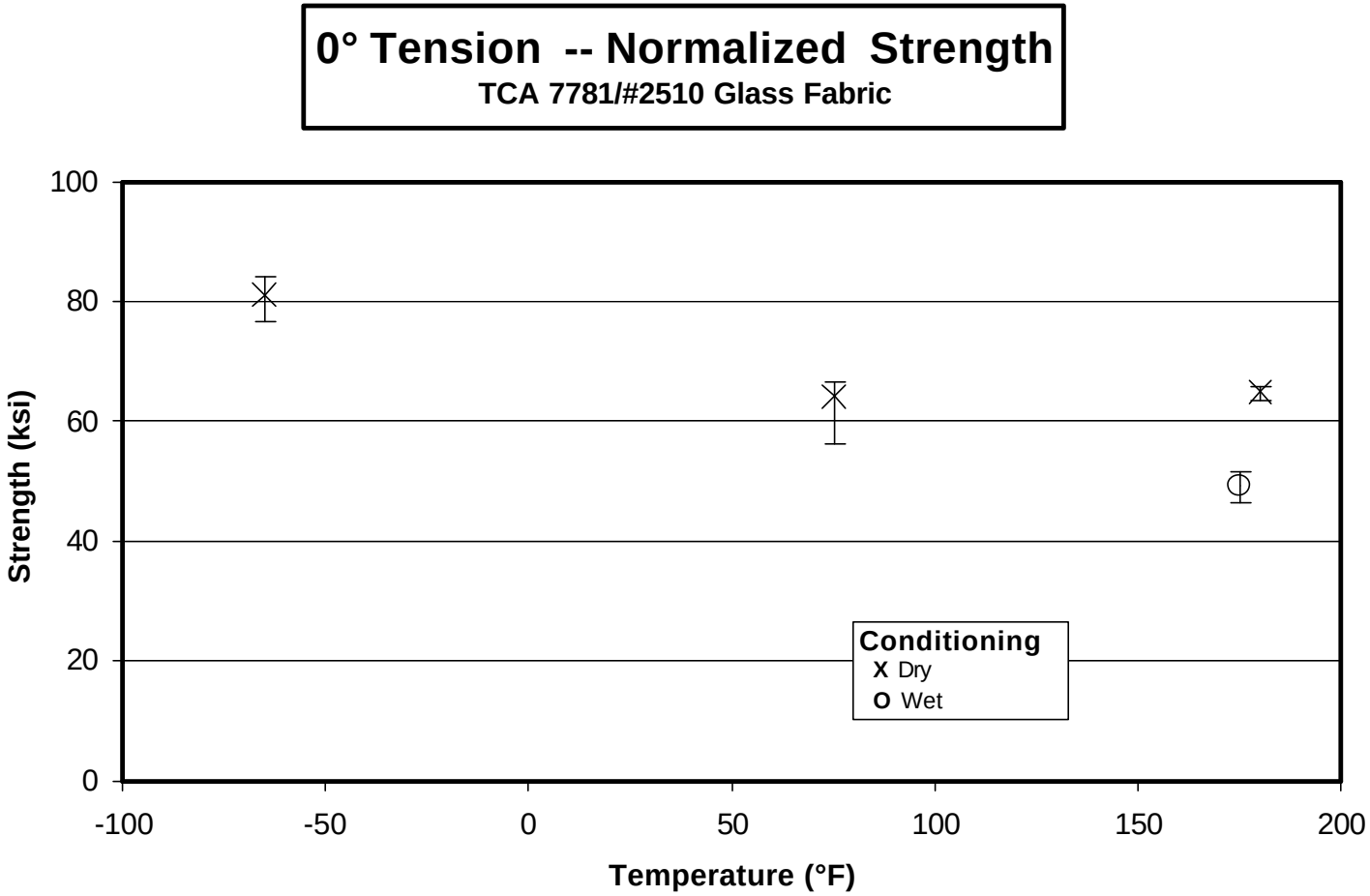
Material:	Toray - TCA 7781/#2510 Glass Fabric		
Resin content:	35 - 41 wt%	**Comp. density:**	1.72 - 1.81 g/cc
Fiber volume:	41 - 45 %	**Void content:**	2.1 - 8.5 %
Ply thickness:	0.0098 - 0.0108 in		
Ply range:	10 plies		
Test method:	D2344-89	**Modulus calculation:**	linear fit from 1000 - 6000με
Normalized by:	N/A		

		CTD		RTD		ETD		ETW			
Test Temperature [°F]		-65		75		180		180			
Moisture Conditioning		dry		dry		dry		equilibrium			
Equilibrium at T, RH		as fabricated		as fabricated		as fabricated		145 F, 85%			
Source code											
		Normalized	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**	**Normalized**	**Measured**		
	Mean				8.712						
	Minimum				7.542						
	Maximum				9.508						
	C.V.(%)				6.616						
$F1_3^{su}$	**B-value**				7.564						
(ksi)	**A-value**				6.747						
	No. Specimens			18							
	No. Prepreg Lots			3							

NOTES: These values represent the apparent interlaminar shear properties and are to be used for quality control purposes only. Do not use these values for interlaminar shear strength design values.

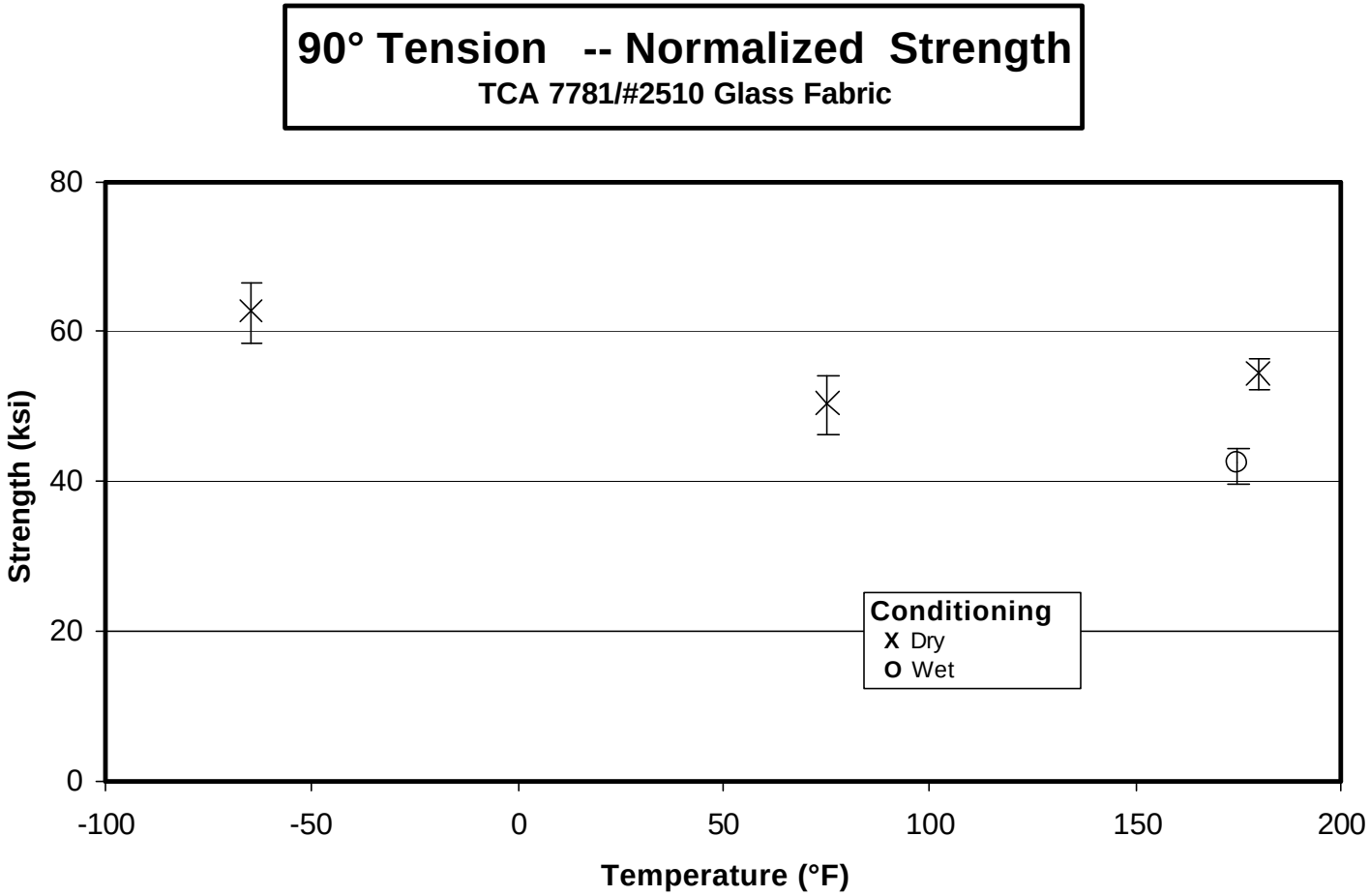
3.1.3. Individual Test Charts

3.1.3.1. Tension, 1-axis



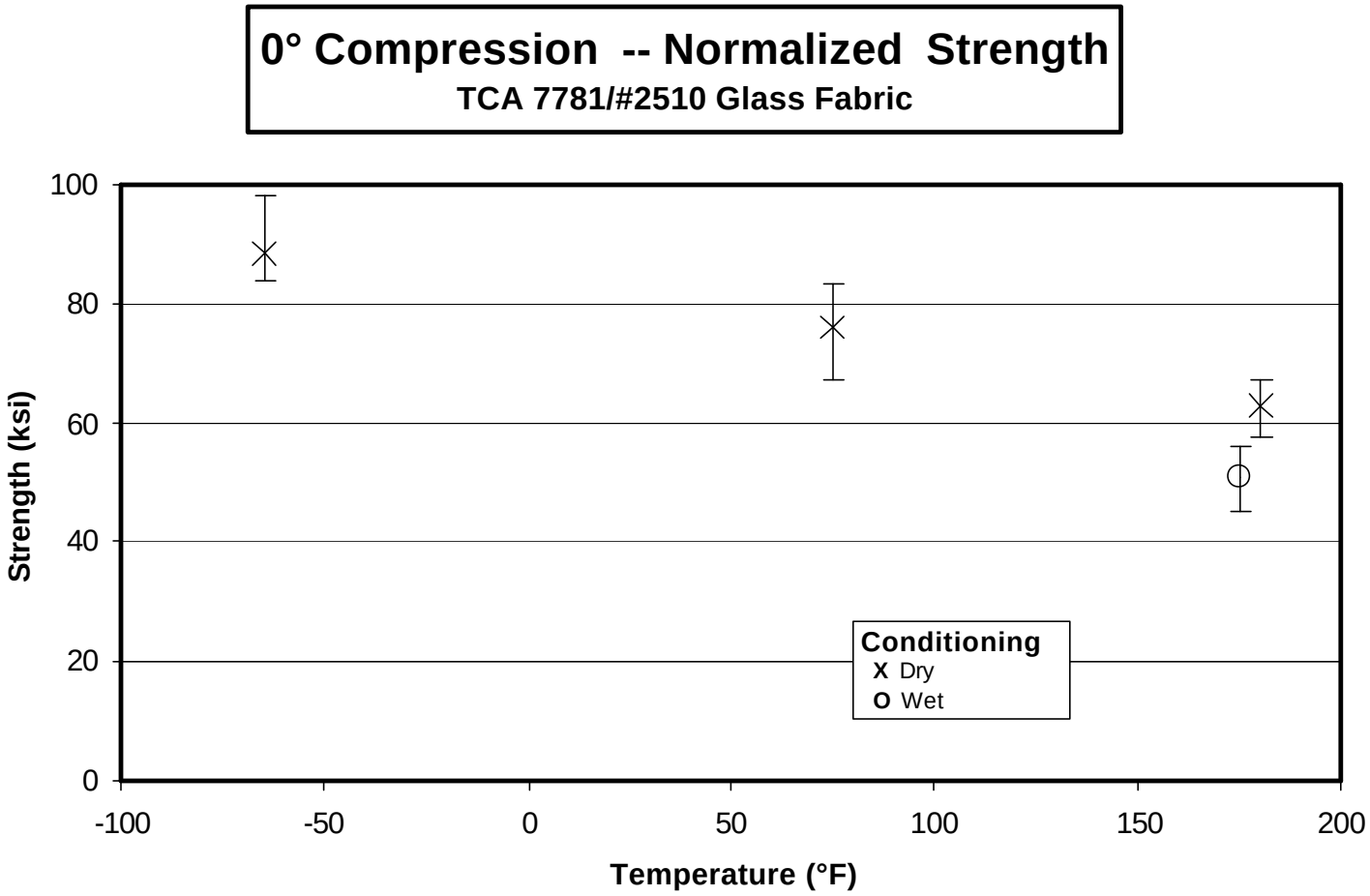
NOTE: The symbols represent the 'pooled' average of all tests, and the bars represent the upper and lower limit of the data. The 180° dry and wet data has been staggered for clarity

3.1.3.2. Tension, 2-axis



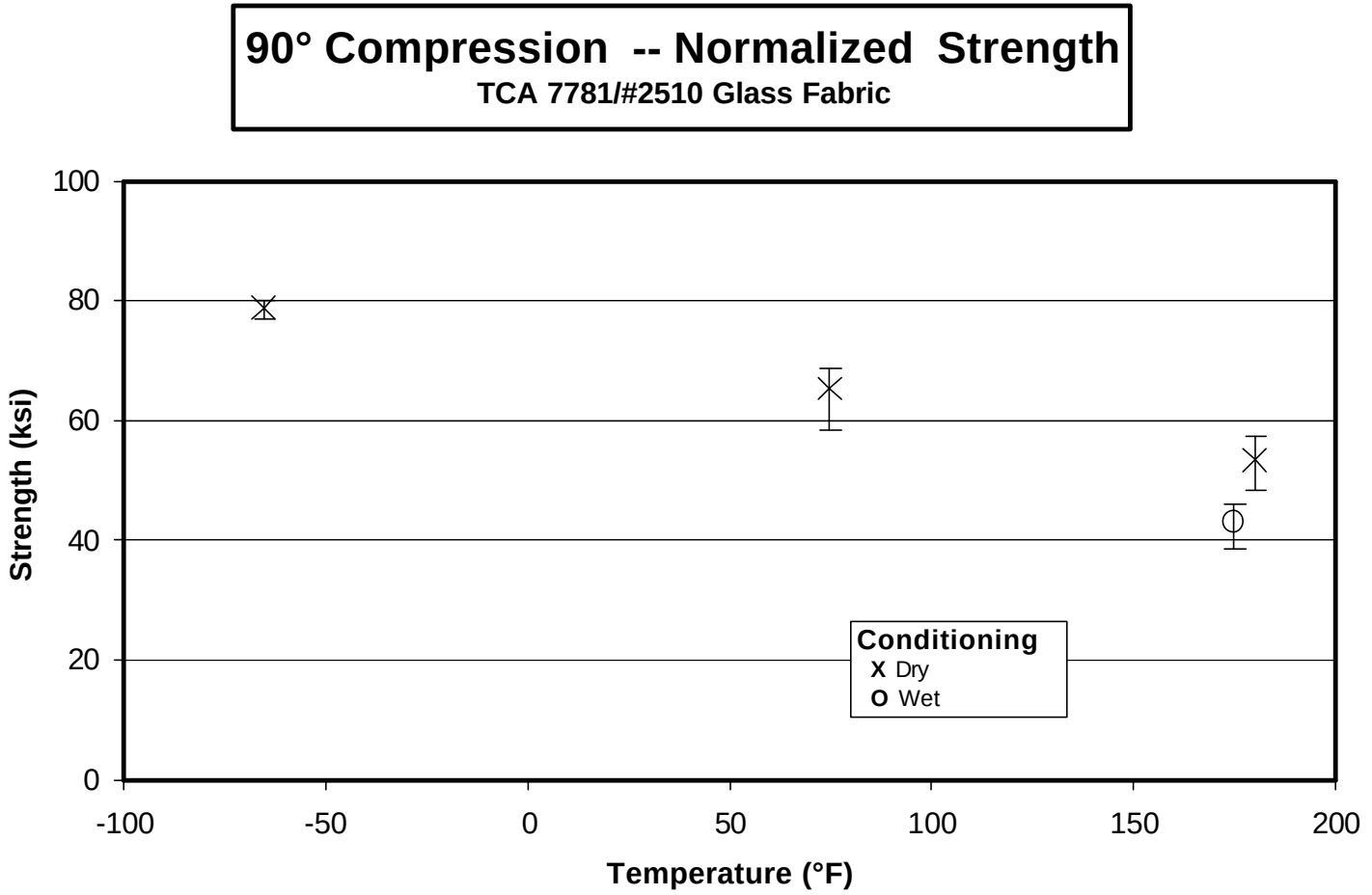
NOTE: The symbols represent the 'pooled' average of all tests, and the bars represent the upper and lower limit of the data. The 180° dry and wet data has been staggered for clarity.

3.1.3.3. Compression, 1-axis



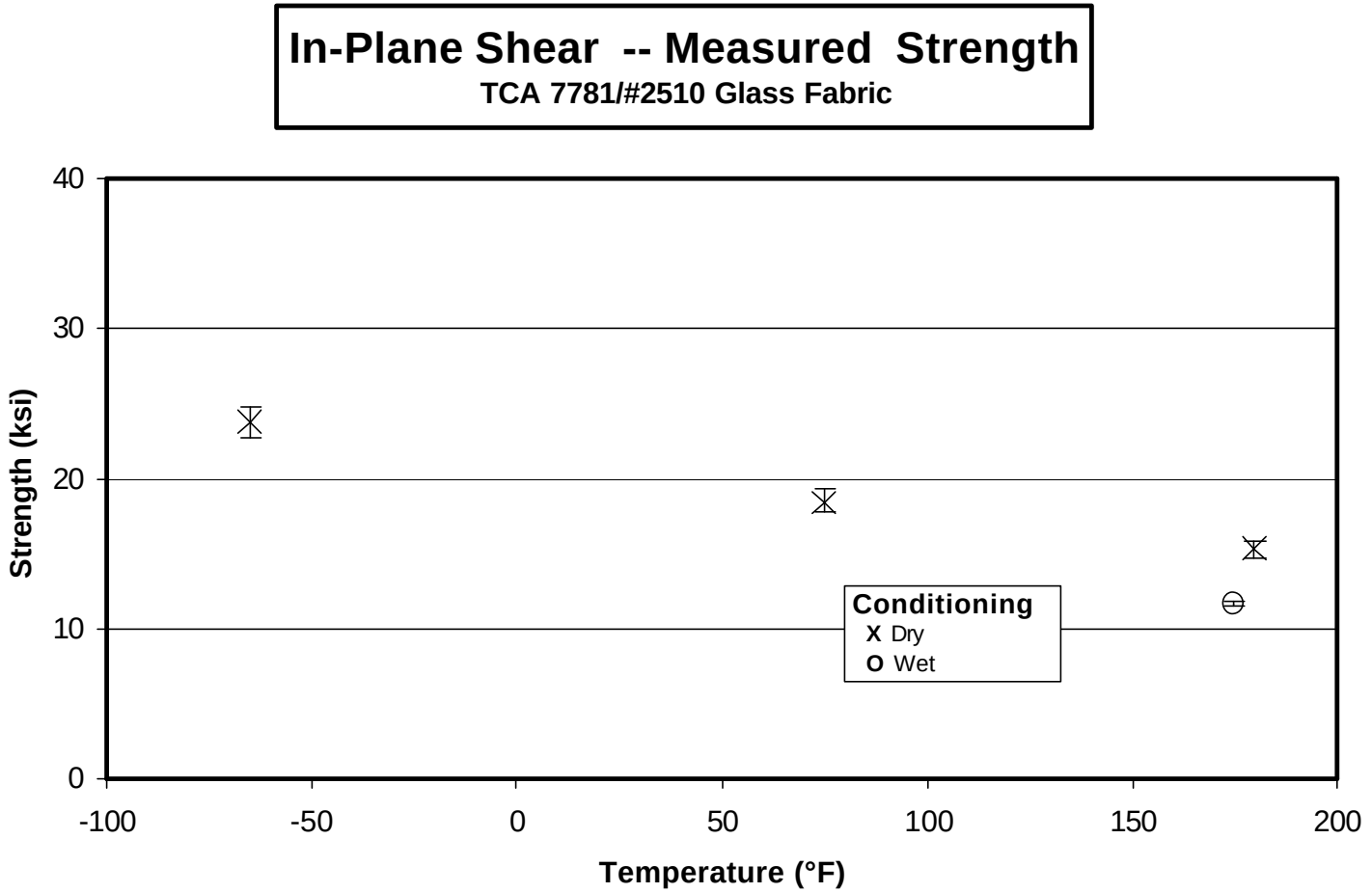
NOTE: The symbols represent the 'pooled' average of all tests, and the bars represent the upper and lower limit of the data. The 180° dry and wet data has been staggered for clarity.

3.1.3.4. Compression, 2-axis



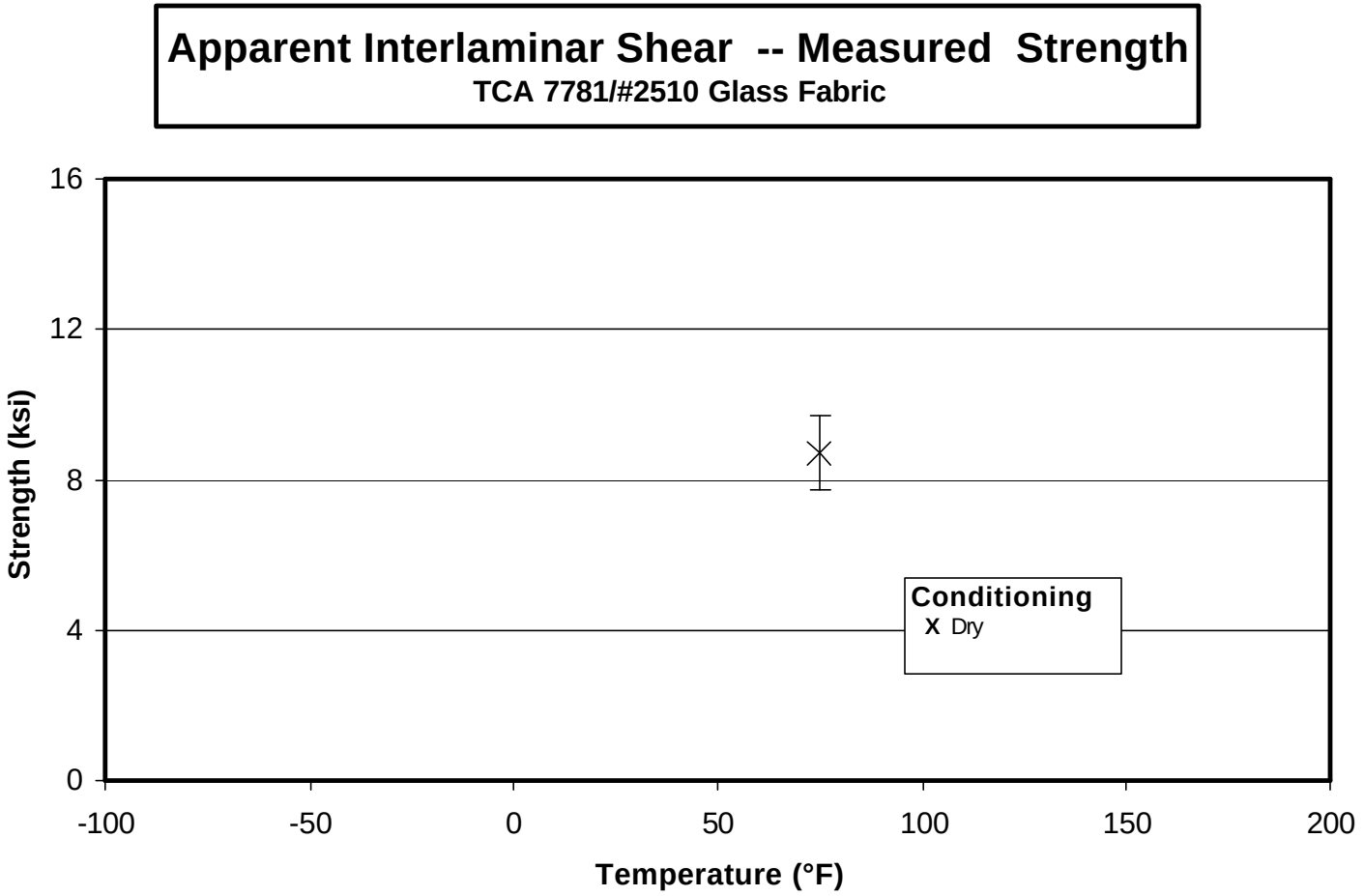
NOTE: The symbols represent the 'pooled' average of all tests, and the bars represent the upper and lower limit of the data. The 180° dry and wet data has been staggered for clarity.

3.1.3.5. Shear, 12 axis



NOTE: The symbols represent the 'pooled' average of all tests, and the bars represent the upper and lower limit of the data. The 180° dry and wet data has been staggered for clarity

3.1.3.6. Shear, 13 axis



NOTE: The symbols represent the 'pooled' average of all tests, and the bars represent the upper and lower limit of the data. The 180° dry and wet data has been staggered for clarity.

3.2. Raw Data

Specimen Naming Convention

Test coupons were identified using a ten-digit specimen code, with the significance of each digit delineated below. A representative sample ID is shown for reference purposes.

A1 – 910-041 – 1-3
0° Tension

1st Character: Independent Cure Cycle
'A' designates a cure cycle that was independently cured from 'B' cure cycle

2nd Character: Panel Number
Numeric order of the panel fabricated for each cure cycle

3rd ~ 8th Character: Master Roll Number
Prepreg Master Roll number used to fabricate the panel

9th ~ 10th Character: Sample Number
The samples cut from each panel, increasing numerically.

Panel Type ID
Panels/specimens were also identified with the test type

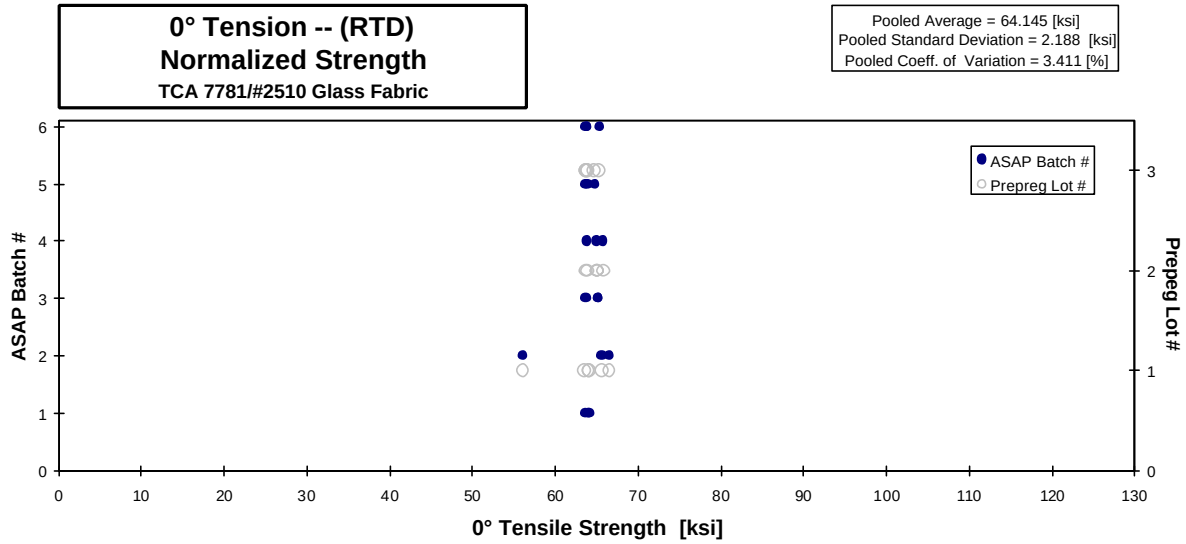
3.2.1. Raw Data Spreadsheets and Scatter Charts

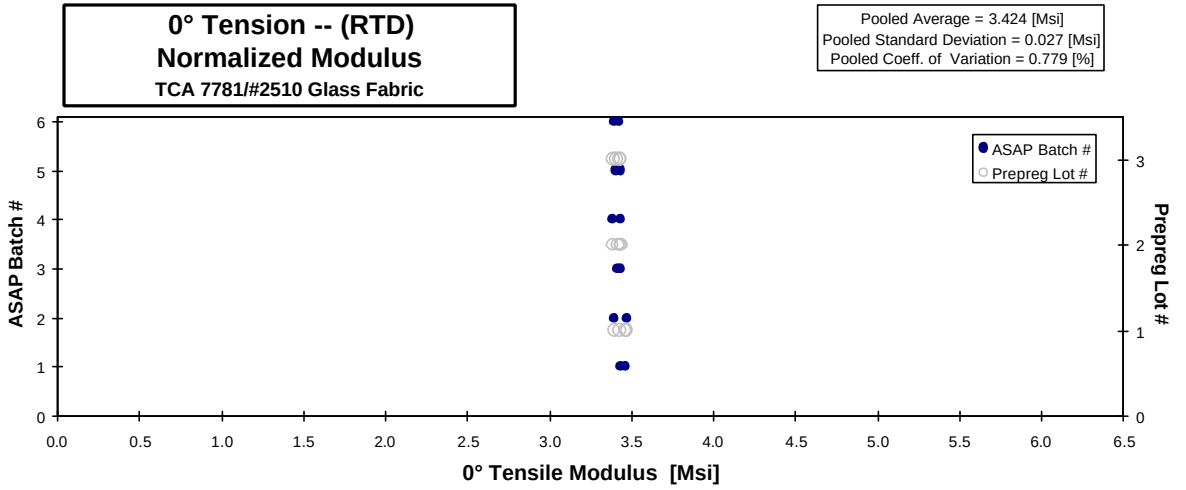
0° Tension -- (RTD)
Strength & Modulus
TCA 7781/#2510 Glass Fabric

normalizing t_{ply} [in]: 0.0104

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Poisson's Ratio	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
A1-911-081-1-3	A	1	1	62.969	3.368	0.144	0.106	10	0.01060	64.150	3.431
A2-911-081-1-3	A	1	1	62.979	3.402	0.144	0.106	10	0.01058	64.069	3.461
A1-911-081-1-4	A	1	1	62.247			0.106	10	0.01063	63.606	
B1-911-081-1-3	B	1	2	66.286	3.503	0.141	0.103	10	0.01031	65.693	3.471
B2-911-081-1-3	B	1	2	54.551	3.299	0.140	0.107	10	0.01070	56.124	3.394
B1-911-081-1-4	B	1	2	66.178			0.105	10	0.01047	66.604	
A1-911-082-1-1	A	2	3	63.384	3.398	0.137	0.105	10	0.01046	63.768	3.419
A2-911-082-1-1	A	2	3	66.638	3.514	0.142	0.102	10	0.01017	65.151	3.435
A1-911-082-1-2	A	2	3	64.328			0.105	10	0.01054	65.182	
B1-911-082-1-1	B	2	4	67.017	3.491	0.139	0.102	10	0.01022	65.876	3.432
B2-911-082-1-1	B	2	4	64.739	3.426	0.140	0.103	10	0.01027	63.930	3.383
B1-911-082-1-2	B	2	4	65.682			0.103	10	0.01030	65.050	
A1-911-083-1-1	A	3	5	65.524	3.504	0.141	0.101	10	0.01011	63.697	3.407
A2-911-083-1-1	A	3	5	66.847	3.589	0.135	0.100	10	0.00995	63.973	3.434
A1-911-083-1-2	A	3	5	66.420			0.101	10	0.01014	64.760	
B1-911-083-1-1	B	3	6	64.667	3.440	0.140	0.103	10	0.01026	63.778	3.393
B2-911-083-1-1	B	3	6	65.592	3.440	0.136	0.104	10	0.01036	65.320	3.426
B1-911-083-1-2	B	3	6	64.666			0.103	10	0.01027	63.870	

	Strength [ksi]	Modulus [Msi]	Poisson's Ratio		$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
Average	64.484	3.448	0.140	$Average_{norm}$ 0.01035	64.145	3.424
Standard Dev.	2.868	0.077	0.003	$Standard\ Dev._{norm}$	2.188	0.027
Coeff. of Var. [%]	4.448	2.245	2.095	$Coeff.\ of\ Var.\ [\%]_{norm}$	3.411	0.779
Min.	54.551	3.299	0.135	Min. 0.0100	56.124	3.383
Max.	67.017	3.589	0.144	Max. 0.0107	66.604	3.471
Number of Spec.	18	12	12	Number of Spec.	18	12



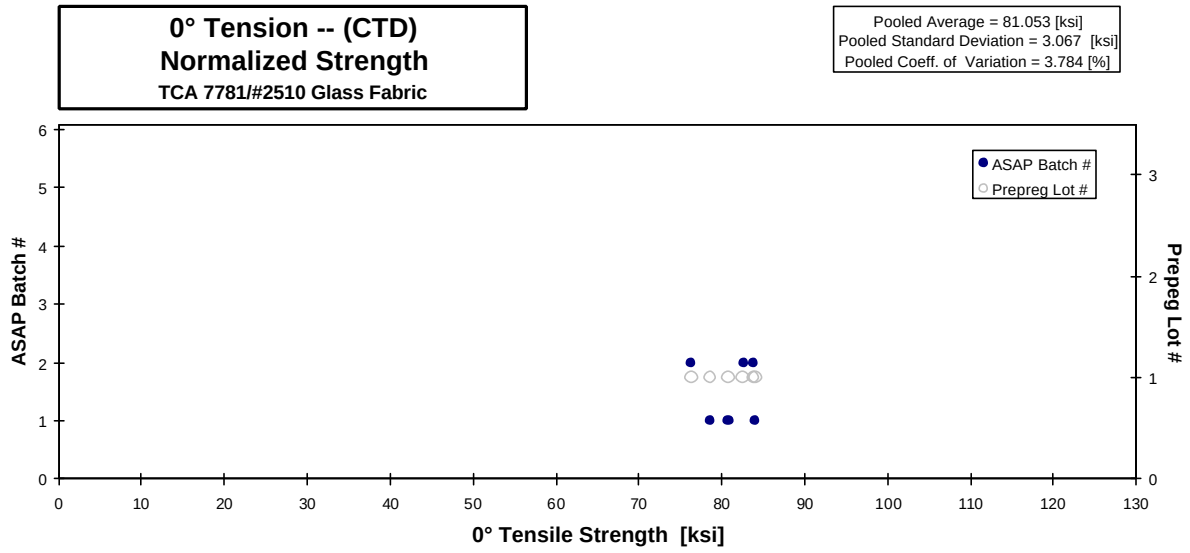


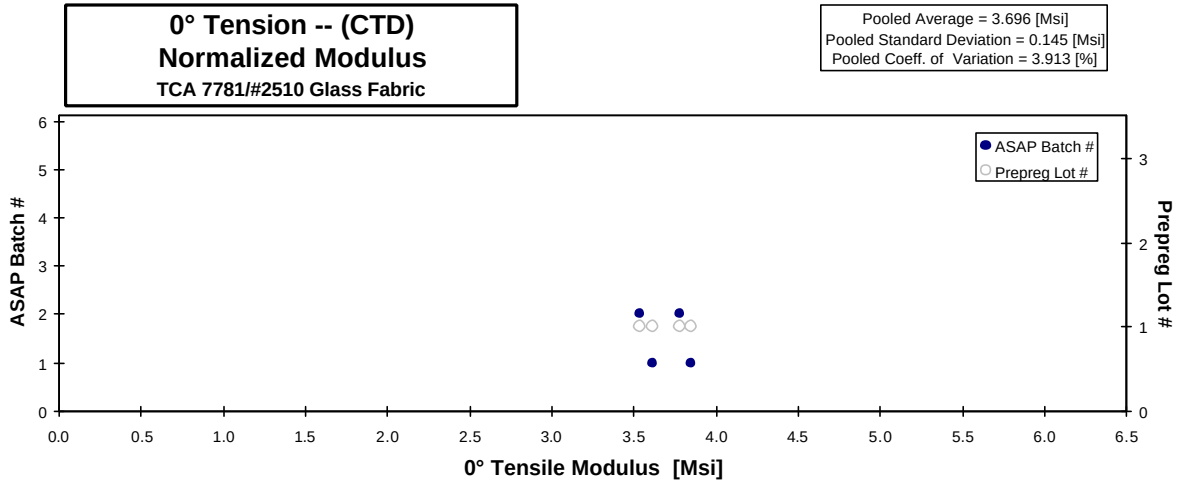
0° Tension -- (CTD)
Strength & Modulus
TCA 7781/#2510 Glass Fabric

normalizing t_{ply} [in]: 0.0104

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Poisson's Ratio	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
A2-911-081-1-2	A	1	1	80.084	3.580	0.140	0.105	10	0.01050	80.854	3.614
A2-911-081-1-1	A	1	1	78.027	3.820	0.190	0.105	10	0.01048	78.627	3.849
A1-911-081-1-2	A	1	1	82.632			0.106	10	0.01058	84.062	
B1-911-081-1-1	B	1	2	87.434	3.690	0.140	0.100	10	0.00997	83.819	3.537
B2-911-081-1-1	B	1	2	78.941	3.910	0.180	0.101	10	0.01006	76.360	3.782
B1-911-081-1-2	B	1	2	85.051			0.101	10	0.01010	82.597	

	Strength [ksi]	Modulus [Msi]	Poisson's Ratio		t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
Average	82.028	3.750	0.163	$Average_{norm}$	0.01028	81.053	3.696
Standard Dev.	3.689	0.145	0.026	$Standard\ Dev._{norm}$		3.067	0.145
Coeff. of Var. [%]	4.497	3.864	16.184	$Coeff.\ of\ Var.\ [\%]_{norm}$		3.784	3.913
Min.	78.027	3.580	0.140	Min.	0.0100	76.360	3.537
Max.	87.434	3.910	0.190	Max.	0.0106	84.062	3.849
Number of Spec.	6	4	4	Number of Spec.		6	4



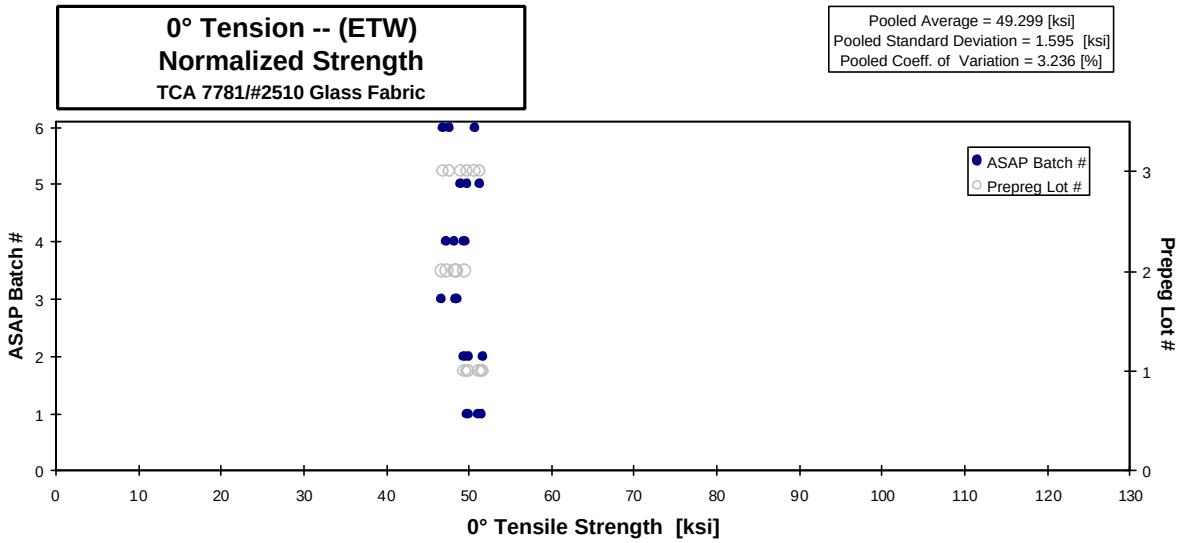


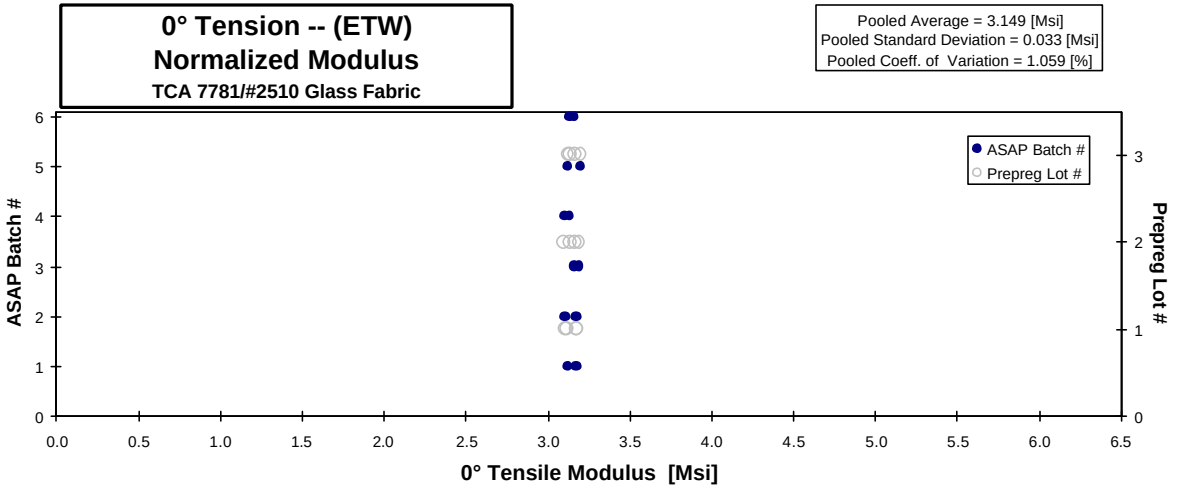
0° Tension -- (ETW)
Strength & Modulus
TCA 7781/#2510 Glass Fabric

normalizing t_{ply} [in]: 0.0104

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Poisson's Ratio	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
A1-911-081-1-7	A	1	1	49.384	3.090	0.115	0.105	10	0.01050	49.835	3.118
A2-911-081-1-7	A	1	1	50.142	3.112	0.116	0.106	10	0.01061	51.145	3.174
A1-911-081-1-8	A	1	1	50.746			0.106	10	0.01055	51.493	
B1-911-081-1-7	B	1	2	49.791	3.057	0.114	0.108	10	0.01080	51.721	3.175
B2-911-081-1-7	B	1	2	48.417	3.042	0.116	0.106	10	0.01062	49.451	3.107
B1-911-081-1-8	B	1	2	48.415			0.107	10	0.01073	49.937	
A1-911-082-1-4	A	2	3	47.749	3.147	0.117	0.105	10	0.01054	48.383	3.189
A2-911-082-1-4	A	2	3	48.730	3.180	0.118	0.103	10	0.01035	48.472	3.163
A1-911-082-1-5	A	2	3	46.076			0.105	10	0.01053	46.638	
B1-911-082-1-4	B	2	4	50.149	3.179	0.112	0.103	10	0.01026	49.459	3.135
B2-911-082-1-4	B	2	4	48.358	3.105	0.112	0.104	10	0.01039	48.288	3.100
B1-911-082-1-5	B	2	4	48.074			0.102	10	0.01023	47.274	
A1-911-083-1-4	A	3	5	52.249	3.181	0.118	0.102	10	0.01021	51.295	3.123
A2-911-083-1-1	A	3	5	48.578	3.173	0.114	0.105	10	0.01049	49.007	3.201
A1-911-083-1-5	A	3	5	50.708			0.102	10	0.01021	49.781	
B1-911-083-1-4	B	3	6	47.158	3.155	0.116	0.103	10	0.01034	46.877	3.136
B2-911-083-1-4	B	3	6	50.968	3.183	0.112	0.103	10	0.01034	50.659	3.164
B1-911-083-1-5	B	3	6	47.983			0.103	10	0.01033	47.660	

Average	**49.093**	**3.134**	**0.115**	**$Average_{norm}$**	**0.01044**	**49.299**	**3.149**
Standard Dev.	**1.541**	**0.051**	**0.002**	**$Standard\ Dev._{norm}$**		**1.595**	**0.033**
Coeff. of Var. [%]	**3.139**	**1.630**	**1.962**	**$Coeff.\ of\ Var.\ [\%]_{norm}$**		**3.236**	**1.059**
Min.	**46.076**	**3.042**	**0.112**	**Min.**	**0.0102**	**46.638**	**3.100**
Max.	**52.249**	**3.183**	**0.118**	**Max.**	**0.0108**	**51.721**	**3.201**
Number of Spec.	**18**	**12**	**12**	**Number of Spec.**		**18**	**12**



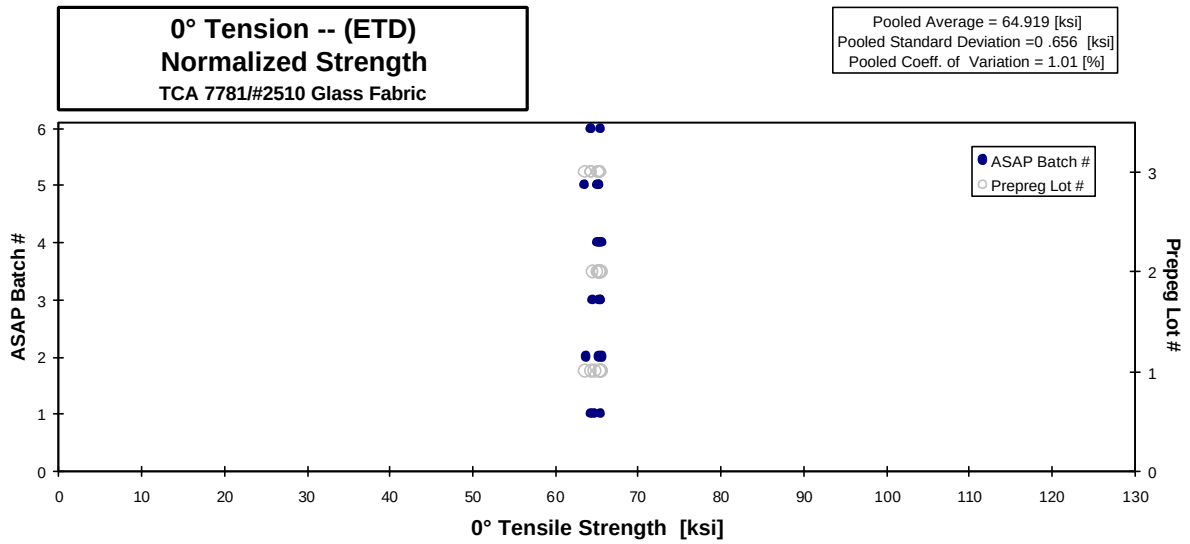


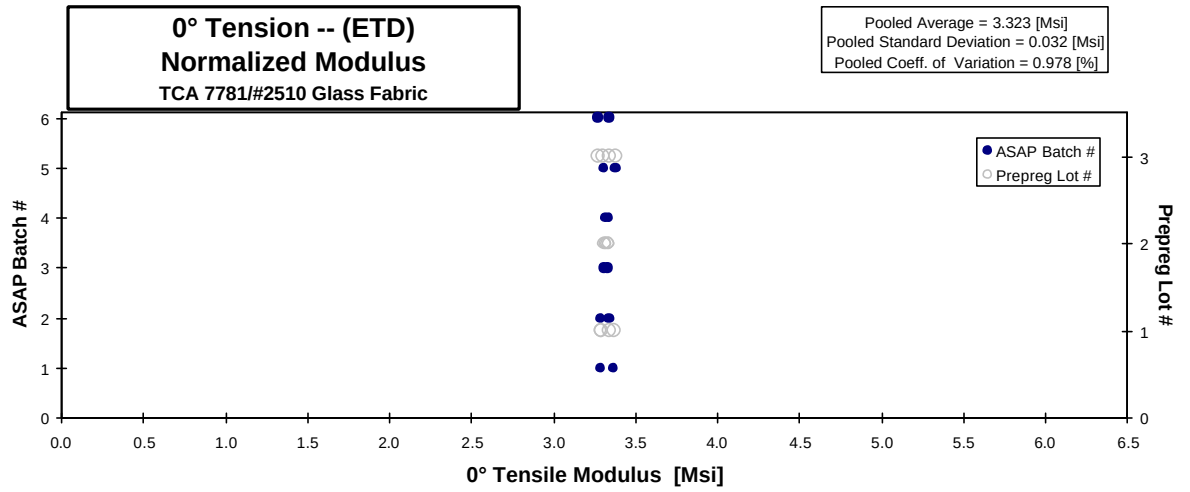
0° Tension -- (ETD)
Strength & Modulus
TCA 7781/#2510 Glass Fabric

normalizing t_{ply} [in]: 0.0104

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Poisson's Ratio	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
A1-911-081-1-5	A	1	1	62.974	3.218	0.126	0.106	10	0.01062	64.294	3.285
A2-911-081-1-5	A	1	1	63.919	3.287	0.131	0.107	10	0.01066	65.505	3.368
A2-911-081-1-4	A	1	1	63.433			0.106	10	0.01061	64.727	
B1-911-081-1-5	B	1	2	62.410	3.275	0.130	0.106	10	0.01061	63.682	3.341
B2-911-081-1-5	B	1	2	62.874	3.153	0.133	0.109	10	0.01085	65.595	3.290
B2-911-081-1-4	B	1	2	62.544			0.109	10	0.01087	65.370	
A1-911-082-1-7	A	2	3	66.014	3.363	0.120	0.103	10	0.01030	65.392	3.332
A2-911-082-1-3	A	2	3	65.909	3.336	0.128	0.103	10	0.01032	65.371	3.309
A2-911-082-1-2	A	2	3	65.499			0.102	10	0.01024	64.504	
B1-911-082-1-3	B	2	4	65.709	3.349	0.128	0.103	10	0.01030	65.090	3.318
B2-911-082-1-3	B	2	4	65.628	3.349	0.129	0.104	10	0.01036	65.357	3.335
B2-911-082-1-2	B	2	4	66.007			0.103	10	0.01033	65.575	
A1-911-083-1-3	A	3	5	64.876	3.373	0.127	0.102	10	0.01019	63.566	3.305
A2-911-083-1-3	A	3	5	65.631	3.403	0.128	0.103	10	0.01033	65.171	3.379
A2-911-083-1-2	A	3	5	66.953			0.101	10	0.01015	65.311	
B1-911-083-1-3	B	3	6	64.775	3.298	0.129	0.103	10	0.01032	64.289	3.273
B2-911-083-1-3	B	3	6	64.323	3.341	0.124	0.104	10	0.01040	64.305	3.340
B2-911-083-1-2	B	3	6	65.399			0.104	10	0.01041	65.443	

Average	**64.715**	**3.312**	**0.128**	**$Average_{norm}$**	**0.01044**	**64.919**	**3.323**
Standard Dev.	**1.381**	**0.071**	**0.003**	**$Standard\ Dev._{norm}$**		**0.656**	**0.032**
Coeff. of Var. [%]	**2.135**	**2.137**	**2.552**	**$Coeff.\ of\ Var.\ [\%]_{norm}$**		**1.010**	**0.978**
Min.	**62.410**	**3.153**	**0.120**	**Min.**	**0.0101**	**63.566**	**3.273**
Max.	**66.953**	**3.403**	**0.133**	**Max.**	**0.0109**	**65.595**	**3.379**
Number of Spec.	**18**	**12**	**12**	**Number of Spec.**		**18**	**12**



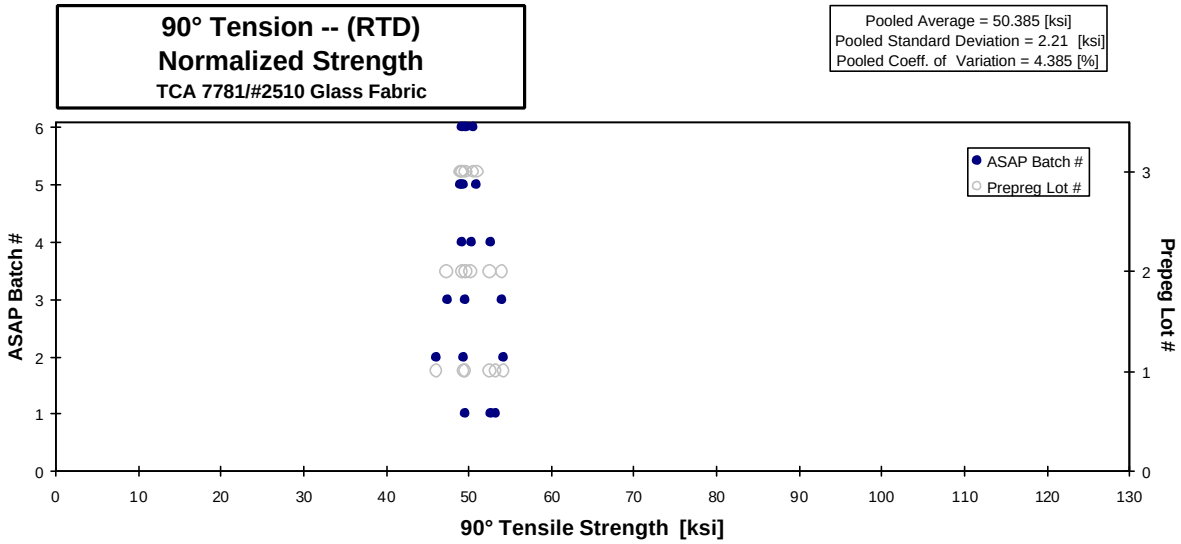


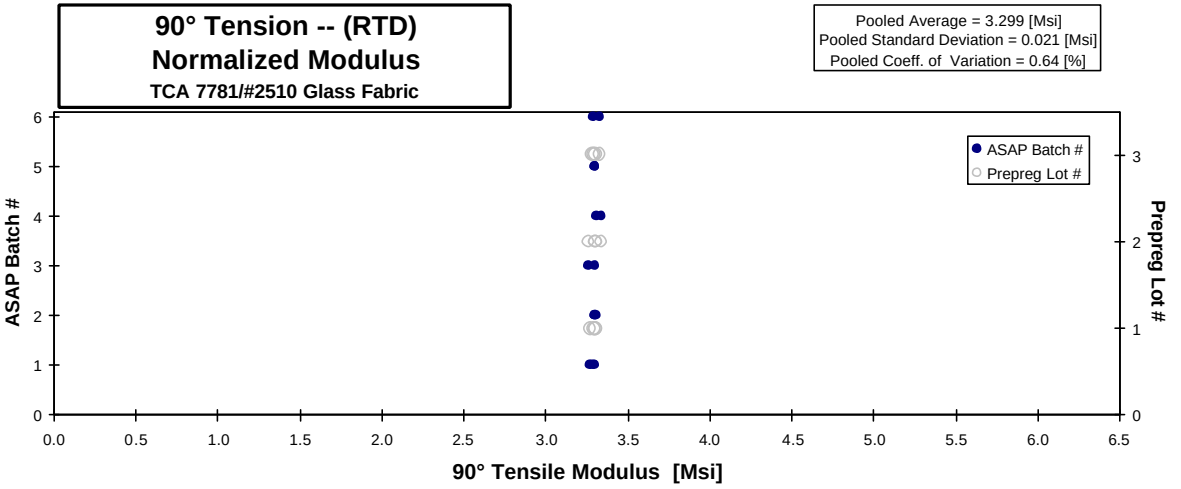
90° Tension -- (RTD)
Strength & Modulus
TCA 7781/#2510 Glass Fabric

normalizing t_{ply} [in]: 0.0104

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
A1-911-081-1-3	A	1	1	52.527	3.227	0.105	10	0.01054	53.245	3.271
A2-911-081-1-3	A	1	1	51.708	3.238	0.106	10	0.01058	52.613	3.295
A1-911-081-1-4	A	1	1	48.892		0.105	10	0.01054	49.560	
B1-911-081-1-3	B	1	2	49.566	3.313	0.104	10	0.01037	49.409	3.303
B2-911-081-1-3	B	1	2	53.533	3.258	0.105	10	0.01054	54.238	3.301
B1-911-081-1-4	B	1	2	46.203		0.104	10	0.01037	46.083	
A1-911-082-1-1	A	2	3	48.574	3.342	0.101	10	0.01015	47.383	3.260
A2-911-082-1-1	A	2	3	50.191	3.339	0.103	10	0.01028	49.627	3.301
A1-911-082-1-2	A	2	3	55.134		0.102	10	0.01020	54.048	
B1-911-082-1-1	B	2	4	50.366	3.384	0.102	10	0.01016	49.218	3.307
B2-911-082-1-1	B	2	4	51.624	3.428	0.101	10	0.01013	50.283	3.339
B1-911-082-1-2	B	2	4	53.335		0.103	10	0.01026	52.617	
A1-911-083-1-1	A	3	5	49.983	3.360	0.102	10	0.01020	49.036	3.296
A2-911-083-1-1	A	3	5	49.835	3.340	0.103	10	0.01028	49.275	3.302
A1-911-083-1-2	A	3	5	51.641		0.103	10	0.01027	50.980	
B1-911-083-1-1	B	3	6	50.345	3.371	0.103	10	0.01027	49.691	3.327
B2-911-083-1-1	B	3	6	50.585	3.384	0.101	10	0.01010	49.116	3.286
B1-911-083-1-2	B	3	6	50.928		0.103	10	0.01031	50.502	

Average	**50.832**	**3.332**	**$Average_{norm}$**	**0.01031**	**50.385**	**3.299**
Standard Dev.	**2.051**	**0.062**	**$Standard\ Dev._{norm}$**		**2.210**	**0.021**
Coeff. of Var. [%]	**4.035**	**1.867**	**$Coeff.\ of\ Var.\ [\%]_{norm}$**		**4.385**	**0.640**
Min.	**46.203**	**3.227**	**Min.**	**0.0101**	**46.083**	**3.260**
Max.	**55.134**	**3.428**	**Max.**	**0.0106**	**54.238**	**3.339**
Number of Spec.	**18**	**12**	**Number of Spec.**		**18**	**12**



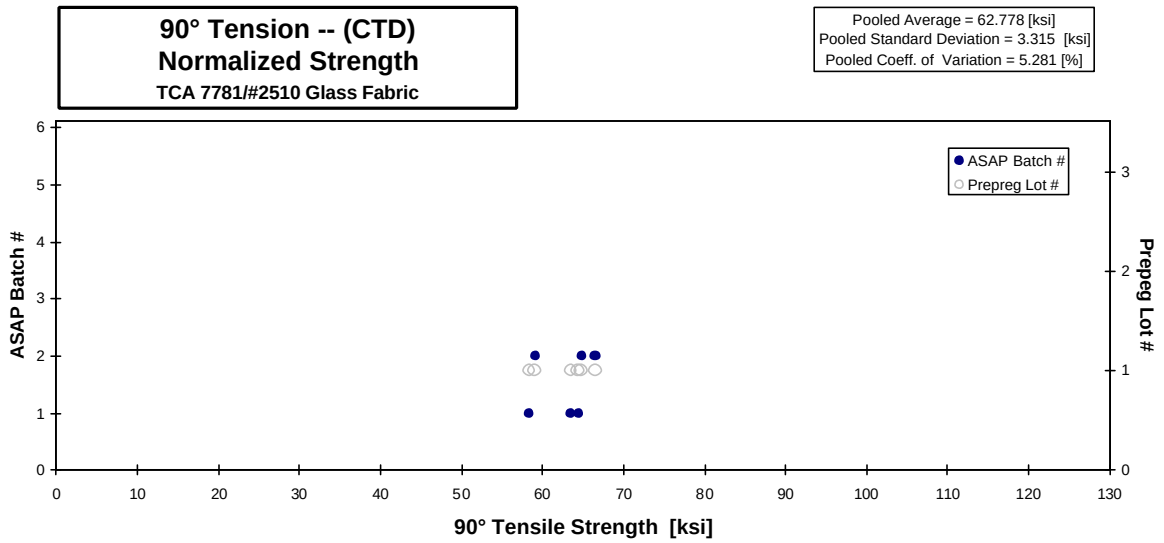


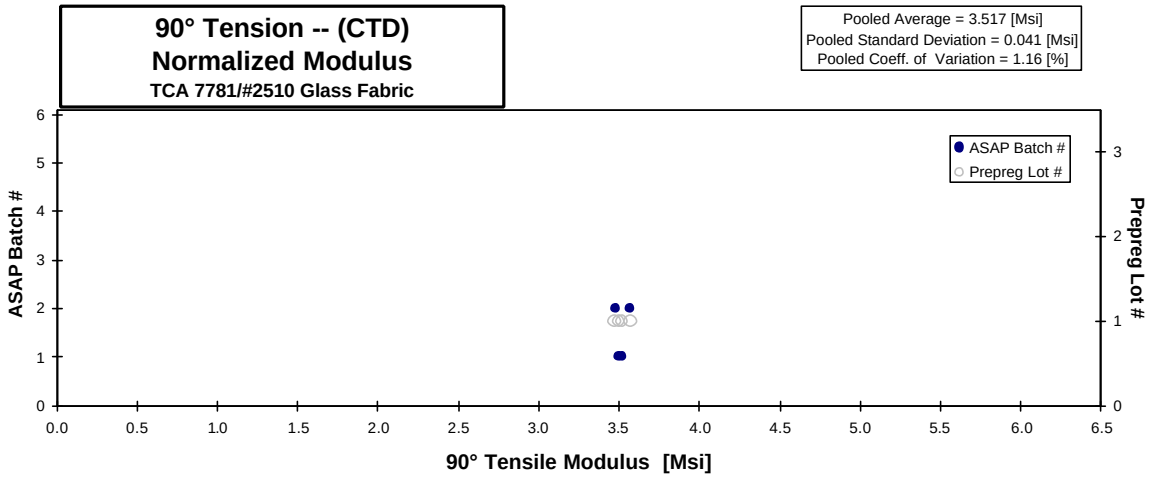
90° Tension -- (CTD)
Strength & Modulus
TCA 7781/#2510 Glass Fabric

normalizing t_{ply} [in]: 0.0104

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
A1-911-081-1-1	A	1	1	63.691	3.460	0.105	10	0.01052	64.426	3.500
A2-911-081-1-1	A	1	1	63.092	3.500	0.105	10	0.01046	63.456	3.520
A1-911-081-1-2	A	1	1	57.611		0.105	10	0.01053	58.331	
B1-911-081-1-1	B	1	2	59.318	3.490	0.104	10	0.01036	59.089	3.477
B2-911-081-1-1	B	1	2	65.317	3.600	0.103	10	0.01032	64.814	3.572
B1-911-081-1-2	B	1	2	66.810		0.104	10	0.01036	66.553	

				$Average_{norm}$		
Average	**62.640**	**3.513**		**0.01043**	**62.778**	**3.517**
Standard Dev.	**3.527**	**0.061**			**3.315**	**0.041**
Coeff. of Var. [%]	**5.630**	**1.730**			**5.281**	**1.160**
Min.	**57.611**	**3.460**	**Min.**	**0.0103**	**58.331**	**3.477**
Max.	**66.810**	**3.600**	**Max.**	**0.0105**	**66.553**	**3.572**
Number of Spec.	**6**	**4**	**Number of Spec.**		**6**	**4**



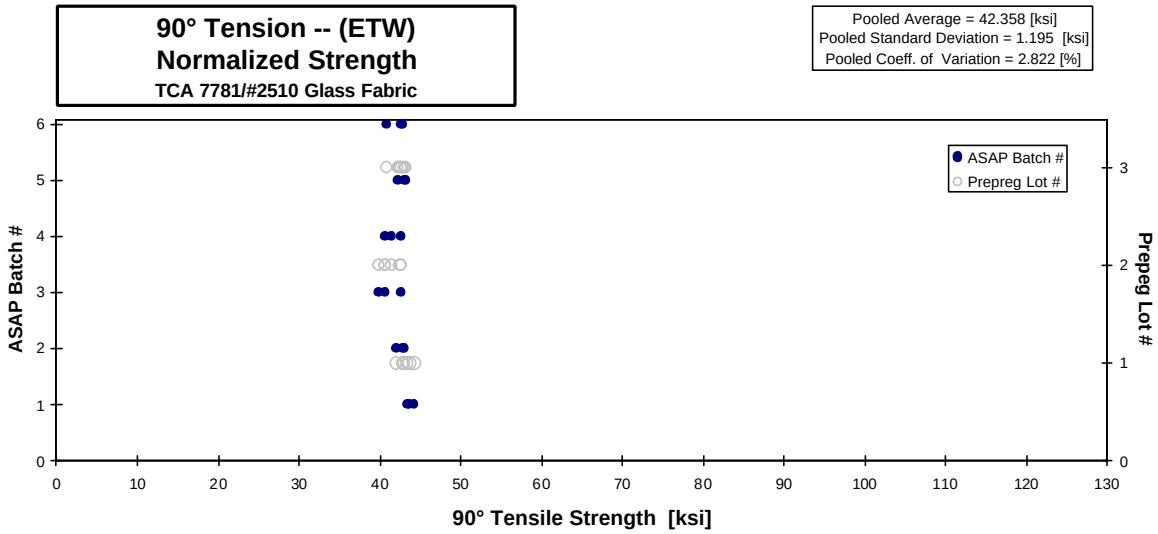


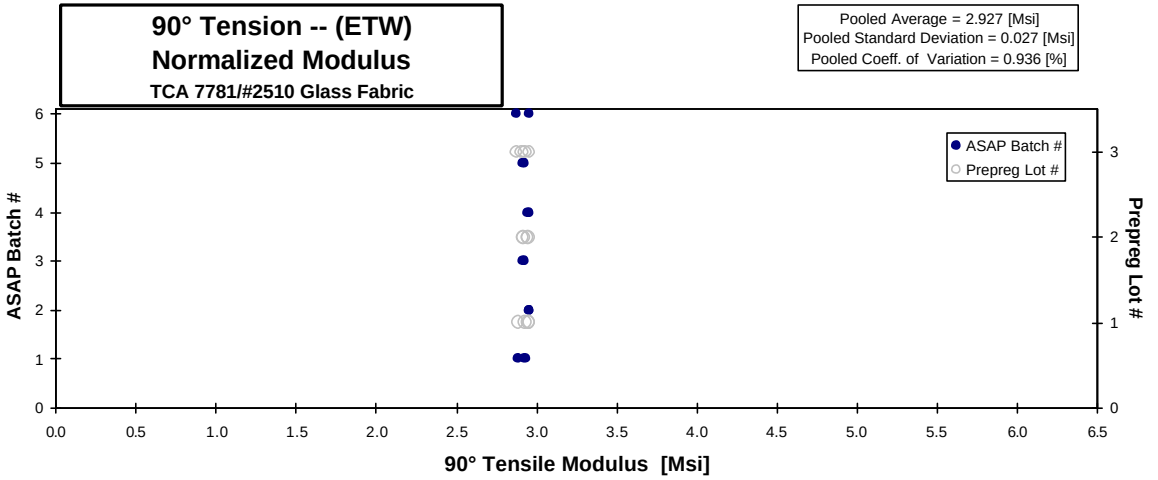
90° Tension -- (ETW)
Strength & Modulus
TCA 7781/#2510 Glass Fabric

normalizing t_{ply} [in]: 0.0104

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
A1-911-081-1-8	A	1	1	43.762	2.887	0.104	10	0.01039	43.720	2.884
A2-911-081-1-8	A	1	1	43.911	2.904	0.105	10	0.01049	44.299	2.930
A1-911-081-1-9	A	1	1	43.685		0.103	10	0.01035	43.467	
B1-911-081-1-8	B	1	2	43.405	2.987	0.103	10	0.01029	42.925	2.954
B2-911-081-1-8	B	1	2	41.213	2.889	0.106	10	0.01063	42.112	2.952
B1-911-081-1-9	B	1	2	43.748		0.102	10	0.01024	43.054	
A1-911-082-1-4	A	2	3	40.351	2.952	0.103	10	0.01027	39.835	2.915
A2-911-082-1-4	A	2	3	40.077	2.875	0.106	10	0.01057	40.721	2.921
A1-911-082-1-5	A	2	3	43.172		0.103	10	0.01028	42.661	
B1-911-082-1-4	B	2	4	40.010	2.897	0.106	10	0.01057	40.676	2.946
B2-911-082-1-4	B	2	4	43.156	2.991	0.103	10	0.01026	42.566	2.950
B1-911-082-1-5	B	2	4	40.799		0.106	10	0.01056	41.435	
A1-911-083-1-4	A	3	5	43.197	2.903	0.104	10	0.01043	43.322	2.911
A2-911-083-1-4	A	3	5	43.380	2.950	0.103	10	0.01033	43.068	2.929
A1-911-083-1-5	A	3	5	42.161		0.104	10	0.01044	42.315	
B1-911-083-1-4	B	3	6	42.725	2.966	0.104	10	0.01036	42.569	2.955
B2-911-083-1-4	B	3	6	43.104	2.895	0.103	10	0.01032	42.773	2.873
B1-911-083-1-5	B	3	6	40.929		0.104	10	0.01040	40.921	

Average	**42.377**	**2.925**	**$Average_{norm}$**	**0.01040**	**42.358**	**2.927**
Standard Dev.	**1.403**	**0.042**	**$Standard\ Dev._{norm}$**		**1.195**	**0.027**
Coeff. of Var. [%]	**3.311**	**1.423**	**$Coeff.\ of\ Var.\ [\%]_{norm}$**		**2.822**	**0.936**
Min.	**40.010**	**2.875**	**Min.**	**0.0102**	**39.835**	**2.873**
Max.	**43.911**	**2.991**	**Max.**	**0.0106**	**44.299**	**2.955**
Number of Spec.	**18**	**12**	**Number of Spec.**		**18**	**12**



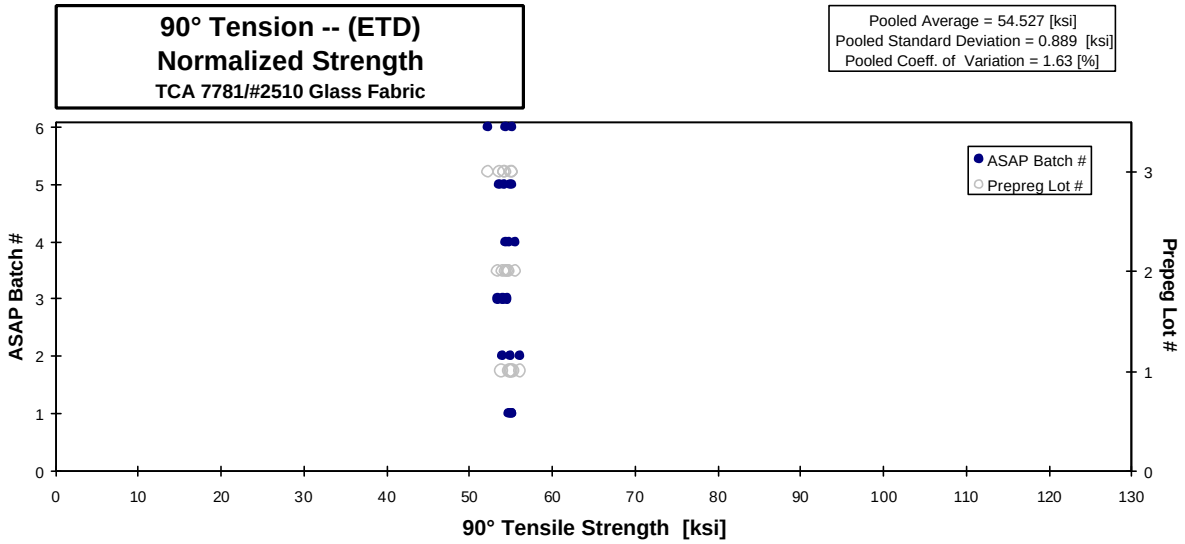


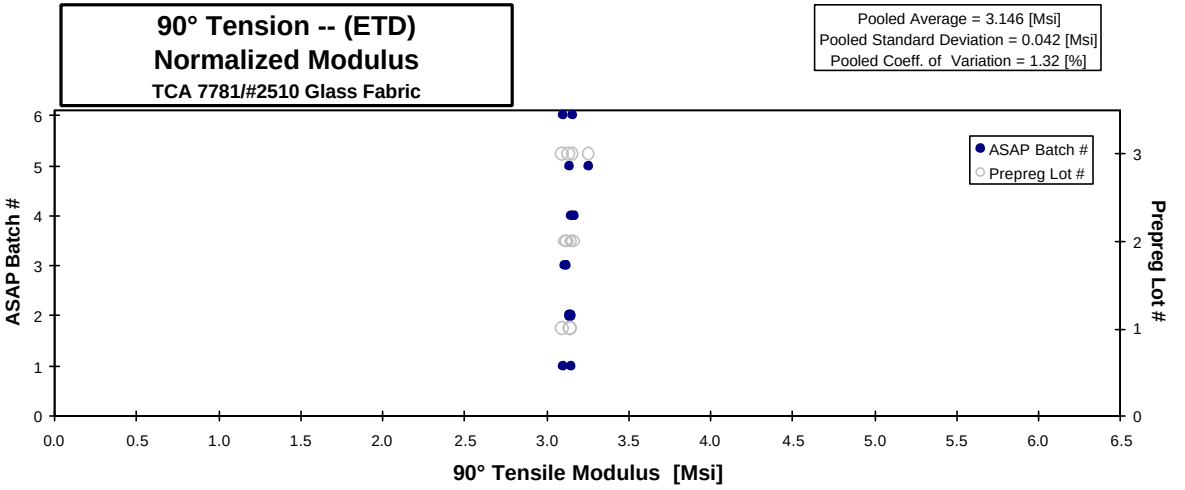
90° Tension -- (ETD)
Strength & Modulus
TCA 7781/#2510 Glass Fabric

normalizing t_{ply} [in]: 0.0104

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
A1-911-081-1-5	A	1	1	54.355	3.060	0.105	10	0.01053	55.050	3.099
A2-911-081-1-5	A	1	1	53.972	3.094	0.106	10	0.01058	54.880	3.146
A2-911-081-1-4	A	1	1	54.139		0.106	10	0.01061	55.217	
B1-911-081-1-5	B	1	2	53.948	3.145	0.104	10	0.01040	53.948	3.145
B2-911-081-1-5	B	1	2	54.063	3.092	0.106	10	0.01058	54.984	3.145
B2-911-081-1-4	B	1	2	55.318		0.106	10	0.01056	56.159	
A1-911-082-1-3	A	2	3	55.357	3.161	0.103	10	0.01025	54.559	3.115
A2-911-082-1-3	A	2	3	53.995	3.119	0.104	10	0.01042	54.099	3.125
A2-911-082-1-2	A	2	3	53.744		0.103	10	0.01033	53.398	
B1-911-082-1-3	B	2	4	54.339	3.163	0.104	10	0.01041	54.407	3.167
B2-911-082-1-3	B	2	4	55.512	3.193	0.103	10	0.01026	54.754	3.150
B2-911-082-1-2	B	2	4	56.501		0.102	10	0.01022	55.507	
A1-911-083-1-3	A	3	5	55.354	3.277	0.103	10	0.01034	55.035	3.258
A2-911-083-1-3	A	3	5	53.895	3.157	0.103	10	0.01034	53.584	3.139
A2-911-083-1-2	A	3	5	54.733		0.103	10	0.01030	54.196	
B1-911-083-1-3	B	3	6	55.414	3.175	0.104	10	0.01035	55.158	3.160
B2-911-083-1-3	B	3	6	52.979	3.143	0.103	10	0.01026	52.256	3.100
B2-911-083-1-2	B	3	6	55.460		0.102	10	0.01018	54.303	

Average	**54.616**	**3.148**	**$Average_{norm}$**	**0.01038**	**54.527**	**3.146**
Standard Dev.	**0.881**	**0.056**	**$Standard\ Dev._{norm}$**		**0.889**	**0.042**
Coeff. of Var. [%]	**1.613**	**1.781**	**$Coeff.\ of\ Var.\ [\%]_{norm}$**		**1.630**	**1.320**
Min.	**52.979**	**3.060**	**Min.**	**0.0102**	**52.256**	**3.099**
Max.	**56.501**	**3.277**	**Max.**	**0.0106**	**56.159**	**3.258**
Number of Spec.	**18**	**12**	**Number of Spec.**		**18**	**12**



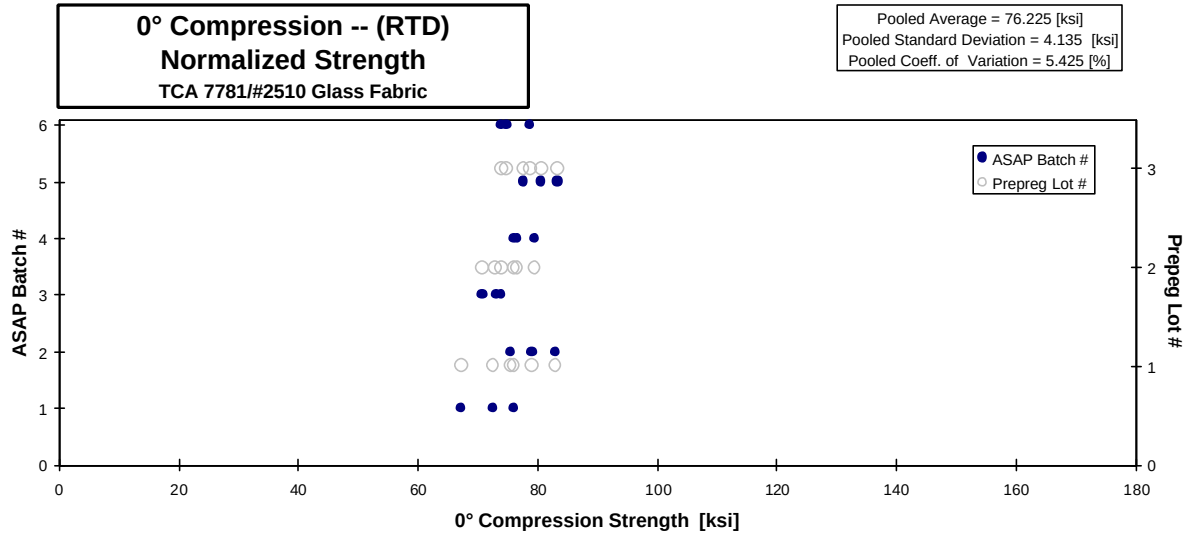


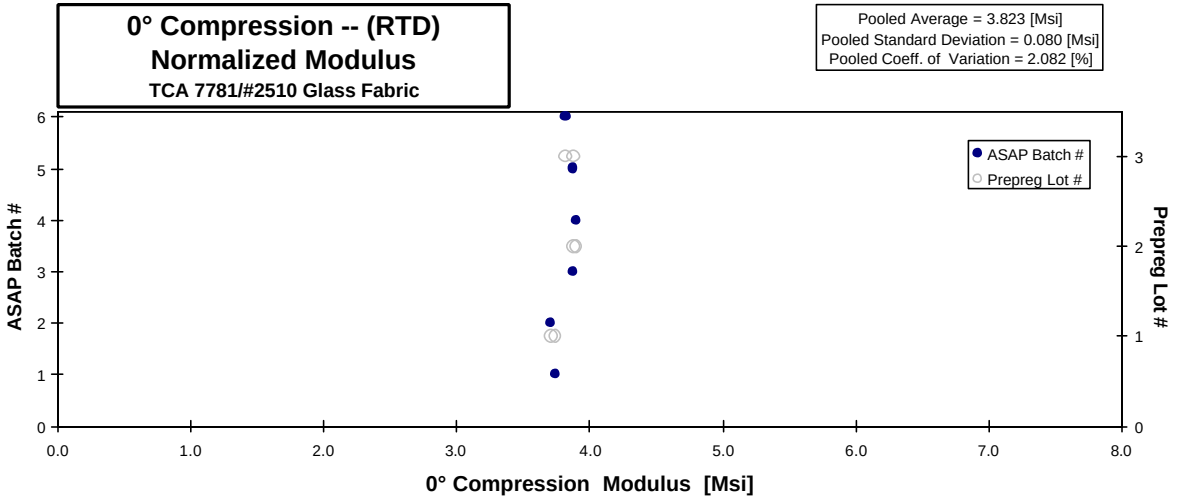
0° Compression -- (RTD)
Strength & Modulus
TCA 7781/#2510 Glass Fabric

normalizing t_{ply} [in]: 0.0104

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
A1-911-081-1-9	A	1	1	72.578		0.131	12	0.01089	76.003	
A1-911-081-1-10	A	1	1	69.244		0.131	12	0.01089	72.512	
A2-911-081-1-17	A	1	1	64.216		0.131	12	0.01089	67.247	
A2-911-081-1-3	A	1	1		3.526	0.132	12	0.01104		3.742
B1-911-081-1-9	B	1	2	76.687		0.123	12	0.01024	75.489	
B2-911-081-1-17	B	1	2	80.318		0.123	12	0.01024	79.063	
B2-911-081-1-18	B	1	2	84.268		0.123	12	0.01024	82.951	
B2-911-081-1-3	B	1	2		3.774	0.123	12	0.01023		3.711
A1-911-082-1-9	A	2	3	76.633		0.120	12	0.01004	73.943	
A1-911-082-1-10	A	2	3	75.606		0.120	12	0.01004	72.953	
A2-911-082-1-17	A	2	3	73.310		0.120	12	0.01004	70.737	
A2-911-082-1-1	A	2	3		4.036	0.120	12	0.01000		3.880
B1-911-082-1-9	B	2	4	77.525		0.122	12	0.01020	76.015	
B2-911-082-1-17	B	2	4	78.093		0.122	12	0.01020	76.572	
B2-911-082-1-18	B	2	4	81.066		0.122	12	0.01020	79.488	
B2-911-082-1-1	B	2	4		3.931	0.124	12	0.01032		3.902
A1-911-083-1-9	A	3	5	79.296		0.127	12	0.01057	80.611	
A1-911-083-1-10	A	3	5	76.353		0.127	12	0.01057	77.620	
A2-911-083-1-17	A	3	5	81.982		0.127	12	0.01057	83.342	
A2-911-083-1-1	A	3	5		3.826	0.127	12	0.01055		3.880
B1-911-083-1-9	B	3	6	79.529		0.124	12	0.01030	78.771	
B2-911-083-1-17	B	3	6	74.648		0.124	12	0.01030	73.936	
B2-911-083-1-18	B	3	6	75.508		0.124	12	0.01030	74.788	
B2-911-083-1-1	B	3	6		3.958	0.120	12	0.01004		3.821

Average	**76.492**	**3.842**		**$Average_{norm}$**	**0.01037**	**76.225**	**3.823**
Standard Dev.	**4.733**	**0.181**		**$Standard\ Dev._{norm}$**		**4.135**	**0.080**
Coeff. of Var. [%]	**6.187**	**4.714**		**$Coeff.\ of\ Var.\ [\%]_{norm}$**		**5.425**	**2.082**
Min.	**64.216**	**3.526**		**Min.**	**0.0100**	**67.247**	**3.711**
Max.	**84.268**	**4.036**		**Max.**	**0.0110**	**83.342**	**3.902**
Number of Spec.	**18**	**6**		**Number of Spec.**		**18**	**6**



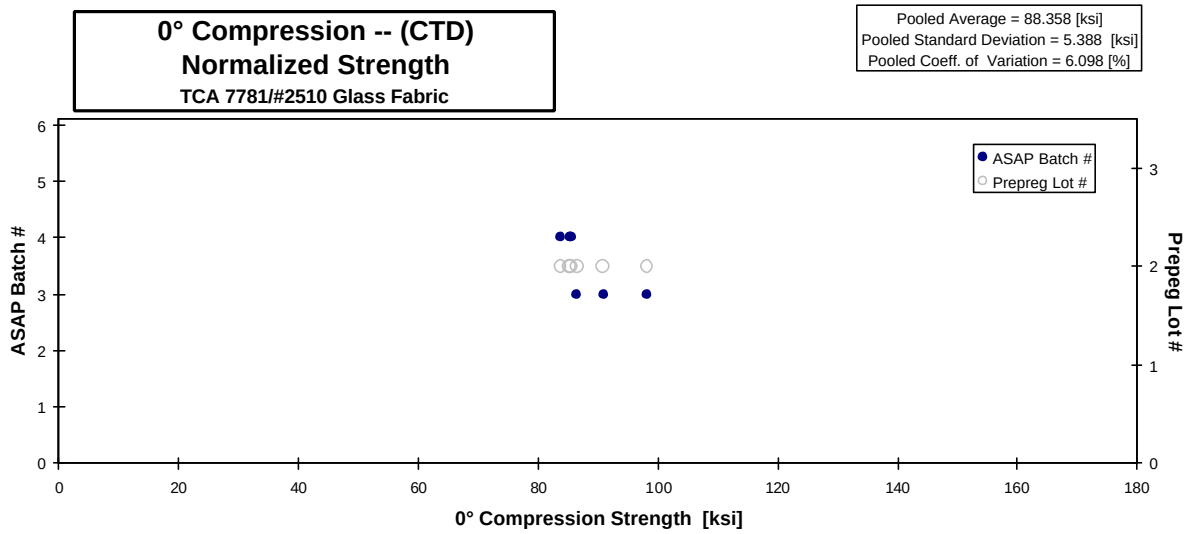


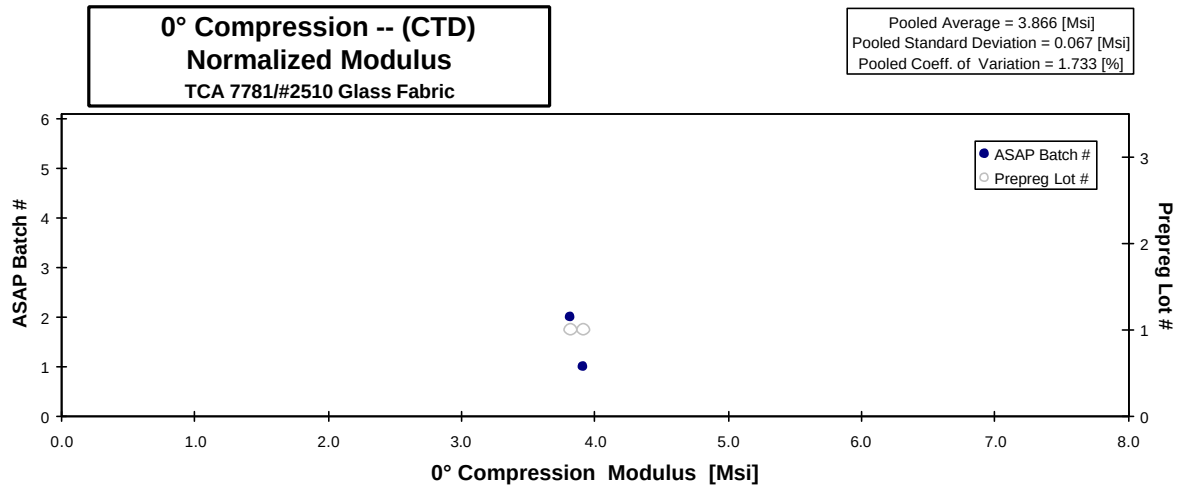
0° Compression -- (CTD)
Strength & Modulus
TCA 7781/#2510 Glass Fabric

normalizing t_{ply} [in]: 0.0104

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
A1-911-082-1-5	A	2	3	86.575		0.125	12	0.01039	86.506	
A1-911-082-1-6	A	2	3	90.935		0.125	12	0.01039	90.863	
A1-911-082-1-7	A	2	3	98.281		0.125	12	0.01039	98.202	
A2-911-081-1-1	A	1	1		3.639	0.134	12	0.01118		3.913
B1-911-082-1-8	B	2	4	89.478		0.119	12	0.00992	85.319	
B1-911-082-1-9	B	2	4	89.670		0.119	12	0.00992	85.503	
B1-911-082-1-10	B	2	4	87.838		0.119	12	0.00992	83.755	
B2-911-081-1-1	B	1	2		3.906	0.122	12	0.01017		3.819

Average	**90.463**	**3.773**		**$Average_{norm}$**	**0.01028**	**88.358**	**3.866**
Standard Dev.	**4.122**	**0.189**		**$Standard\ Dev._{norm}$**		**5.388**	**0.067**
Coeff. of Var. [%]	**4.556**	**5.004**		**$Coeff.\ of\ Var.\ [\%]_{norm}$**		**6.098**	**1.733**
Min.	**86.575**	**3.639**		**Min.**	**0.0099**	**83.755**	**3.819**
Max.	**98.281**	**3.906**		**Max.**	**0.0112**	**98.202**	**3.913**
Number of Spec.	**6**	**2**		**Number of Spec.**		**6**	**2**





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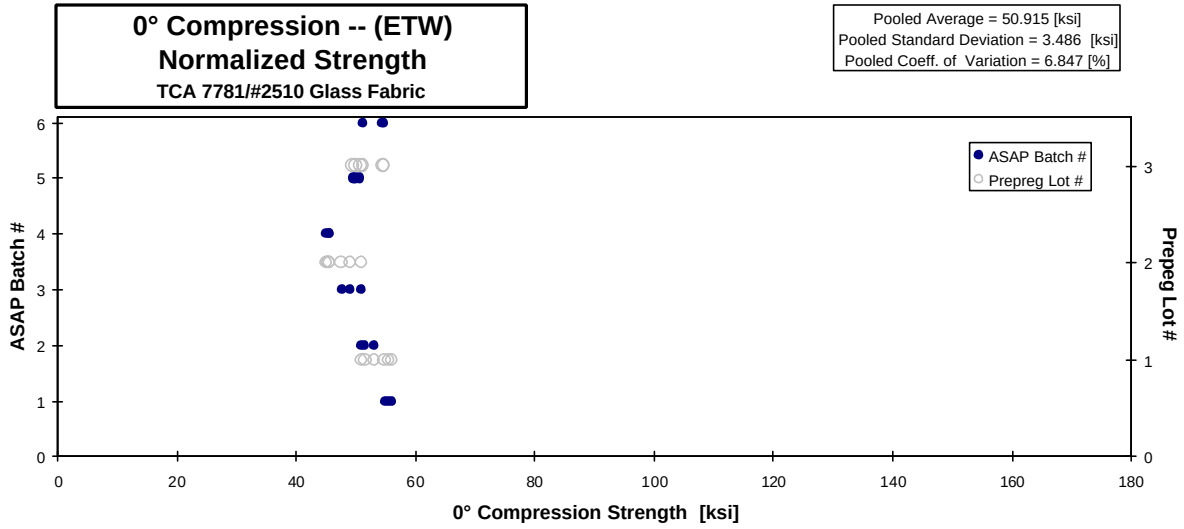
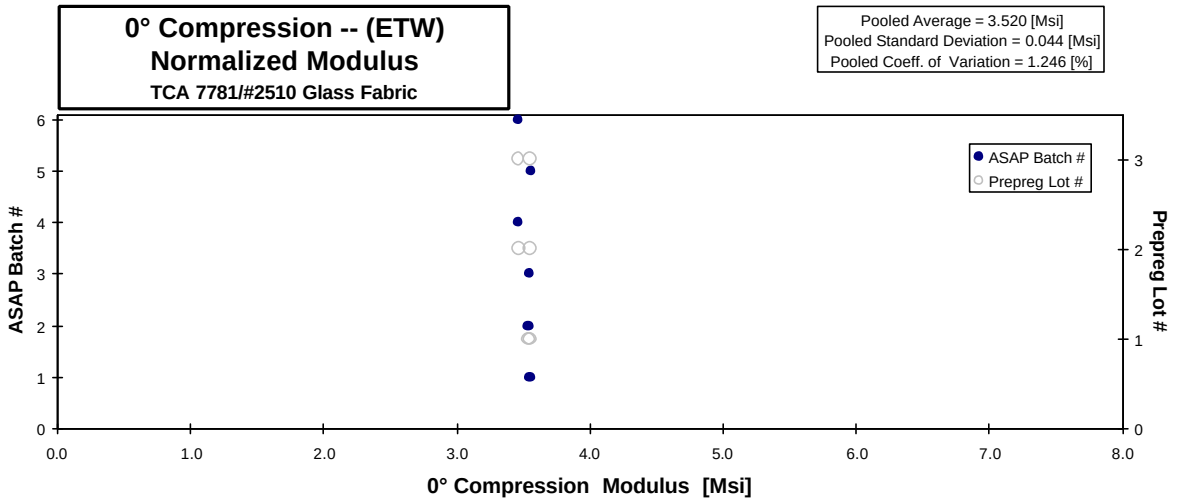
0° Compression -- (ETW)
Strength & Modulus
TCA 7781/#2510 Glass Fabric

normalizing t_{ply} [in]: 0.0104

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
A1-911-081-1-1	A	1	1	54.455		0.129	12	0.01071	56.070	
A1-911-081-1-2	A	1	1	53.913		0.129	12	0.01071	55.511	
A1-911-081-1-3	A	1	1	53.295		0.129	12	0.01071	54.876	
A2-911-081-1-5	A	1	1		3.372	0.131	12	0.01096		3.552
B1-911-081-1-1	B	1	2	50.052		0.129	12	0.01071	51.536	
B1-911-081-1-2	B	1	2	51.595		0.129	12	0.01071	53.125	
B1-911-081-1-3	B	1	2	49.488		0.129	12	0.01071	50.956	
B2-911-081-1-5	B	1	2		3.593	0.123	12	0.01024		3.539
A1-911-082-1-1	A	2	3	47.528		0.125	12	0.01042	47.604	
A1-911-082-1-2	A	2	3	48.965		0.125	12	0.01042	49.043	
A1-911-082-1-3	A	2	3	50.825		0.125	12	0.01042	50.907	
A2-911-082-1-3	A	2	3		3.643	0.122	12	0.01013		3.547
B1-911-082-1-1	B	2	4	46.021		0.122	12	0.01017	44.988	
B1-911-082-1-2	B	2	4	46.522		0.122	12	0.01017	45.479	
B1-911-082-1-3	B	2	4	46.652		0.122	12	0.01017	45.605	
B2-911-082-1-3	B	2	4		3.510	0.123	12	0.01027		3.465
A1-911-083-1-1	A	3	5	50.005		0.127	12	0.01056	50.754	
A1-911-083-1-2	A	3	5	49.254		0.127	12	0.01056	49.992	
A1-911-083-1-3	A	3	5	48.802		0.127	12	0.01056	49.533	
A2-911-083-1-3	A	3	5		3.495	0.127	12	0.01058		3.555
B1-911-083-1-1	B	3	6	54.947		0.124	12	0.01032	54.520	
B1-911-083-1-2	B	3	6	55.185		0.124	12	0.01032	54.756	
B1-911-083-1-3	B	3	6	51.611		0.124	12	0.01032	51.210	
B2-911-083-1-3	B	3	6		3.532	0.122	12	0.01020		3.463

Average	**50.506**	**3.524**		**$Average_{norm}$**	**0.01046**	**50.915**	**3.520**
Standard Dev.	**2.942**	**0.093**		**$Standard\ Dev._{norm}$**		**3.486**	**0.044**
Coeff. of Var. [%]	**5.825**	**2.634**		**$Coeff.\ of\ Var.\ [\%]_{norm}$**		**6.847**	**1.246**
Min.	**46.021**	**3.372**		**Min.**	**0.0101**	**44.988**	**3.463**
Max.	**55.185**	**3.643**		**Max.**	**0.0110**	**56.070**	**3.555**
Number of Spec.	**18**	**6**		**Number of Spec.**		**18**	**6**



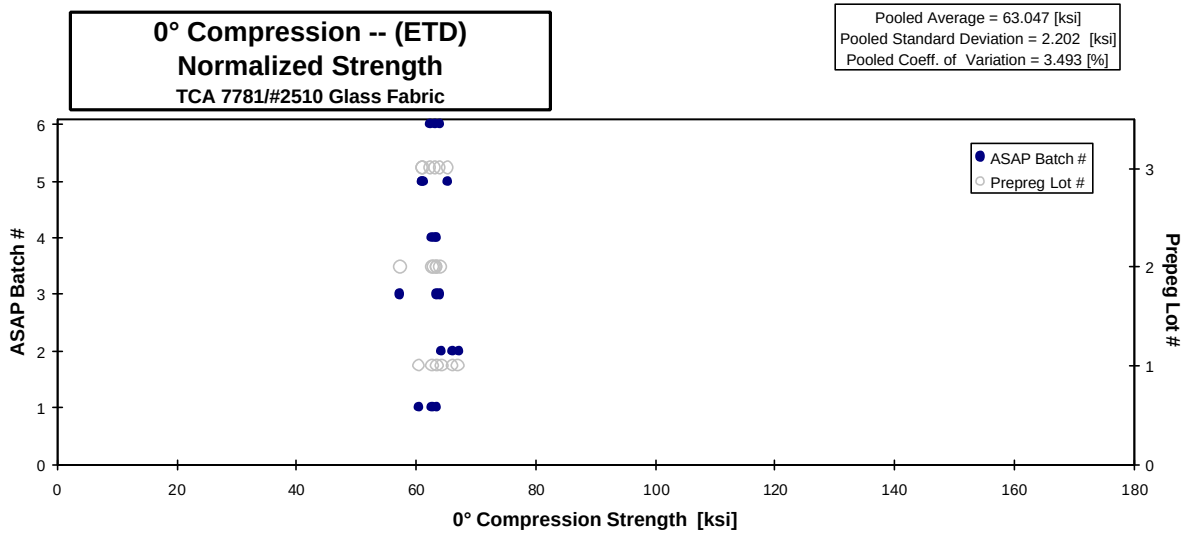


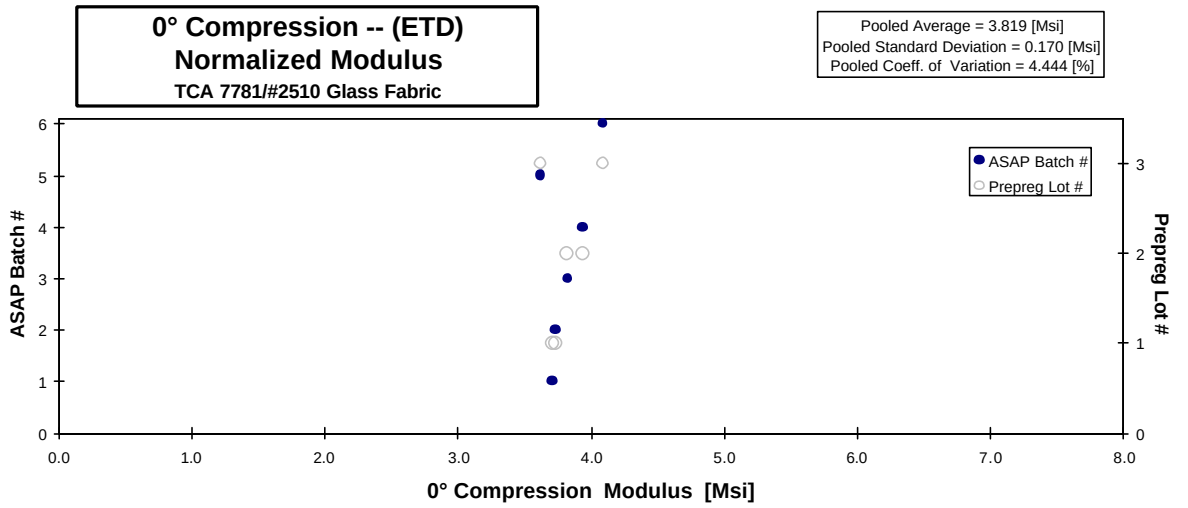
0° Compression -- (ETD)
Strength & Modulus
TCA 7781/#2510 Glass Fabric

normalizing t_{ply} [in]: 0.0104

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
A1-911-081-1-11	A	1	1	60.596		0.131	12	0.01089	63.456	
A2-911-081-1-18	A	1	1	59.895		0.131	12	0.01089	62.722	
A2-911-081-1-19	A	1	1	57.697		0.131	12	0.01089	60.420	
A2-911-081-1-4	A	1	1		3.512	0.132	12	0.01099		3.711
B1-911-081-1-10	B	1	2	65.318		0.123	12	0.01024	64.298	
B1-911-081-1-11	B	1	2	68.122		0.123	12	0.01024	67.058	
B2-911-081-1-19	B	1	2	67.181		0.123	12	0.01024	66.131	
B2-911-081-1-4	B	1	2		3.791	0.123	12	0.01024		3.734
A1-911-082-1-11	A	2	3	59.422		0.120	12	0.01004	57.336	
A2-911-082-1-18	A	2	3	66.365		0.120	12	0.01004	64.036	
A2-911-082-1-19	A	2	3	65.692		0.120	12	0.01004	63.386	
A2-911-082-1-2	A	2	3		3.940	0.121	12	0.01008		3.820
B1-911-082-1-10	B	2	4	63.943		0.122	12	0.01020	62.698	
B1-911-082-1-11	B	2	4	64.302		0.122	12	0.01020	63.050	
B2-911-082-1-19	B	2	4	64.641		0.122	12	0.01020	63.382	
B2-911-082-1-2	B	2	4		3.974	0.124	12	0.01031		3.939
A1-911-083-1-11	A	3	5	60.185		0.127	12	0.01057	61.183	
A2-911-083-1-18	A	3	5	64.242		0.127	12	0.01057	65.308	
A2-911-083-1-19	A	3	5	59.989		0.127	12	0.01057	60.985	
A2-911-083-1-2	A	3	5		3.567	0.127	12	0.01056		3.623
B1-911-083-1-10	B	3	6	63.198		0.126	12	0.01053	63.963	
B1-911-083-1-11	B	3	6	62.340		0.126	12	0.01053	63.094	
B2-911-083-1-19	B	3	6	61.600		0.126	12	0.01053	62.345	
B2-911-083-1-2	B	3	6		4.203	0.121	12	0.01012		4.088

Average	**63.040**	**3.831**	**$Average_{norm}$**	**0.01040**	**63.047**	**3.819**
Standard Dev.	**2.973**	**0.262**	**$Standard\ Dev._{norm}$**		**2.202**	**0.170**
Coeff. of Var. [%]	**4.715**	**6.846**	**$Coeff.\ of\ Var.\ [\%]_{norm}$**		**3.493**	**4.444**
Min.	**57.697**	**3.512**	**Min.**	**0.0100**	**57.336**	**3.623**
Max.	**68.122**	**4.203**	**Max.**	**0.0110**	**67.058**	**4.088**
Number of Spec.	**18**	**6**	**Number of Spec.**		**18**	**6**



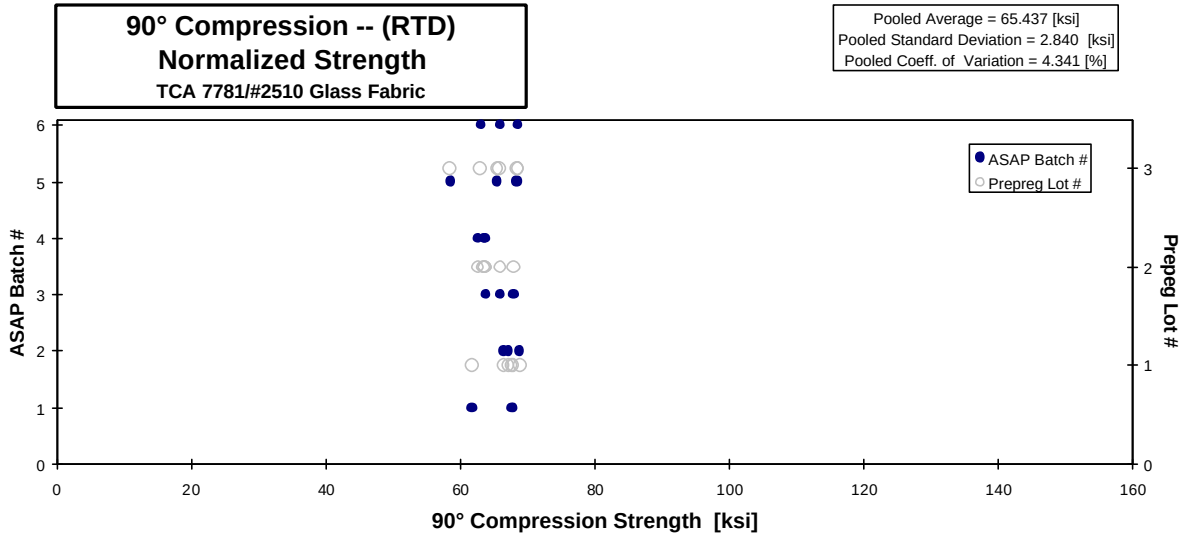


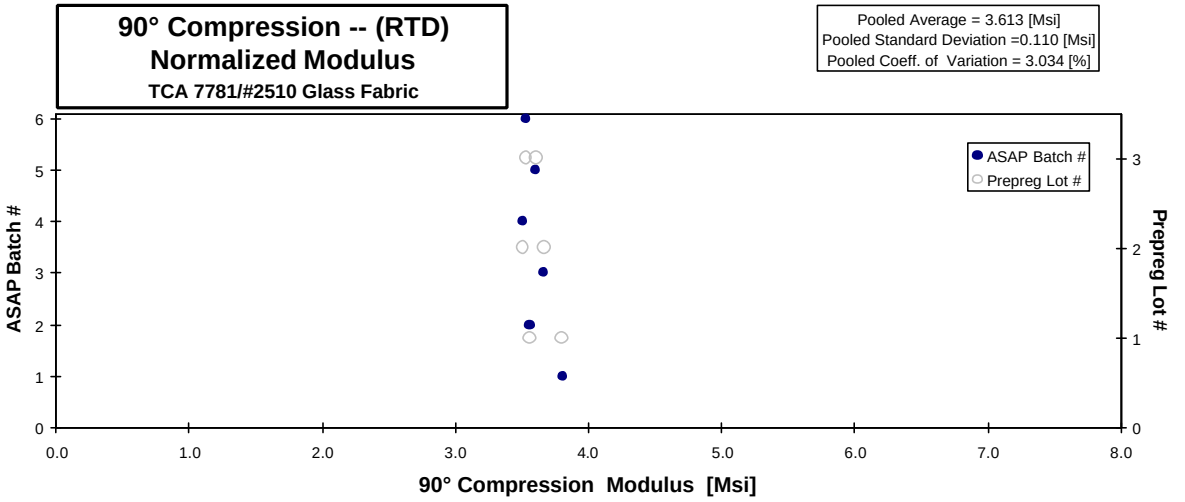
90° Compression -- (RTD)
Strength & Modulus
TCA 7781/#2510 Glass Fabric

normalizing t_{ply} [in]: 0.0104

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
A1-911-081-1-9	A	1	1	67.057		0.126	12	0.01053	67.901	
A1-911-081-1-10	A	1	1	66.811		0.126	12	0.01053	67.652	
A2-911-081-1-17	A	1	1	61.038		0.126	12	0.01053	61.806	
A2-911-081-1-3	A	1	1		3.758	0.126	12	0.01053		3.805
B1-911-081-1-9	B	1	2	67.286		0.125	12	0.01039	67.205	
B2-911-081-1-17	B	1	2	68.977		0.125	12	0.01039	68.895	
B2-911-081-1-18	B	1	2	66.587		0.125	12	0.01039	66.507	
B2-911-081-1-3	B	1	2		3.560	0.125	12	0.01040		3.560
A2-911-082-1-17	A	2	3	69.420		0.122	12	0.01019	68.019	
A2-911-082-1-20	A	2	3	65.114		0.122	12	0.01019	63.799	
A2-911-082-1-21	A	2	3	67.372		0.122	12	0.01019	66.011	
A2-911-082-1-1	A	2	3		3.781	0.121	12	0.01009		3.666
B1-911-082-1-9	B	2	4	62.985		0.126	12	0.01053	63.763	
B2-911-082-1-17	B	2	4	61.876		0.126	12	0.01053	62.639	
B2-911-082-1-18	B	2	4	62.785		0.126	12	0.01053	63.560	
B2-911-082-1-1	B	2	4		3.480	0.126	12	0.01049		3.509
A1-911-083-1-9	A	3	5	68.457		0.125	12	0.01041	68.512	
A1-911-083-1-10	A	3	5	65.446		0.125	12	0.01041	65.499	
A2-911-083-1-17	A	3	5	58.504		0.125	12	0.01041	58.551	
A2-911-083-1-1	A	3	5		3.572	0.126	12	0.01049		3.605
B1-911-083-1-9	B	3	6	66.090		0.124	12	0.01037	65.900	
B2-911-083-1-17	B	3	6	68.813		0.124	12	0.01037	68.615	
B2-911-083-1-18	B	3	6	63.223		0.124	12	0.01037	63.041	
B2-911-083-1-1	B	3	6		3.578	0.123	12	0.01026		3.531

Average	**65.436**	**3.621**	**$Average_{norm}$**	**0.01040**	**65.437**	**3.613**
Standard Dev.	**3.073**	**0.120**	**$Standard\ Dev._{norm}$**		**2.840**	**0.110**
Coeff. of Var. [%]	**4.696**	**3.319**	**$Coeff.\ of\ Var.\ [\%]_{norm}$**		**4.341**	**3.034**
Min.	**58.504**	**3.480**	**Min.**	**0.0101**	**58.551**	**3.509**
Max.	**69.420**	**3.781**	**Max.**	**0.0105**	**68.895**	**3.805**
Number of Spec.	**18**	**6**	**Number of Spec.**		**18**	**6**



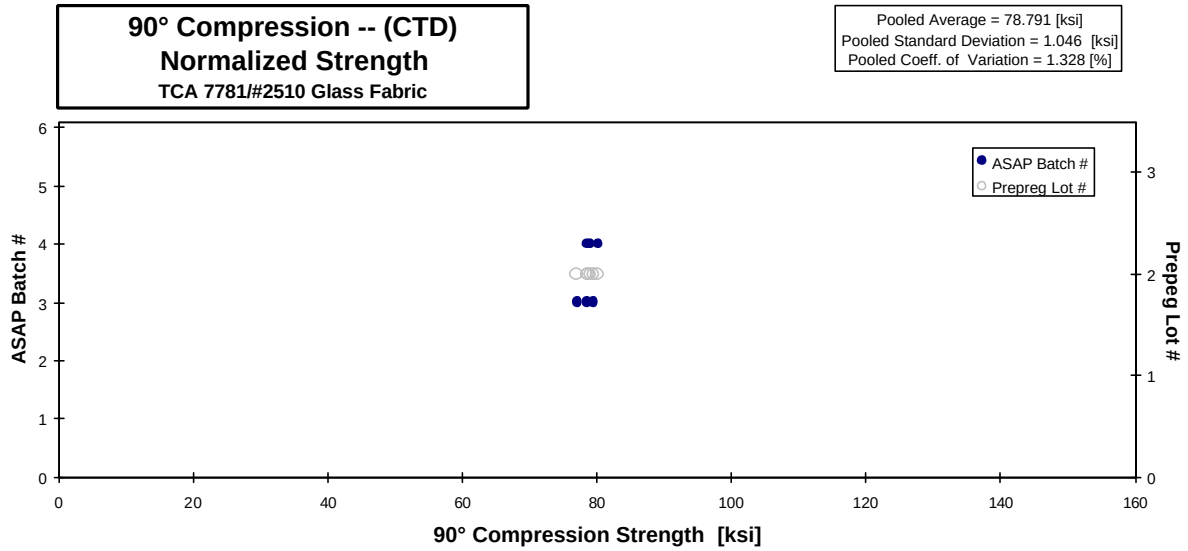


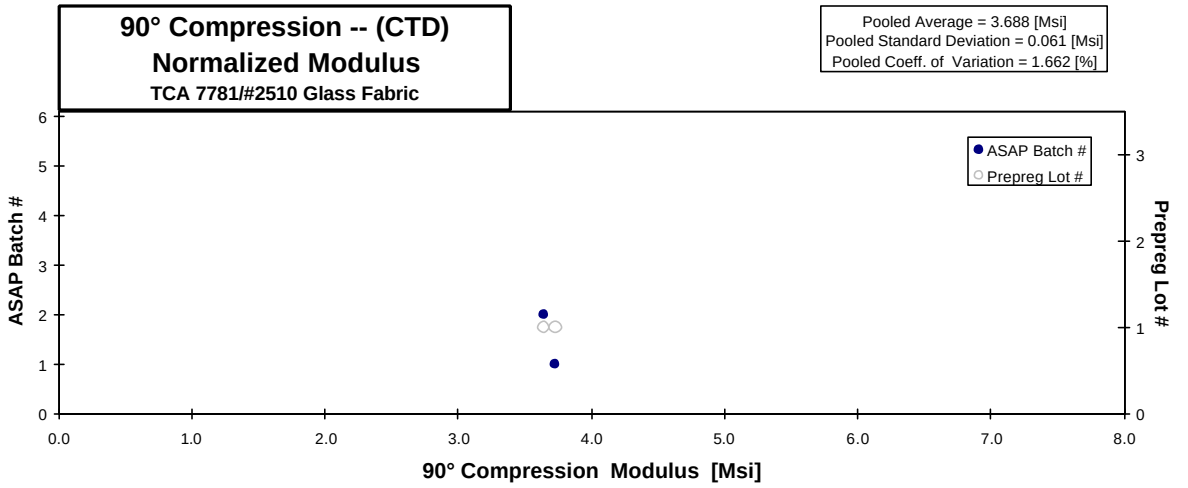
90° Compression -- (CTD)
Strength & Modulus
TCA 7781/#2510 Glass Fabric

normalizing t_{ply} [in]: 0.0104

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
A-911-082-1-1	A	2	3	77.709		0.124	12	0.01031	77.024	
A-911-082-1-2	A	2	3	80.153		0.124	12	0.01031	79.447	
A-911-082-1-3	A	2	3	79.212		0.124	12	0.01031	78.514	
A2-911-081-1-1	A	1	1		3.693	0.126	12	0.01051		3.732
B1-911-082-1-7	B	2	4	78.687		0.125	12	0.01044	79.003	
B1-911-082-1-8	B	2	4	79.804		0.125	12	0.01044	80.123	
B1-911-082-1-11	B	2	4	78.324		0.125	12	0.01044	78.638	
B2-911-081-1-1	B	1	2		3.654	0.125	12	0.01038		3.645

	Strength [ksi]	Modulus [Msi]		t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
Average	**78.981**	**3.674**	**$Average_{norm}$**	**0.01039**	**78.791**	**3.688**
Standard Dev.	**0.921**	**0.028**	**$Standard\ Dev._{norm}$**		**1.046**	**0.061**
Coeff. of Var. [%]	**1.166**	**0.759**	**$Coeff.\ of\ Var.\ [\%]_{norm}$**		**1.328**	**1.662**
Min.	**77.709**	**3.654**	**Min.**	**0.0103**	**77.024**	**3.645**
Max.	**80.153**	**3.693**	**Max.**	**0.0105**	**80.123**	**3.732**
Number of Spec.	**6**	**2**	**Number of Spec.**		**6**	**2**



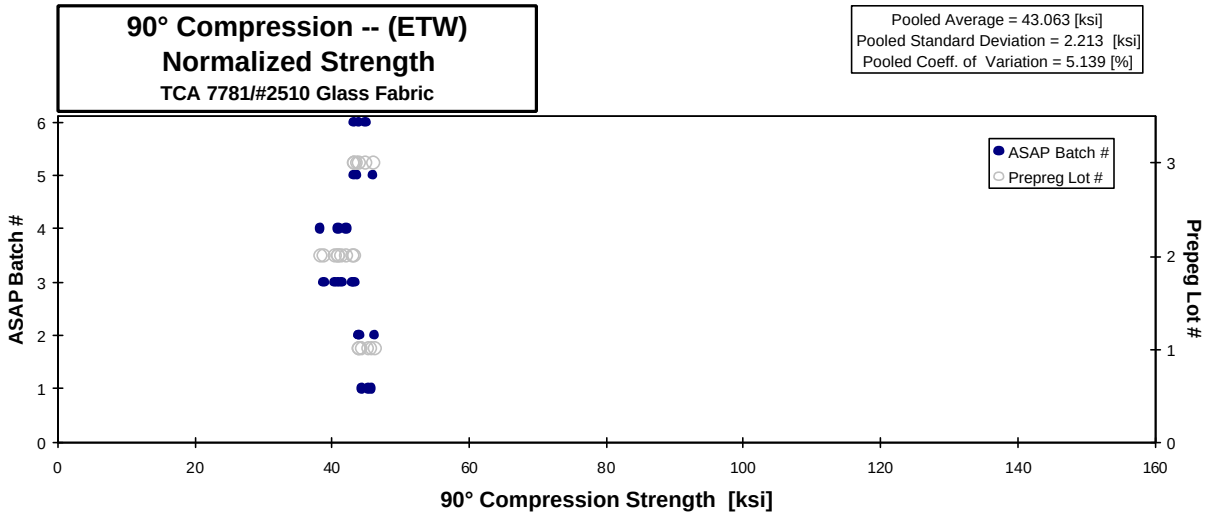


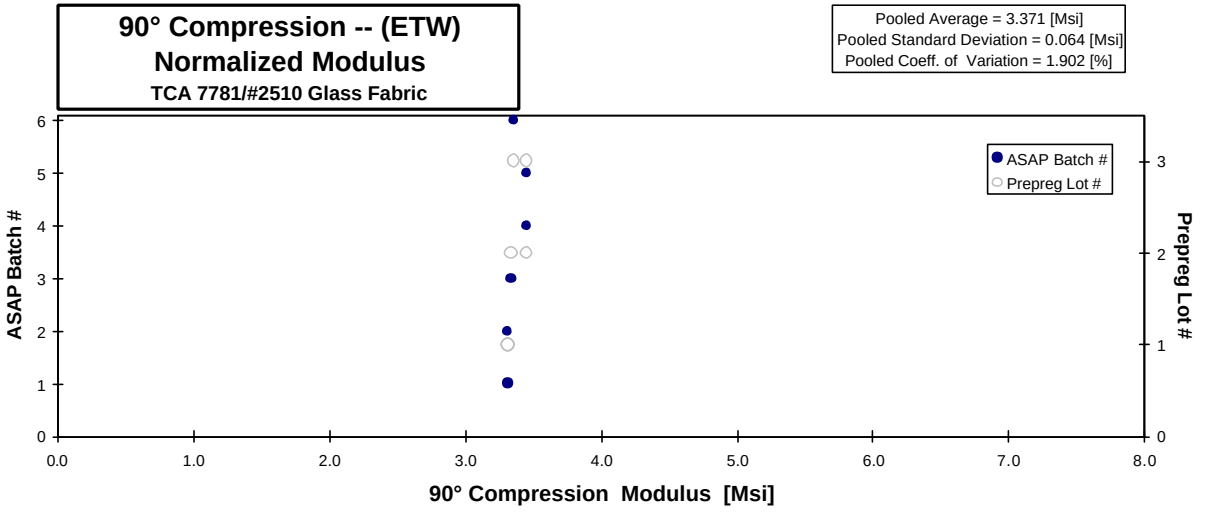
90° Compression -- (ETW)
Strength & Modulus
TCA 7781/#2510 Glass Fabric

normalizing t_{ply} [in]: 0.0104

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
A1-911-081-1-1	A	1	1	43.613		0.127	12	0.01059	44.410	
A1-911-081-1-2	A	1	1	44.917		0.127	12	0.01059	45.738	
A1-911-081-1-3	A	1	1	44.472		0.127	12	0.01059	45.284	
A2-911-081-1-5	A	1	1		3.270	0.127	12	0.01054		3.316
B1-911-081-1-1	B	1	2	43.199		0.127	12	0.01059	43.989	
B1-911-081-1-2	B	1	2	45.433		0.127	12	0.01059	46.263	
B1-911-081-1-3	B	1	2	43.170		0.127	12	0.01059	43.959	
B2-911-081-1-5	B	1	2		3.307	0.125	12	0.01041		3.311
A1-911-082-1-4	A	2	3	43.926		0.123	12	0.01025	43.293	
A1-911-082-1-5	A	2	3	40.225		0.126	12	0.01046	40.450	
A1-911-082-1-6	A	2	3	43.326		0.124	12	0.01033	43.049	
A2-911-082-1-2	A	2	3	38.972		0.125	12	0.01038	38.878	
A2-911-082-1-3	A	2	3	41.604		0.125	12	0.01038	41.504	
A2-911-082-1-3	A	2	3		3.416	0.122	12	0.01017		3.339
A2-911-082-1-4	A	2	3	41.192		0.124	12	0.01033	40.928	
B1-911-082-1-1	B	2	4	40.761		0.129	12	0.01075	42.133	
B1-911-082-1-2	B	2	4	39.670		0.129	12	0.01075	41.006	
B1-911-082-1-3	B	2	4	37.135		0.129	12	0.01075	38.384	
B2-911-082-1-3	B	2	4		3.404	0.126	12	0.01054		3.450
A1-911-083-1-1	A	3	5	45.890		0.125	12	0.01044	46.085	
A1-911-083-1-2	A	3	5	43.065		0.125	12	0.01044	43.248	
A1-911-083-1-3	A	3	5	43.470		0.125	12	0.01044	43.655	
A2-911-083-1-3	A	3	5		3.447	0.125	12	0.01041		3.451
B1-911-083-1-1	B	3	6	44.194		0.127	12	0.01057	44.913	
B1-911-083-1-2	B	3	6	43.253		0.127	12	0.01057	43.957	
B1-911-083-1-3	B	3	6	42.514		0.127	12	0.01057	43.206	
B2-911-083-1-3	B	3	6		3.381	0.124	12	0.01033		3.358

Average	**42.572**	**3.371**	**$Average_{norm}$**	**0.01049**	**43.063**	**3.371**
Standard Dev.	**2.228**	**0.068**	**Standard $Dev._{norm}$**		**2.213**	**0.064**
Coeff. of Var. [%]	**5.233**	**2.017**	**Coeff. of Var. $[\%]_{norm}$**		**5.139**	**1.902**
Min.	**37.135**	**3.270**	**Min.**	**0.0102**	**38.384**	**3.311**
Max.	**45.890**	**3.447**	**Max.**	**0.0108**	**46.263**	**3.451**
Number of Spec.	**21**	**6**	**Number of Spec.**		**21**	**6**



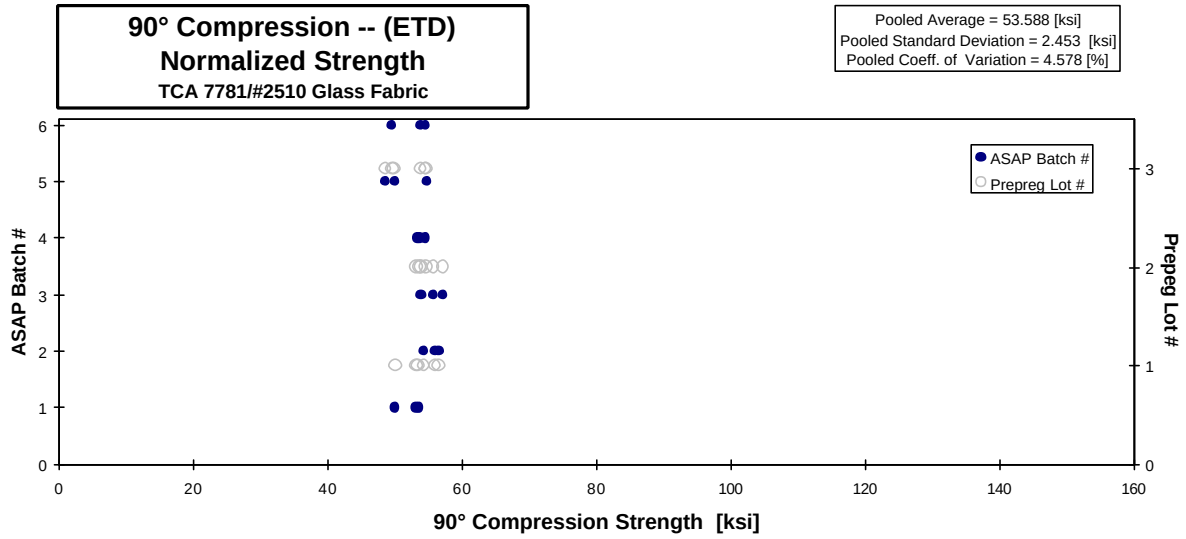


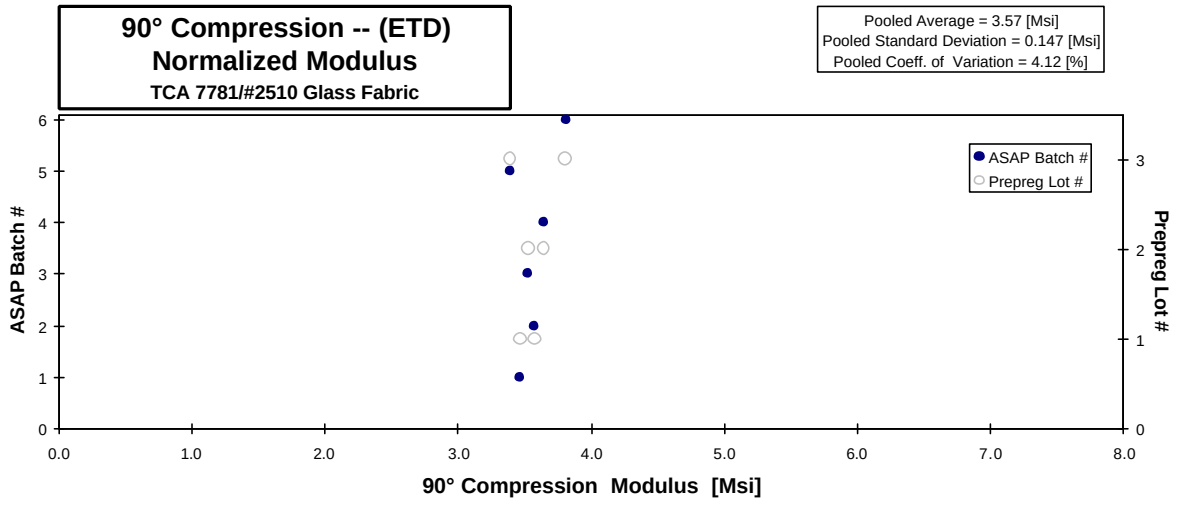
90° Compression -- (ETD)
Strength & Modulus
TCA 7781/#2510 Glass Fabric

normalizing t_{ply} [in]: 0.0104

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]	$Strength_{norm}$ [ksi]	$Modulus_{norm}$ [Msi]
A1-911-081-1-11	A	1	1	52.641		0.126	12	0.01053	53.303	
A2-911-081-1-18	A	1	1	49.546		0.126	12	0.01053	50.169	
A2-911-081-1-19	A	1	1	52.919		0.126	12	0.01053	53.584	
A2-911-081-1-4	A	1	1		3.424	0.126	12	0.01053		3.467
B1-911-081-1-10	B	1	2	54.458		0.125	12	0.01039	54.393	
B1-911-081-1-11	B	1	2	56.699		0.125	12	0.01039	56.631	
B2-911-081-1-19	B	1	2	56.066		0.125	12	0.01039	55.999	
B2-911-081-1-4	B	1	2		3.572	0.125	12	0.01042		3.577
A2-911-082-1-18	A	2	3	58.405		0.122	12	0.01019	57.225	
A2-911-082-1-19	A	2	3	56.987		0.122	12	0.01019	55.836	
A2-911-082-1-23	A	2	3	55.148		0.122	12	0.01019	54.034	
A2-911-082-1-2	A	2	3		3.628	0.121	12	0.01011		3.527
B1-911-082-1-10	B	2	4	53.119		0.126	12	0.01053	53.774	
B1-911-082-1-11	B	2	4	54.022		0.126	12	0.01053	54.688	
B2-911-082-1-19	B	2	4	52.668		0.126	12	0.01053	53.317	
B2-911-082-1-2	B	2	4		3.610	0.126	12	0.01050		3.646
A1-911-083-1-11	A	3	5	54.744		0.125	12	0.01041	54.788	
A2-911-083-1-18	A	3	5	48.596		0.125	12	0.01041	48.635	
A2-911-083-1-19	A	3	5	49.993		0.125	12	0.01041	50.033	
A2-911-083-1-2	A	3	5		3.372	0.125	12	0.01046		3.390
B1-911-083-1-10	B	3	6	54.057		0.124	12	0.01037	53.901	
B1-911-083-1-11	B	3	6	49.821		0.124	12	0.01037	49.677	
B2-911-083-1-19	B	3	6	54.755		0.124	12	0.01037	54.597	
B2-911-083-1-2	B	3	6		3.847	0.124	12	0.01030		3.810

Average	**53.591**	**3.575**	**$Average_{norm}$**	**0.01040**	**53.588**	**3.570**
Standard Dev.	**2.740**	**0.169**	**$Standard\ Dev._{norm}$**		**2.453**	**0.147**
Coeff. of Var. [%]	**5.113**	**4.715**	**$Coeff.\ of\ Var.\ [\%]_{norm}$**		**4.578**	**4.120**
Min.	**48.596**	**3.372**	**Min.**	**0.0101**	**48.635**	**3.390**
Max.	**58.405**	**3.847**	**Max.**	**0.0105**	**57.225**	**3.810**
Number of Spec.	**18**	**6**	**Number of Spec.**		**18**	**6**

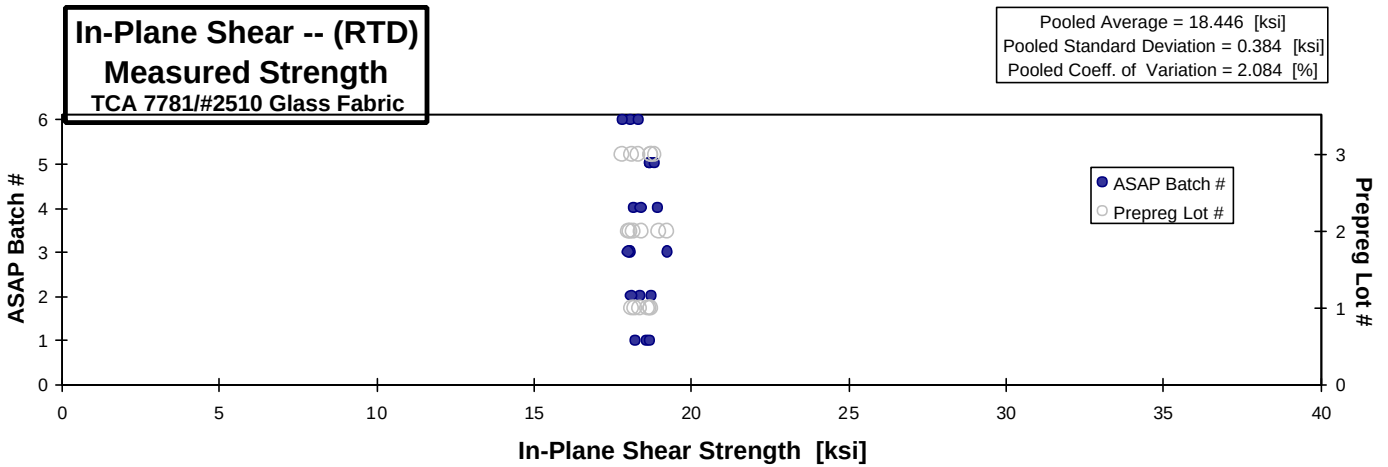


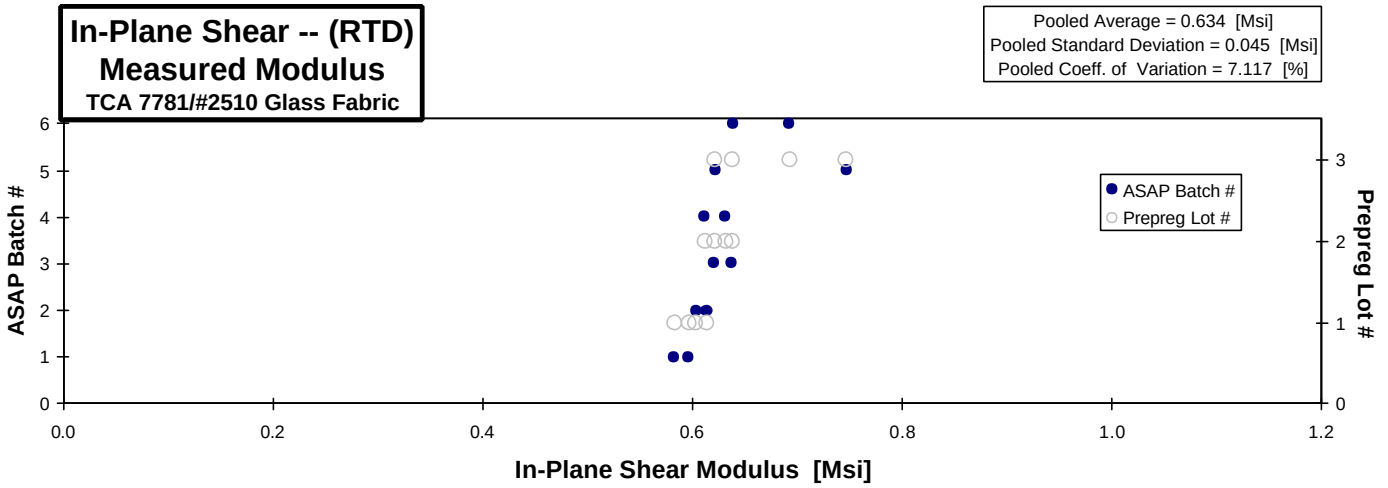


In-Plane Shear -- (RTD)
Strength & Modulus
TCA 7781/#2510 Glass Fabric

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]
A1-911-081-1-11	A	1	1	18.598	0.583	0.125	12	0.01041
A1-911-081-2-2	A	1	1	18.687	0.597	0.123	12	0.01027
A1-911-081-3-2	A	1	1	18.210		0.123	12	0.01026
B1-911-081-1-2	B	1	2	18.732	0.614	0.123	12	0.01023
B1-911-081-2-2	B	1	2	18.369	0.604	0.125	12	0.01044
B1-911-081-3-2	B	1	2	18.104		0.123	12	0.01027
A1-911-082-1-1	A	2	3	18.067	0.621	0.122	12	0.01013
A1-911-082-2-1	A	2	3	18.002	0.638	0.123	12	0.01023
A1-911-082-3-1	A	2	3	19.236		0.122	12	0.01019
B1-911-082-1-1	B	2	4	18.173	0.632	0.122	12	0.01017
B1-911-082-2-1	B	2	4	18.409	0.612	0.122	12	0.01017
B1-911-082-3-1	B	2	4	18.966		0.122	12	0.01016
A1-911-083-1-1	A	3	5	18.713	0.747	0.120	12	0.00999
A1-911-083-2-1	A	3	5	18.712	0.622	0.120	12	0.01001
A1-911-083-3-1	A	3	5	18.848		0.119	12	0.00995
B1-911-083-1-1	B	3	6	18.088	0.693	0.118	12	0.00983
B1-911-083-2-1	B	3	6	18.312	0.639	0.118	12	0.00986
B1-911-083-3-1	B	3	6	17.807		0.119	12	0.00993

Average	**18.446**	**0.634**	**Average**	**0.0101**
Standard Dev.	**0.384**	**0.045**		
Coeff. of Var. [%]	**2.084**	**7.117**		
Min.	**17.807**	**0.583**	**Min.**	**0.0098**
Max.	**19.236**	**0.747**	**Max.**	**0.0104**
Number of Spec.	**18**	**12**		

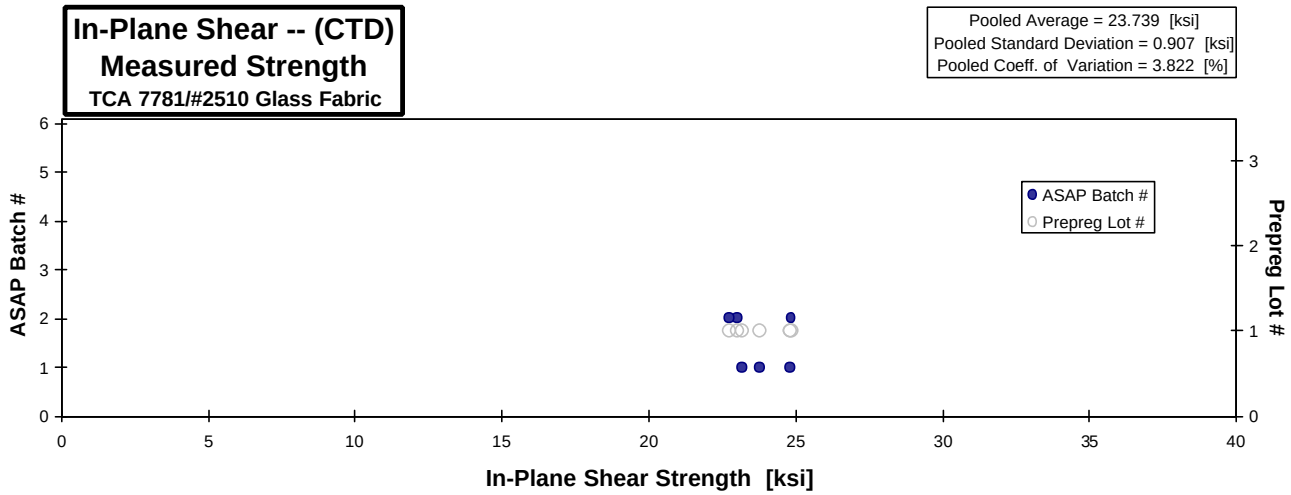


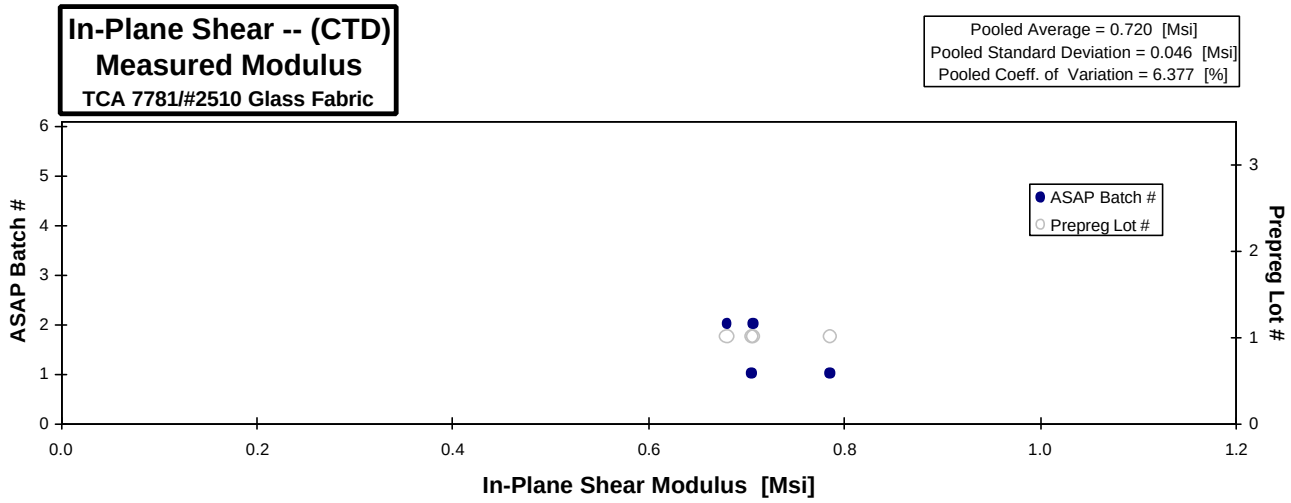


In-Plane Shear -- (CTD)
Strength & Modulus
TCA 7781/#2510 Glass Fabric

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]
A1-911-081-1-1	A	1	1	23.767	0.786	0.123	12	0.01022
A1-911-081-2-1	A	1	1	23.199	0.706	0.123	12	0.01027
A1-911-081-3-1	A	1	1	24.801		0.123	12	0.01023
B1-911-081-1-1	B	1	2	23.034	0.707	0.122	12	0.01015
B1-911-081-2-1	B	1	2	22.770	0.680	0.124	12	0.01034
B1-911-081-3-1	B	1	2	24.862		0.122	12	0.01018

Average	**23.739**	**0.720**	**Average**	**0.0102**
Standard Dev.	**0.907**	**0.046**		
Coeff. of Var. [%]	**3.822**	**6.377**		
Min.	**22.770**	**0.680**	**Min.**	**0.0102**
Max.	**24.862**	**0.786**	**Max.**	**0.0103**
Number of Spec.	**6**	**4**		

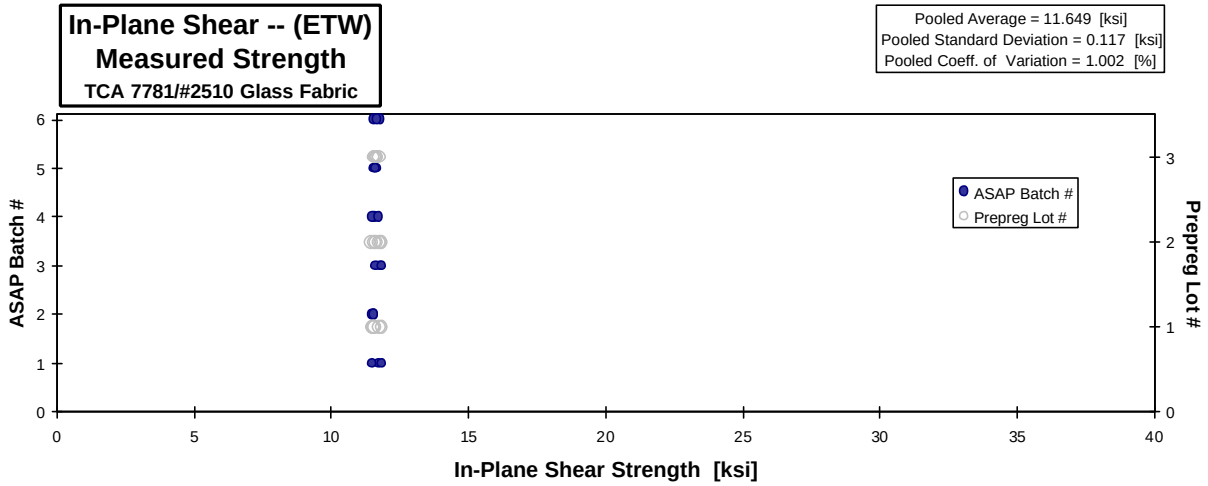


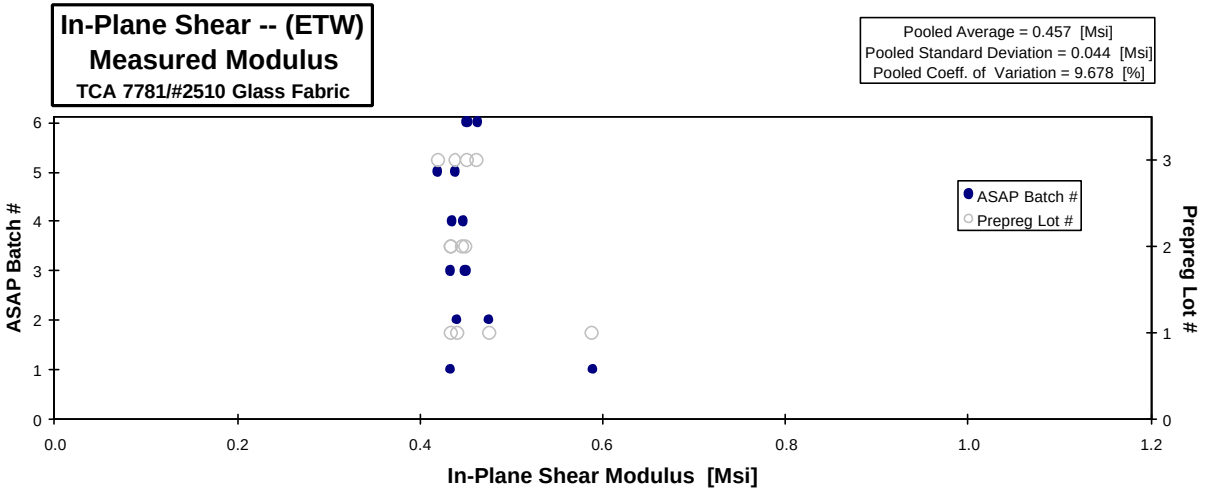


In-Plane Shear -- (ETW)
Strength & Modulus
TCA 7781/#2510 Glass Fabric

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]
A1-911-081-1-4	A	1	1	11.750	0.434	0.124	12	0.01033
A1-911-081-1-5	A	1	1	11.507	0.589	0.124	12	0.01036
A1-911-081-1-6	A	1	1	11.853		0.125	12	0.01039
B1-911-081-1-4	B	1	2	11.566	0.441	0.126	12	0.01048
B1-911-081-1-5	B	1	2	11.504	0.476	0.126	12	0.01052
B1-911-081-1-6	B	1	2	11.570		0.126	12	0.01052
A1-911-082-1-3	A	2	3	11.776	0.450	0.123	12	0.01027
A1-911-082-1-4	A	2	3	11.644	0.434	0.124	12	0.01033
A1-911-082-1-5	A	2	3	11.844		0.125	12	0.01040
B1-911-082-1-3	B	2	4	11.581	0.435	0.123	12	0.01029
B1-911-082-1-4	B	2	4	11.489	0.447	0.124	12	0.01036
B1-911-082-1-5	B	2	4	11.753		0.125	12	0.01039
A1-911-083-1-3	A	3	5	11.650	0.439	0.122	12	0.01016
A1-911-083-1-4	A	3	5	11.564	0.420	0.123	12	0.01022
A1-911-083-1-5	A	3	5	11.632		0.123	12	0.01022
B1-911-083-1-3	B	3	6	11.559	0.452	0.119	12	0.00993
B1-911-083-1-4	B	3	6	11.767	0.463	0.120	12	0.01003
B1-911-083-1-5	B	3	6	11.668		0.122	12	0.01014

Average	**11.649**	**0.457**	**Average**	**0.0103**
Standard Dev.	**0.117**	**0.044**		
Coeff. of Var. [%]	**1.002**	**9.678**		
Min.	**11.489**	**0.420**	**Min.**	**0.0099**
Max.	**11.853**	**0.589**	**Max.**	**0.0105**
Number of Spec.	**18**	**12**		

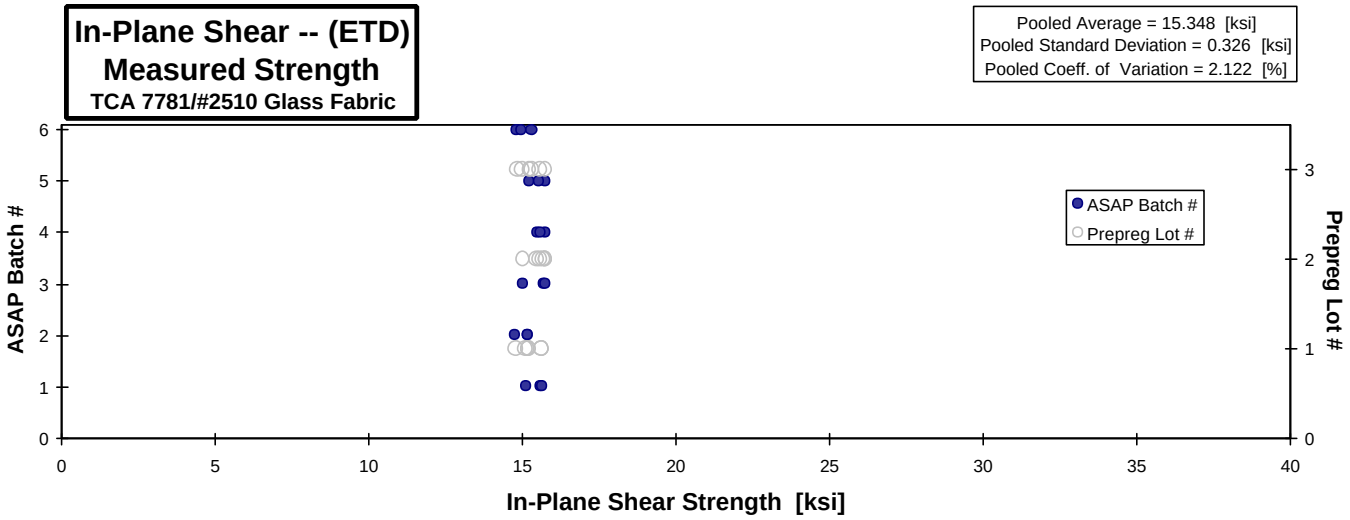


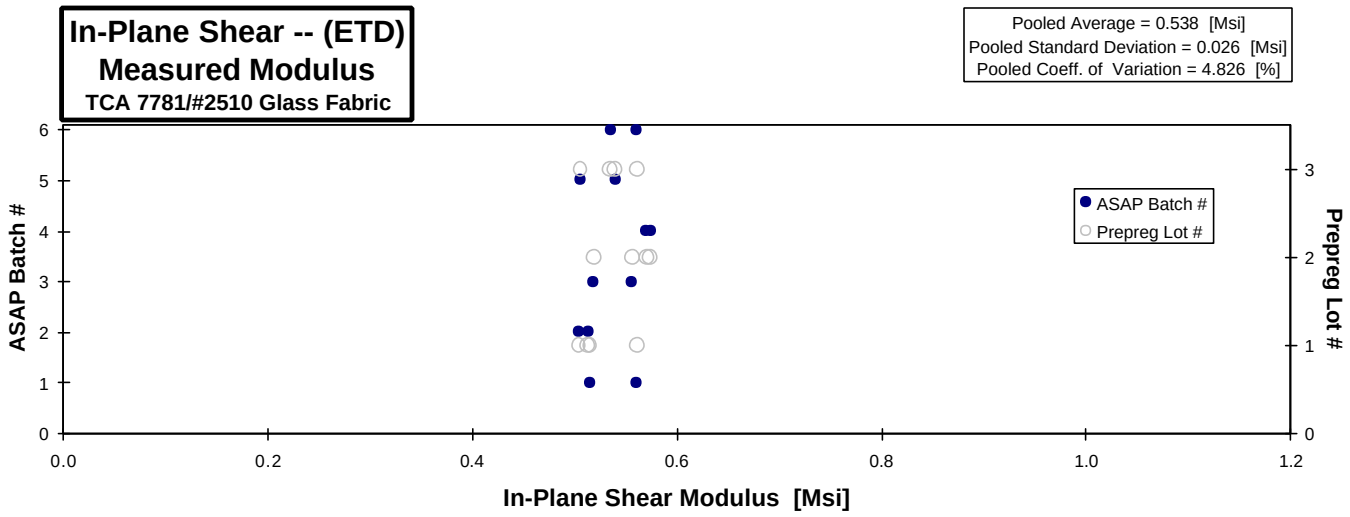


In-Plane Shear -- (ETD)
Strength & Modulus
TCA 7781/#2510 Glass Fabric

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Modulus [Msi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]
A1-911-081-1-3	A	1	1	15.611	0.561	0.123	12	0.01027
A1-911-081-2-3	A	1	1	15.612	0.515	0.124	12	0.01032
A1-911-081-3-3	A	1	1	15.099		0.124	12	0.01033
B1-911-081-1-3	B	1	2	15.166	0.504	0.124	12	0.01035
B1-911-081-2-3	B	1	2	14.771	0.513	0.127	12	0.01058
B1-911-081-3-3	B	1	2	15.195		0.125	12	0.01042
A1-911-082-1-2	A	2	3	15.669	0.519	0.122	12	0.01020
A1-911-082-2-2	A	2	3	15.016	0.556	0.124	12	0.01029
A1-911-082-3-2	A	2	3	15.734		0.123	12	0.01025
B1-911-082-1-2	B	2	4	15.733	0.570	0.123	12	0.01021
B1-911-082-2-2	B	2	4	15.475	0.574	0.123	12	0.01024
B1-911-082-3-2	B	2	4	15.575		0.123	12	0.01025
A1-911-083-1-2	A	3	5	15.749	0.540	0.121	12	0.01005
A1-911-083-2-2	A	3	5	15.222	0.506	0.121	12	0.01012
A1-911-083-3-2	A	3	5	15.541		0.121	12	0.01008
B1-911-083-1-2	B	3	6	14.815	0.561	0.118	12	0.00983
B1-911-083-2-2	B	3	6	15.298	0.535	0.118	12	0.00984
B1-911-083-3-2	B	3	6	14.980		0.119	12	0.00992

Average	**15.348**	**0.538**	**Average**	**0.0102**
Standard Dev.	**0.326**	**0.026**		
Coeff. of Var. [%]	**2.122**	**4.826**		
Min.	**14.771**	**0.504**	**Min.**	**0.0098**
Max.	**15.749**	**0.574**	**Max.**	**0.0106**
Number of Spec.	**18**	**12**		



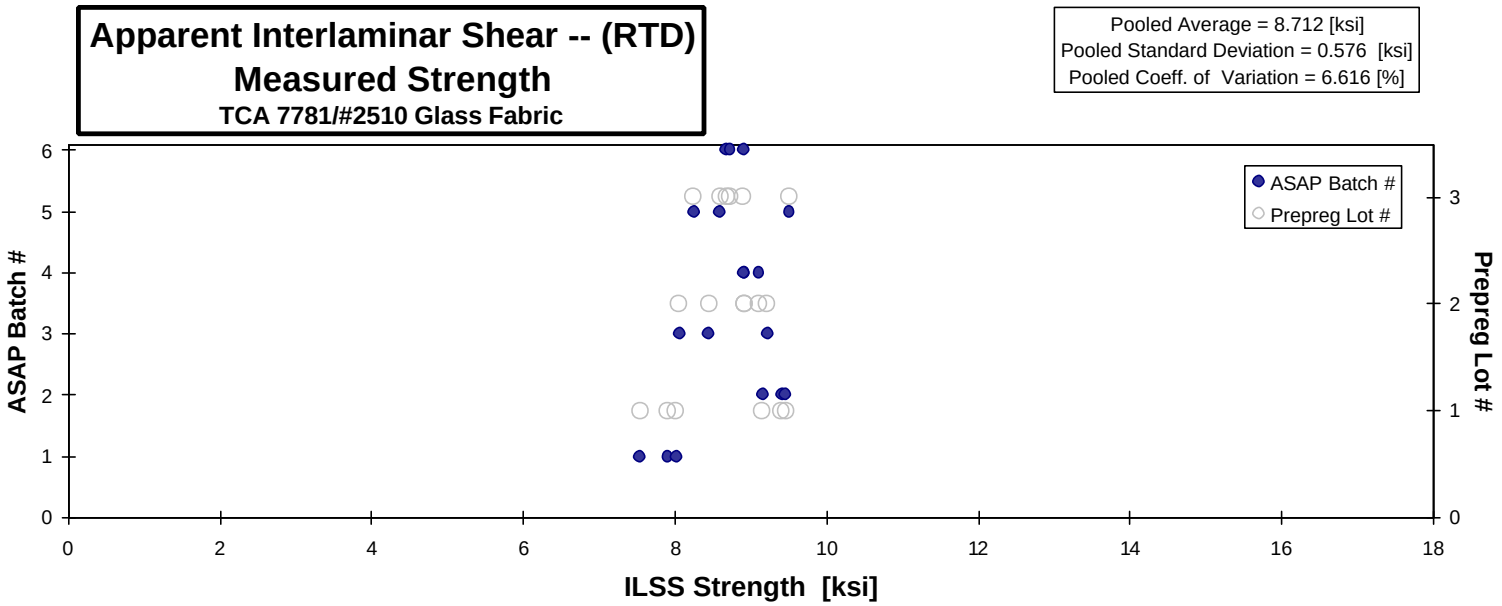


Apparent Interlaminar Shear -- (RTD) Strength

TCA 7781/#2510 Glass Fabric

Specimen Number	Cure Cycle	Prepreg Lot #	ASAP Batch #	Strength [ksi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]
A1-911-081-1-4	A	1	1	7.542	0.108	10	0.01084
A1-911-081-1-5	A	1	1	7.905	0.108	10	0.01084
A1-911-081-1-6	A	1	1	8.015	0.108	10	0.01080
B1-911-081-1-1	B	1	2	9.412	0.104	10	0.01041
B1-911-081-1-2	B	1	2	9.461	0.104	10	0.01037
B1-911-081-1-3	B	1	2	9.155	0.104	10	0.01039
A1-911-082-1-1	A	2	3	8.061	0.104	10	0.01042
A1-911-082-1-2	A	2	3	9.219	0.104	10	0.01038
A1-911-082-1-3	A	2	3	8.447	0.104	10	0.01042
B1-911-082-1-1	B	2	4	8.918	0.104	10	0.01044
B1-911-082-1-2	B	2	4	9.109	0.104	10	0.01041
B1-911-082-1-3	B	2	4	8.915	0.105	10	0.01047
A1-911-083-1-1	A	3	5	8.595	0.099	10	0.00988
A1-911-083-1-2	A	3	5	8.247	0.099	10	0.00987
A1-911-083-1-3	A	3	5	9.508	0.098	10	0.00977
B1-911-083-1-1	B	3	6	8.683	0.106	10	0.01065
B1-911-083-1-2	B	3	6	8.907	0.105	10	0.01052
B1-911-083-1-3	B	3	6	8.727	0.106	10	0.01060

Average	**8.712**	**Average**	**0.0104**
Standard Dev.	**0.576**		
Coeff. of Var. [%]	**6.616**		
Min.	**7.542**	**Min.**	**0.0098**
Max.	**9.508**	**Max.**	**0.0108**
Number of Spec.	**18**		



3.2.2. Fluid Sensitivity Raw Data Spreadsheets and Scatter Charts

In-Plane Shear -- (MEK - RTD) Strength

TCA 7781/#2510 Glass Fabric

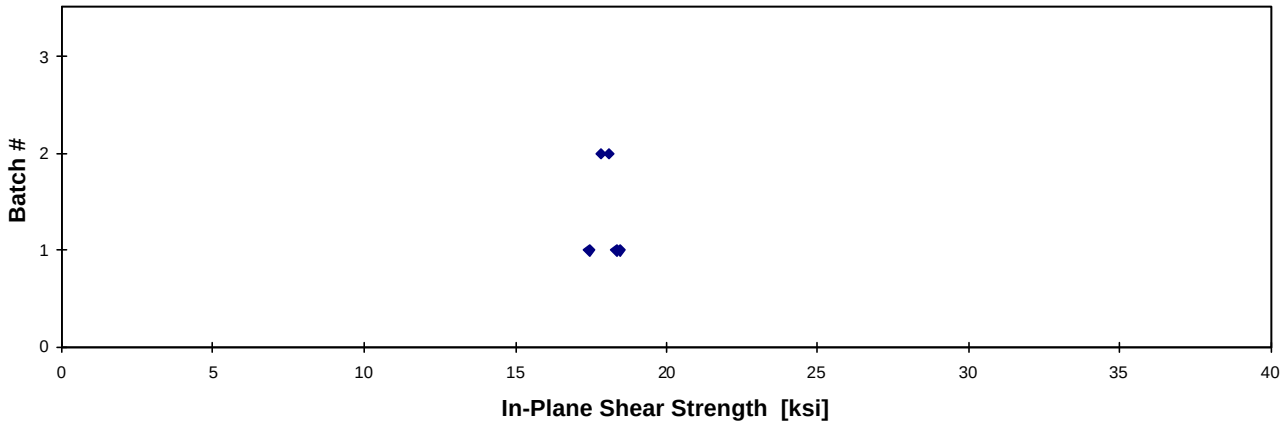
Specimen Number	Batch Number	Strength [ksi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]
A1-911-081-1-7	1	18.339	0.125	12	0.01040
A1-911-081-2-7	1	18.493	0.125	12	0.01045
A1-911-081-3-7	1	17.474	0.125	12	0.01045
B1-911-081-1-7	2	18.091	0.126	12	0.01053
B1-911-081-2-7	2	17.845	0.129	12	0.01075

Average	**18.048**		**0.0105**
Standard Dev.	**0.405**		
Coeff. of Var. [%]	**2.242**		
Min.	**17.474**	**Min.**	**0.0104**
Max.	**18.493**	**Max.**	**0.0108**
Number of Spec.	**5**		

In-Plane Shear -- (MEK - RTD) Measured Strength

TCA 7781/#2510 Glass Fabric

Pooled Average = 18.048 [ksi]
Pooled Standard Deviation = 0.405 [ksi]
Pooled Coeff. of Variation = 2.242 [%]



In-Plane Shear -- (JP-4 JET FUEL - ETD) Strength

TCA 7781/#2510 Glass Fabric

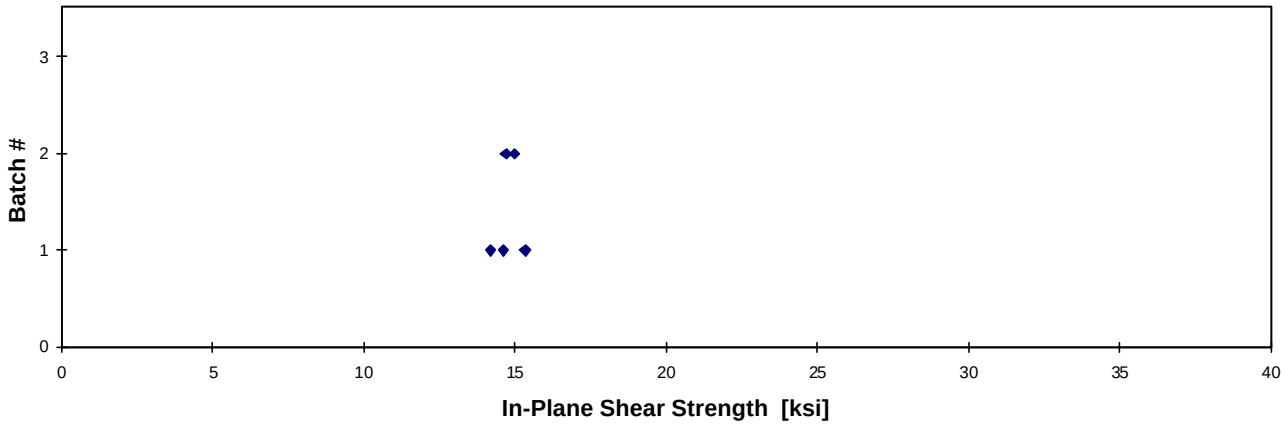
Specimen Number	Batch Number	Strength [ksi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]
A1-911-081-1-9	1	15.353	0.126	12	0.01050
A1-911-081-2-9	1	14.189	0.126	12	0.01050
A1-911-081-3-9	1	14.601	0.125	12	0.01042
B1-911-081-1-9	2	14.683	0.125	12	0.01042
B1-911-081-2-9	2	15.016	0.127	12	0.01058

Average	**14.768**		**0.0105**
Standard Dev.	**0.440**		
Coeff. of Var. [%]	**2.980**		
Min.	**14.189**	**Min.**	**0.0104**
Max.	**15.353**	**Max.**	**0.0106**
Number of Spec.	**5**		

In-Plane Shear -- (JP-4 JET FUEL - ETD) Measured Strength

TCA 7781/#2510 Glass Fabric

Pooled Average = 14.768 [ksi]
Pooled Standard Deviation = 0.440 [ksi]
Pooled Coeff. of Variation = 2.980 [%]



In-Plane Shear -- (Hydraulic Fluid - ETD) Strength

TCA 7781/#2510 Glass Fabric

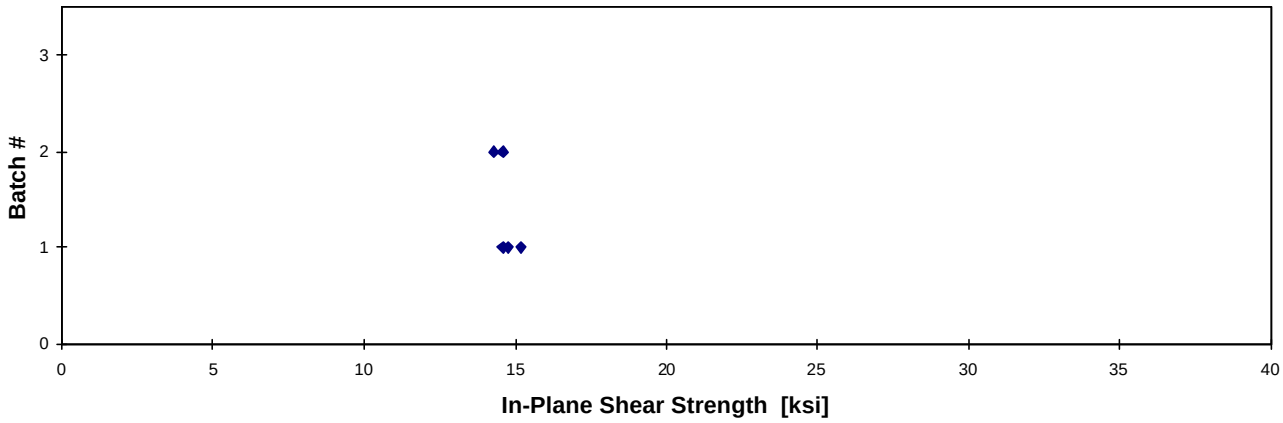
Specimen Number	Batch Number	Strength [ksi]	Avg. Specimen Thickn. [in]	# Plies in Laminate	Avg. t_{ply} [in]
A1-911-081-1-8	1	15.200	0.125	12	0.01042
A1-911-081-2-8	1	14.743	0.125	12	0.01042
A1-911-081-3-8	1	14.607	0.125	12	0.01042
B1-911-081-1-8	2	14.585	0.126	12	0.01050
B1-911-081-2-8	2	14.301	0.128	12	0.01067

Average	**14.687**		**0.0105**
Standard Dev.	**0.329**		
Coeff. of Var. [%]	**2.238**		
Min.	**14.301**	**Min.**	**0.0104**
Max.	**15.200**	**Max.**	**0.0107**
Number of Spec.	**5**		

In-Plane Shear -- (Hydraulic Fluid - ETD) Measured Strength

TCA 7781/#2510 Glass Fabric

Pooled Average = 14.687 [ksi]
Pooled Standard Deviation = 0.329 [ksi]
Pooled Coeff. of Variation = 2.238 [%]



Fluid Sensitivity Comparison:

Average In-Plane Shear Strength with Fluid (ksi)	Same Environment In-Plane Shear Strength without Fluid (ksi)	Worst Case Environment In-Plane Shear Strength (ksi)
MEK (RTD)	(RTD)	(ETW)
18.048	18.446	11.649

The RTD average in-plane shear strength was reduced by 2% after exposure to MEK. However, it remained 55% higher than water exposure in ETW condition.

Average In-Plane Shear Strength with Fluid (ksi)	Same Environment In-Plane Shear Strength without Fluid (ksi)	Worst Case Environment In-Plane Shear Strength (ksi)
JP-4 JET FUEL (ETD)	(ETD)	(ETW)
14.768	15.348	11.649

The ETD average in-plane shear strength was reduced by 4% after exposure to JP-4 Jet Fuel. However it remained 27% higher than water exposure in ETW conditions.

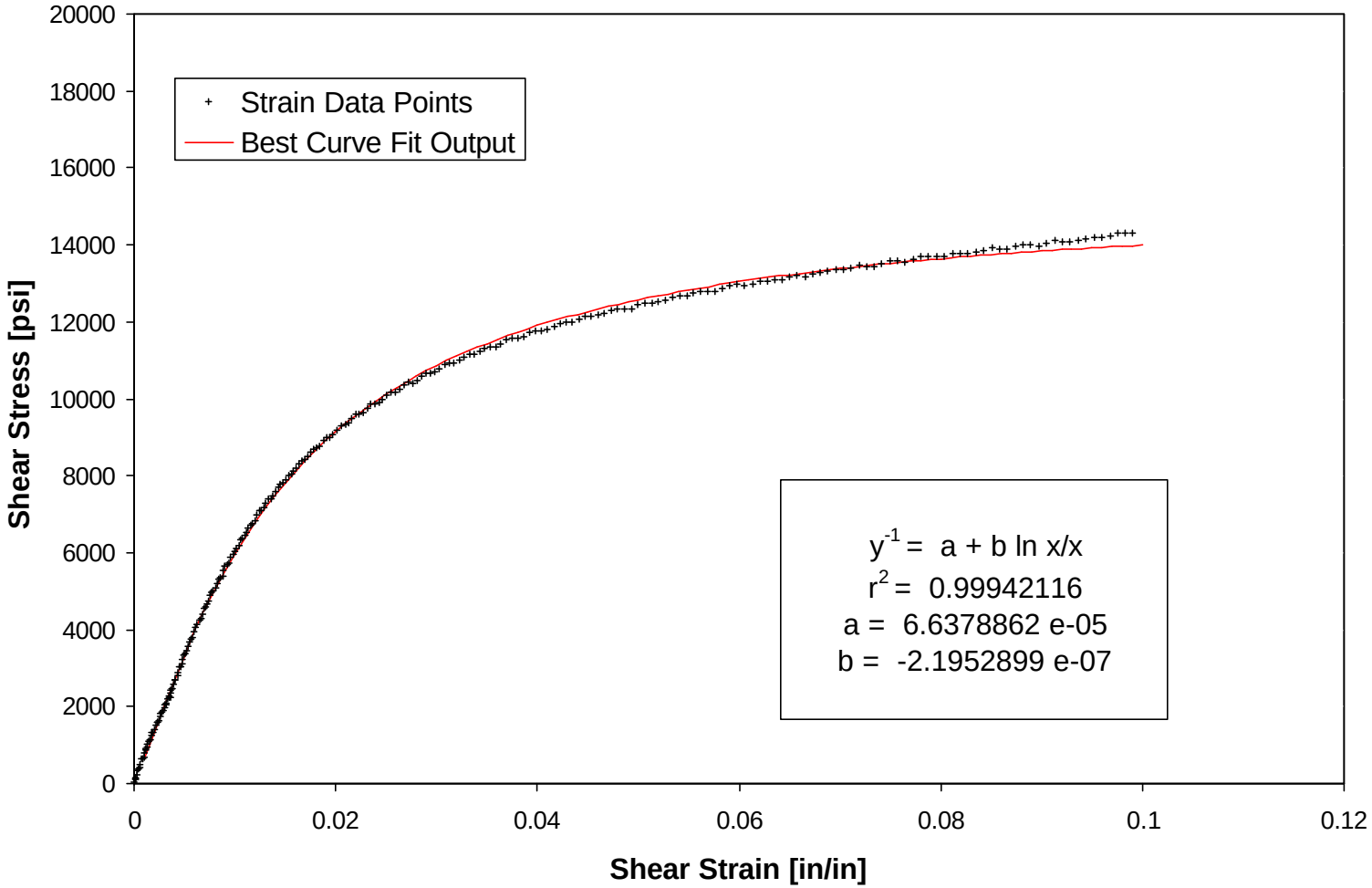
Average In-Plane Shear Strength with Fluid (ksi)	Same Environment In-Plane Shear Strength without Fluid (ksi)	Worst Case Environment In-Plane Shear Strength (ksi)
HYDRAULIC FLUID (ETD)	(ETD)	(ETW)
14.687	15.348	11.649

The ETD average in-plane shear strength was reduced by 4% after exposure to hydraulic fluid. However it remained 26% higher than water exposure in ETW conditions.

3.2.3. Representative Shear Stress-Strain Curve

The following stress-strain curve is representative of the TORAY 7781 Finish 558/#2510 Fiberglass Woven Fabric prepreg system. The tension and compression stress-strain curves are not presented in graphical form. If strain design allowables from these tests are required, simple one-dimensional linear stress-strain relationships may be used to obtain corresponding strain design values. This process should approximate tensile and compressive strain behavior relatively well but may produce extremely conservative strain values in shear due to the nonlinear behavior. A more realistic approach for shear strain design allowables is to use a maximum strain value of 5% (reference MIL-HDBK-17-1E, section 5.7.6). If a nonlinear analysis of the material's shear behavior is required, the curve-fit of the shear stress-strain curve may be used. The representative shear stress-strain curve was obtained by taking the average of all the sample shear curves and determining the best-fit line through the data. The actual data points are also presented on the chart to demonstrate material variability.

Shear Stress vs. Shear Strain, RTD



3.3. Statistical Results

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TCA 7781/#2510 Glass Fabric

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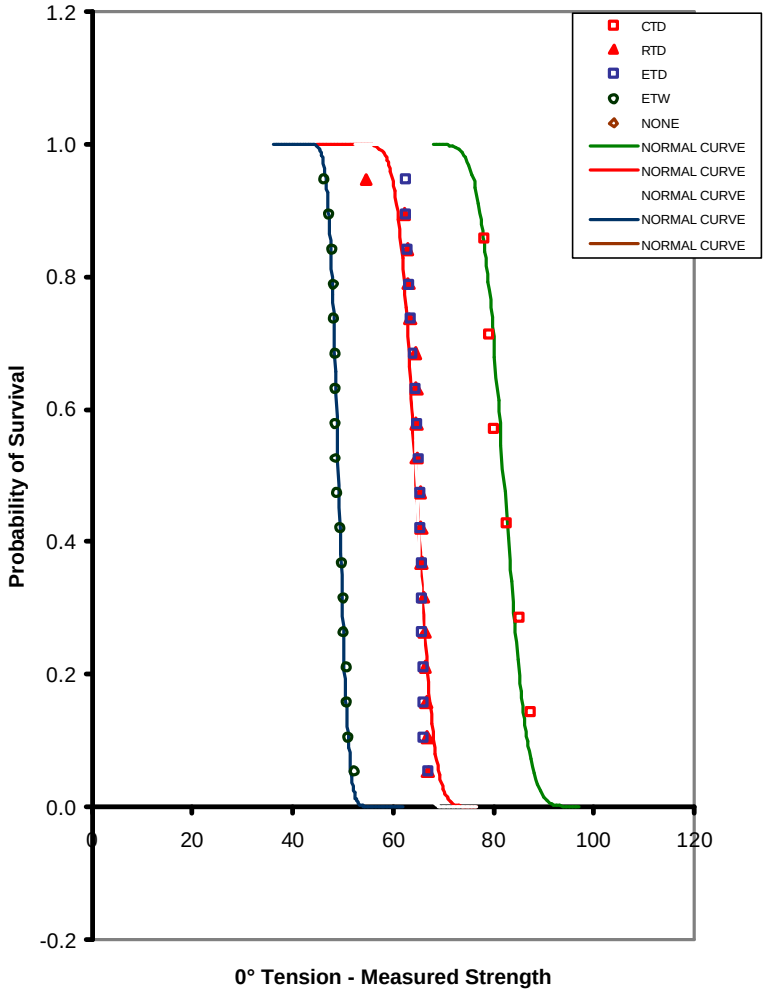
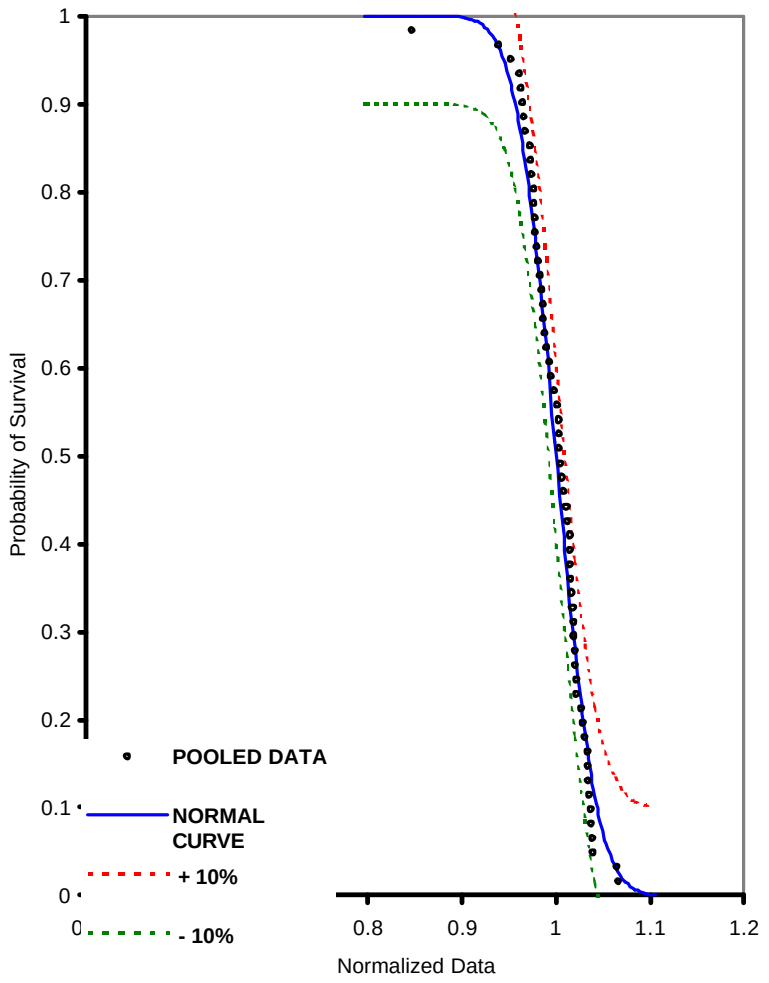
DISTRIBUTION OF DATA AT INDIVIDUAL TEST CONDITIONS



DISTRIBUTION OF POOLED DATA



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TCA 7781/#2510 Glass Fabric

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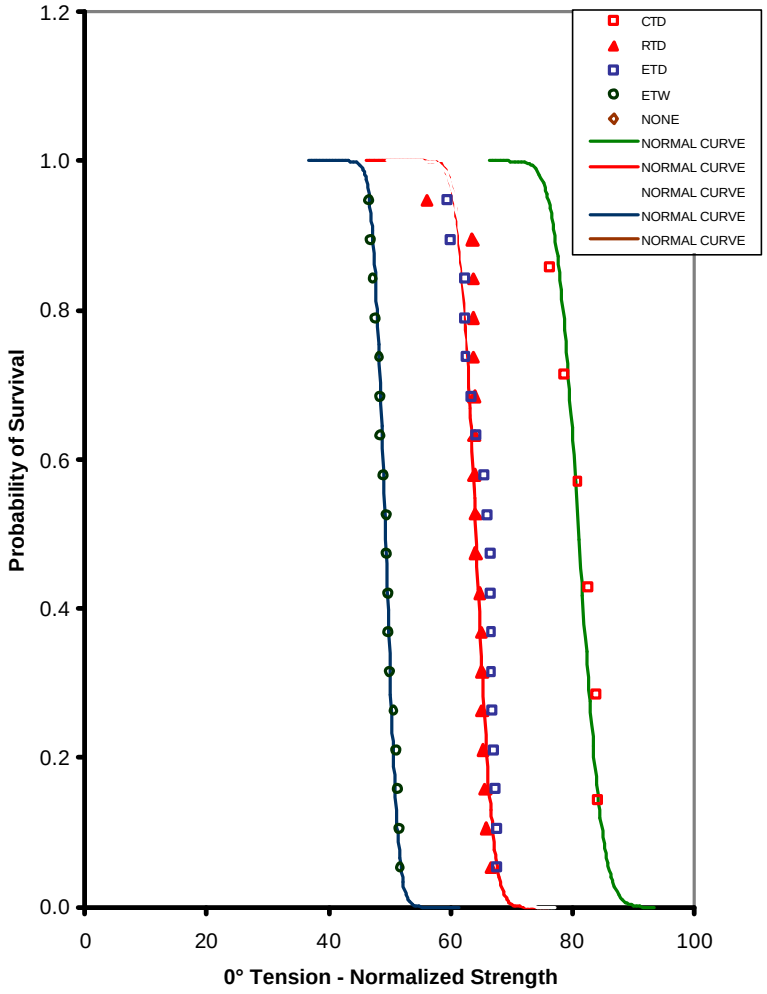
DISTRIBUTION OF DATA AT INDIVIDUAL TEST CONDITIONS



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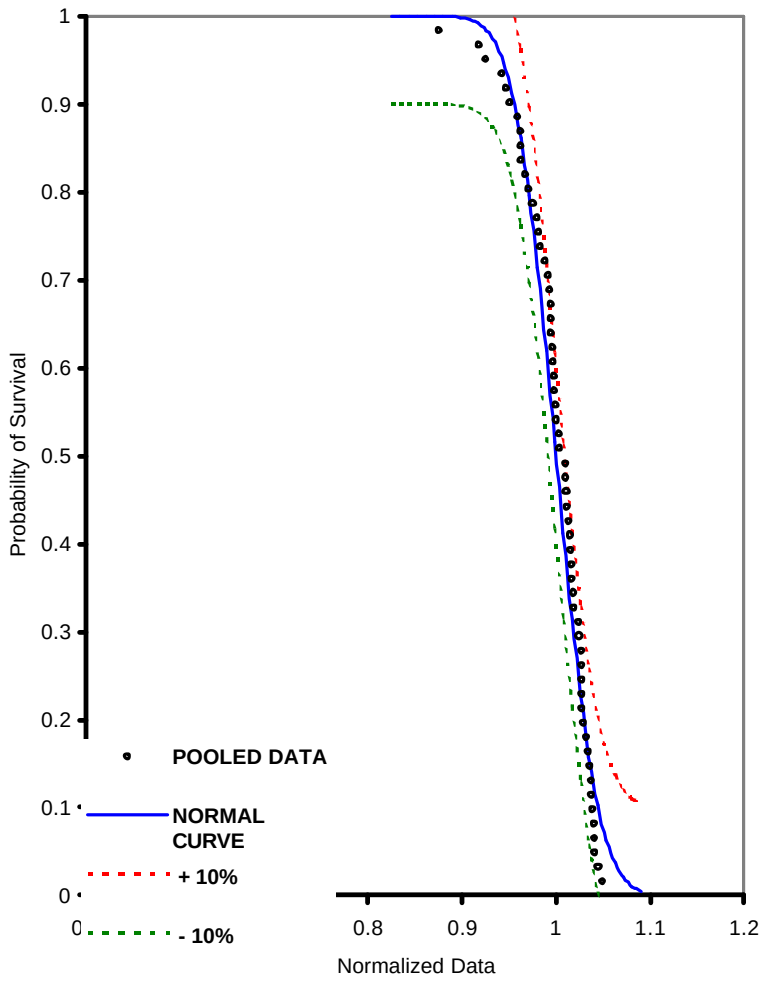

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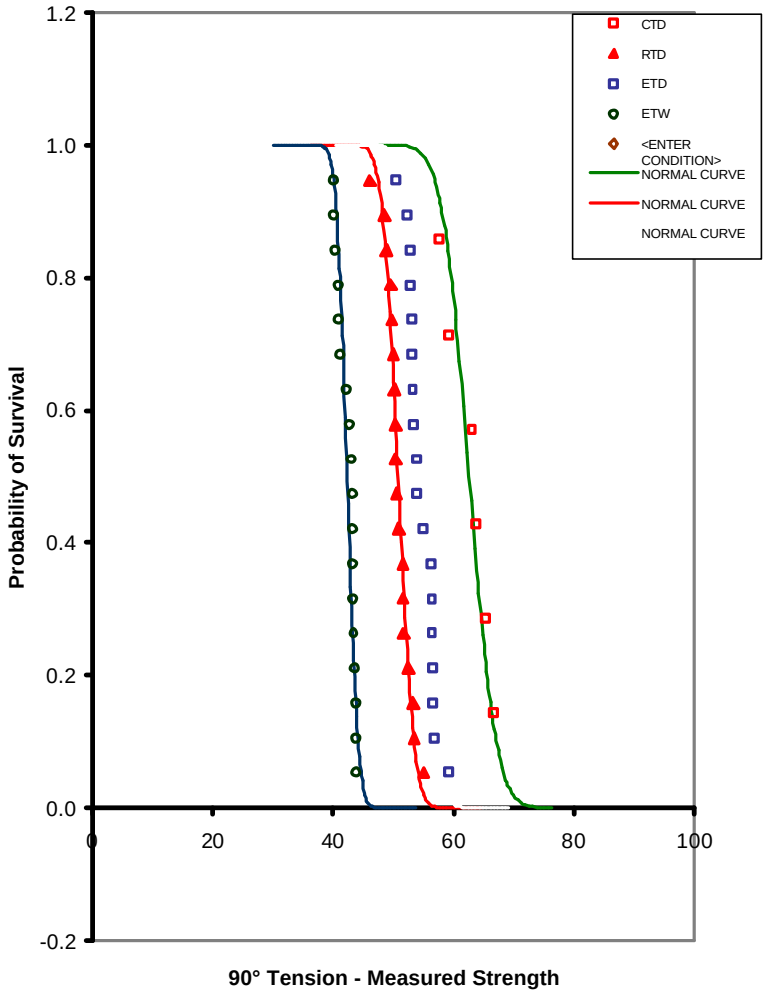

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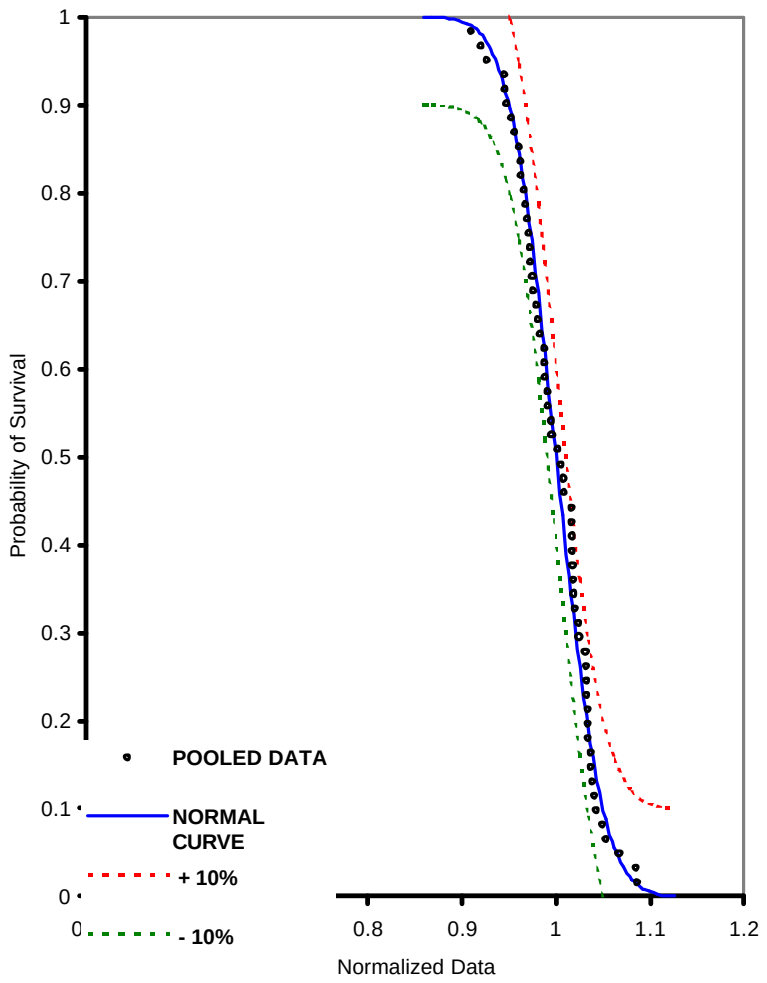

DISTRIBUTION OF DATA & NORMAL CURVES

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TCA 7781/#2510 Glass Fabric

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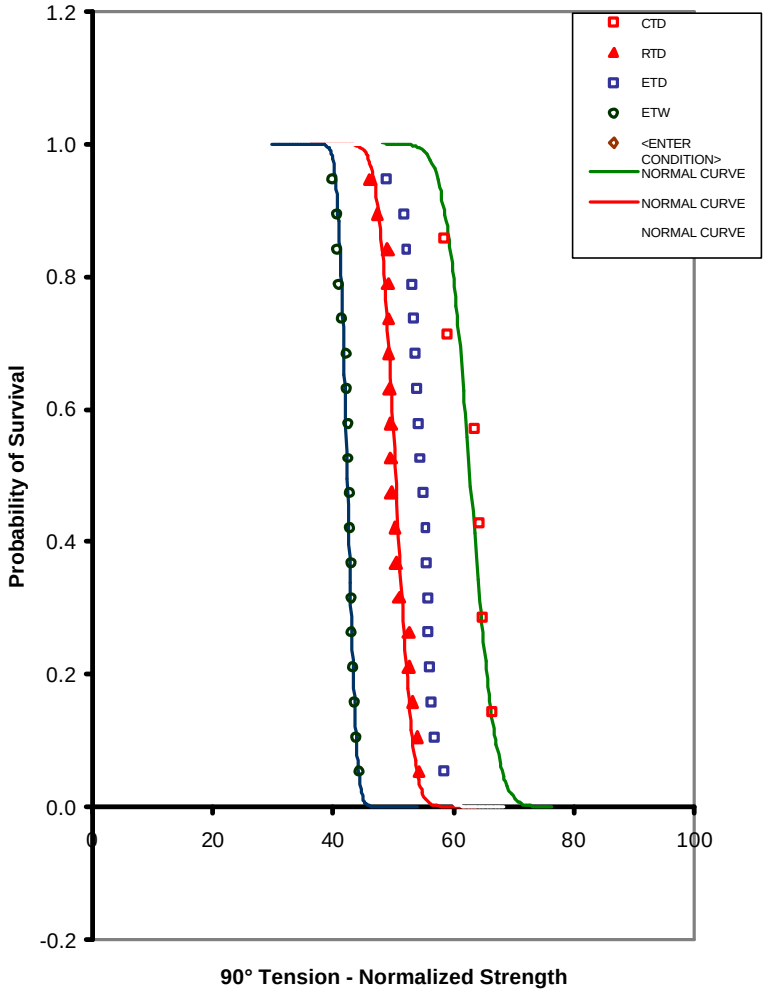

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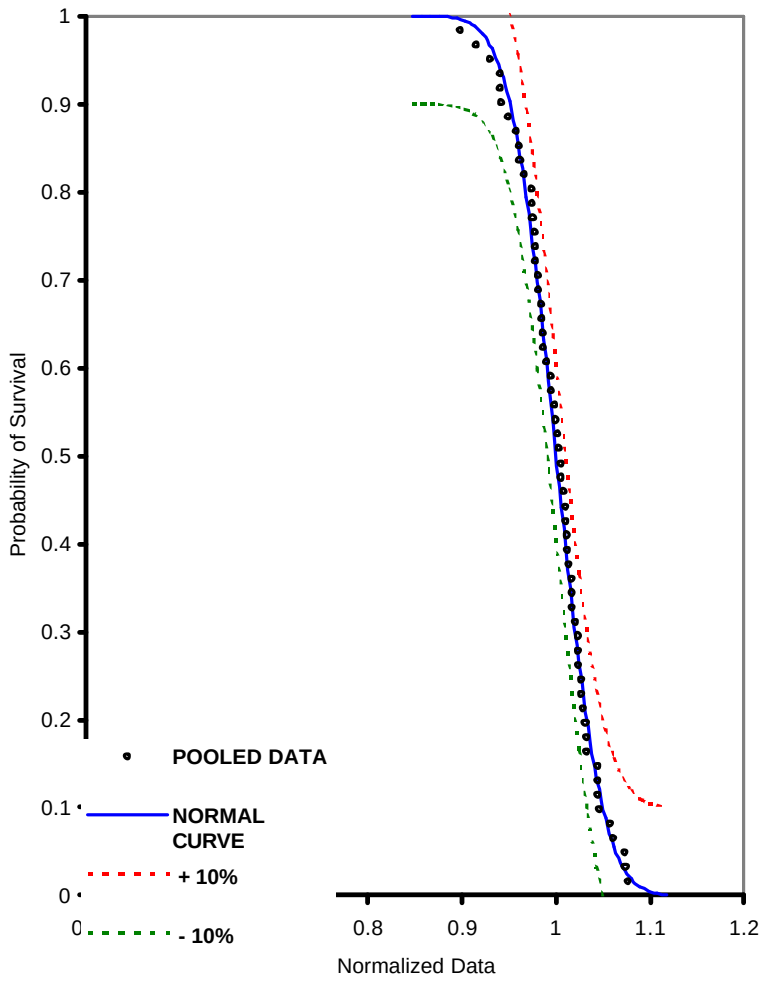

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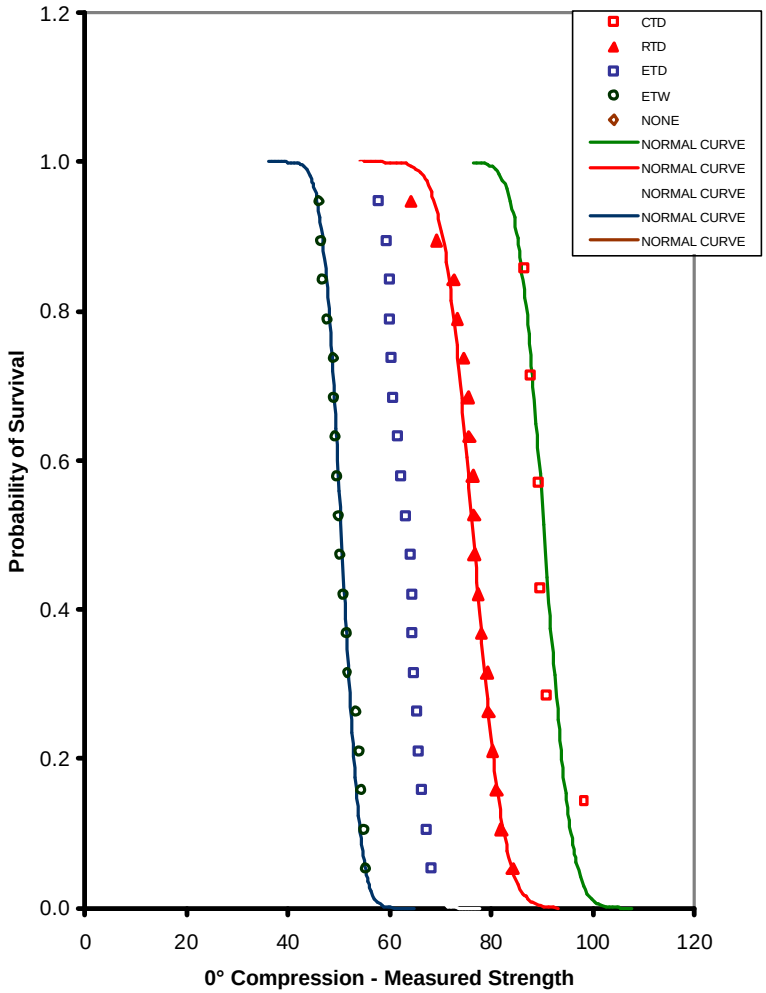

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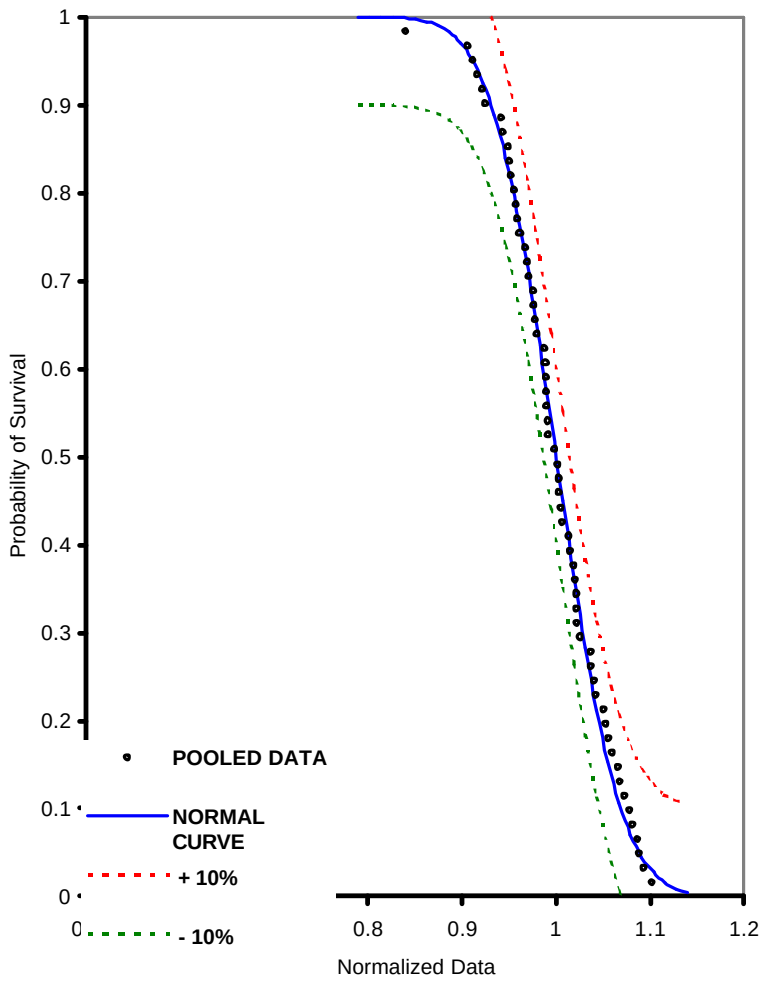

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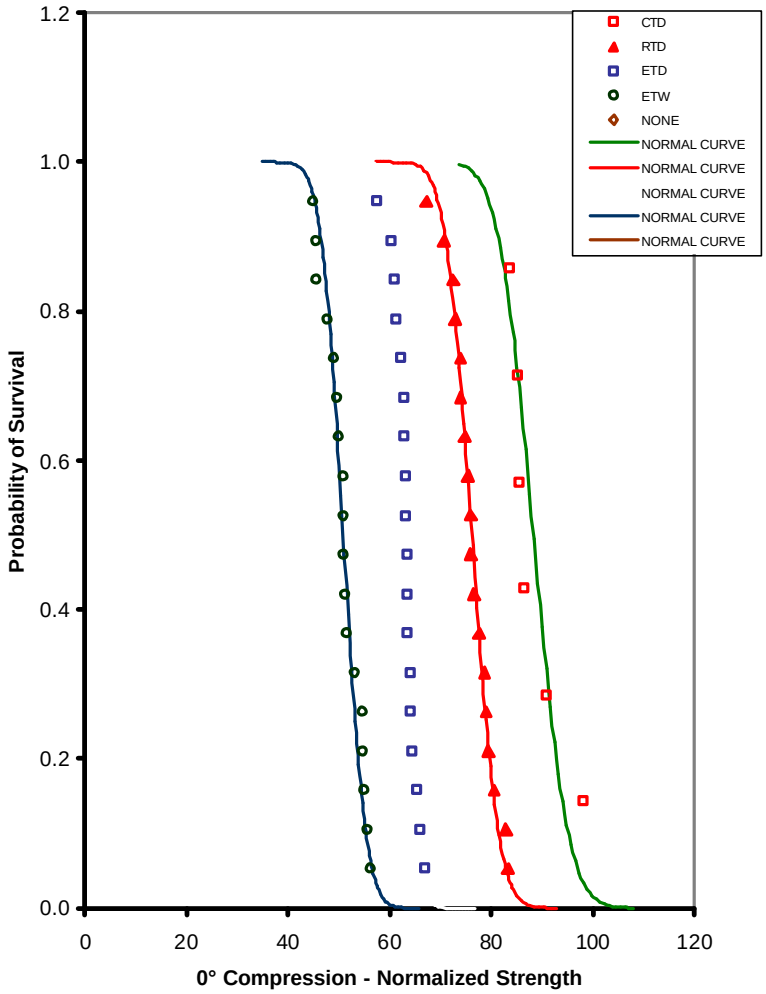

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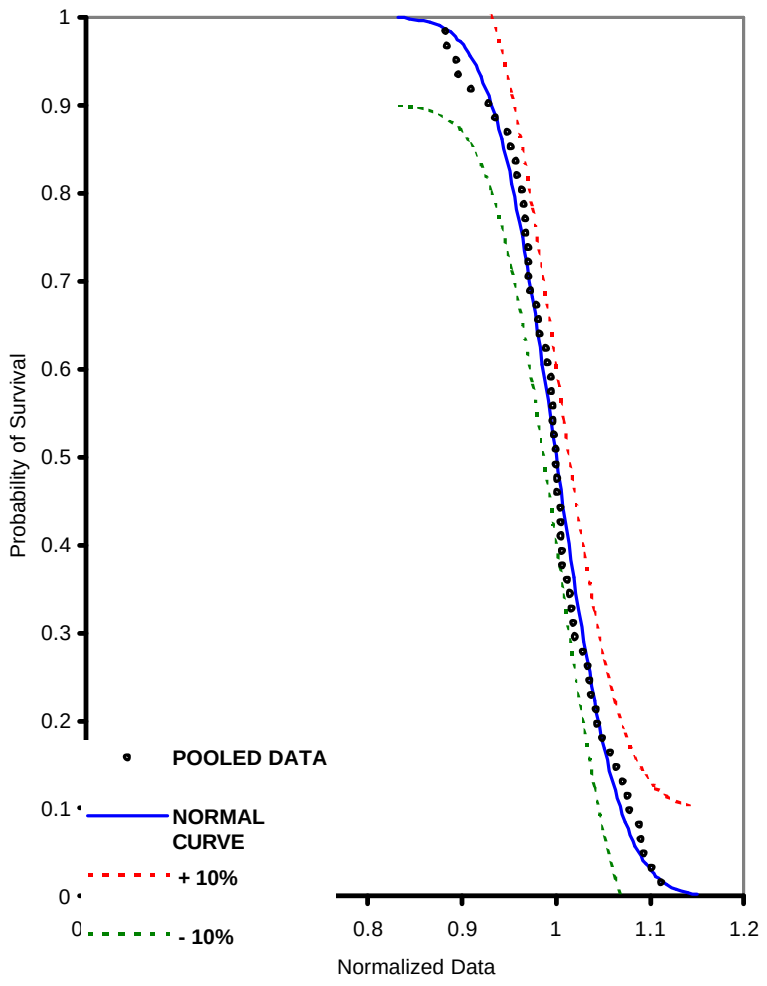

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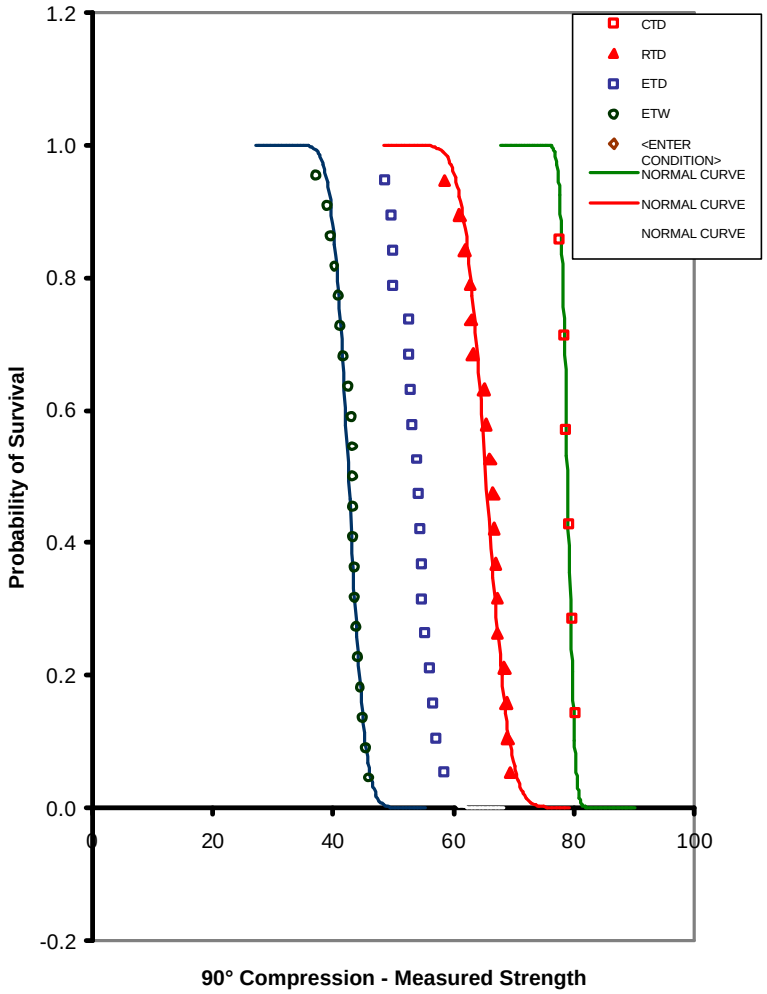

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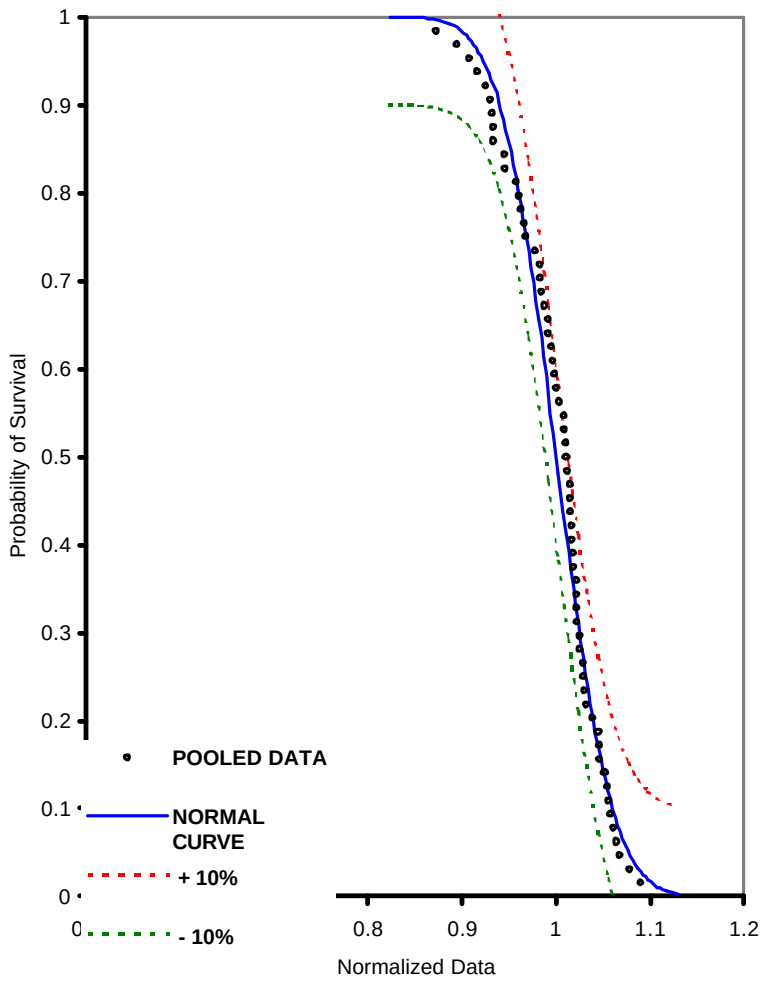

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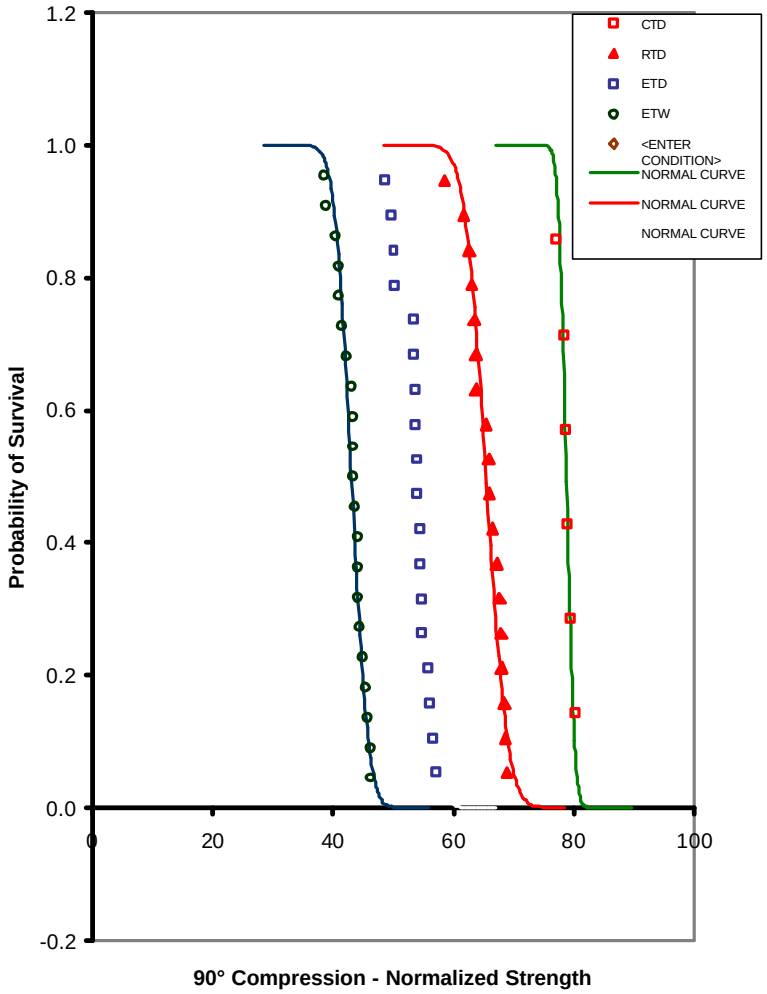

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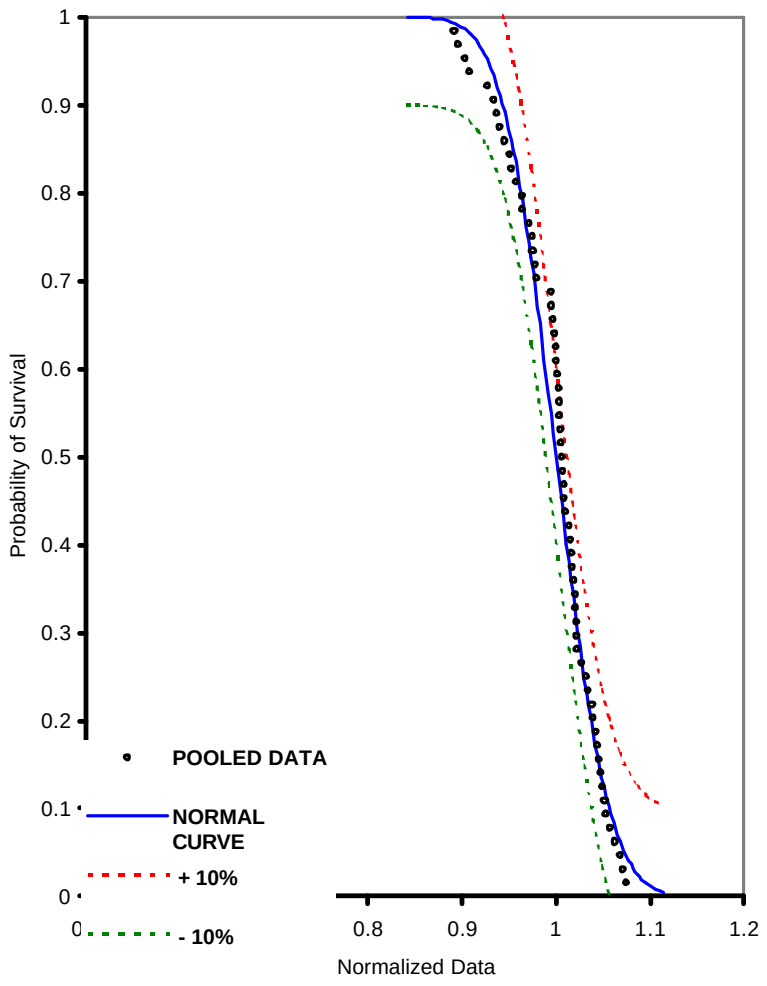

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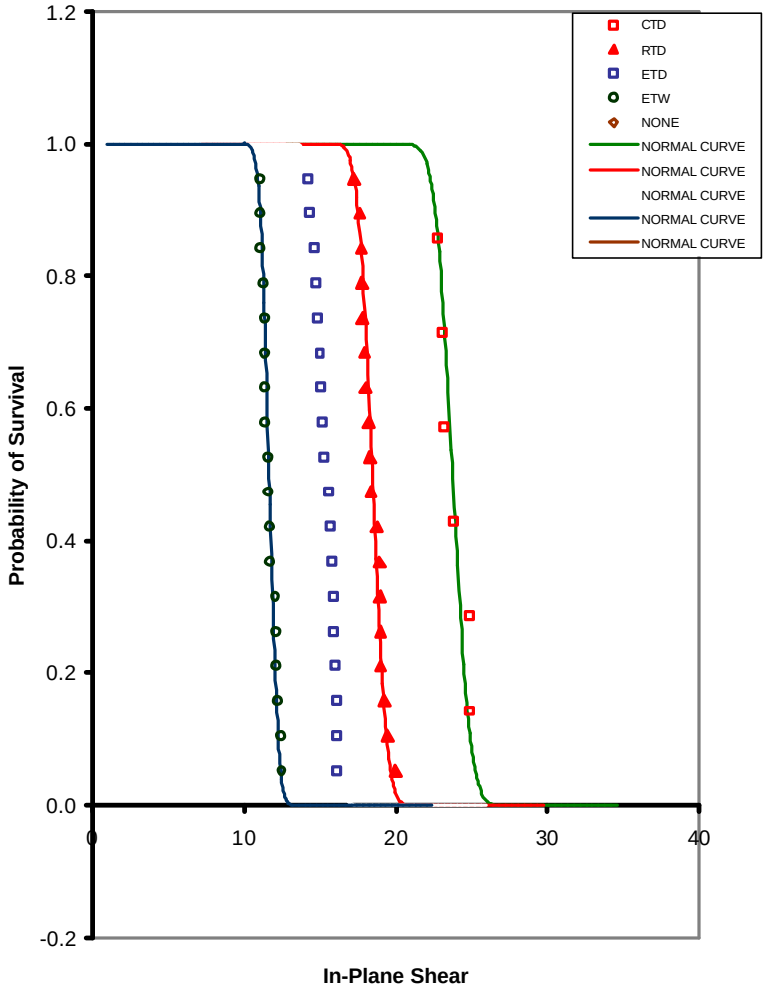

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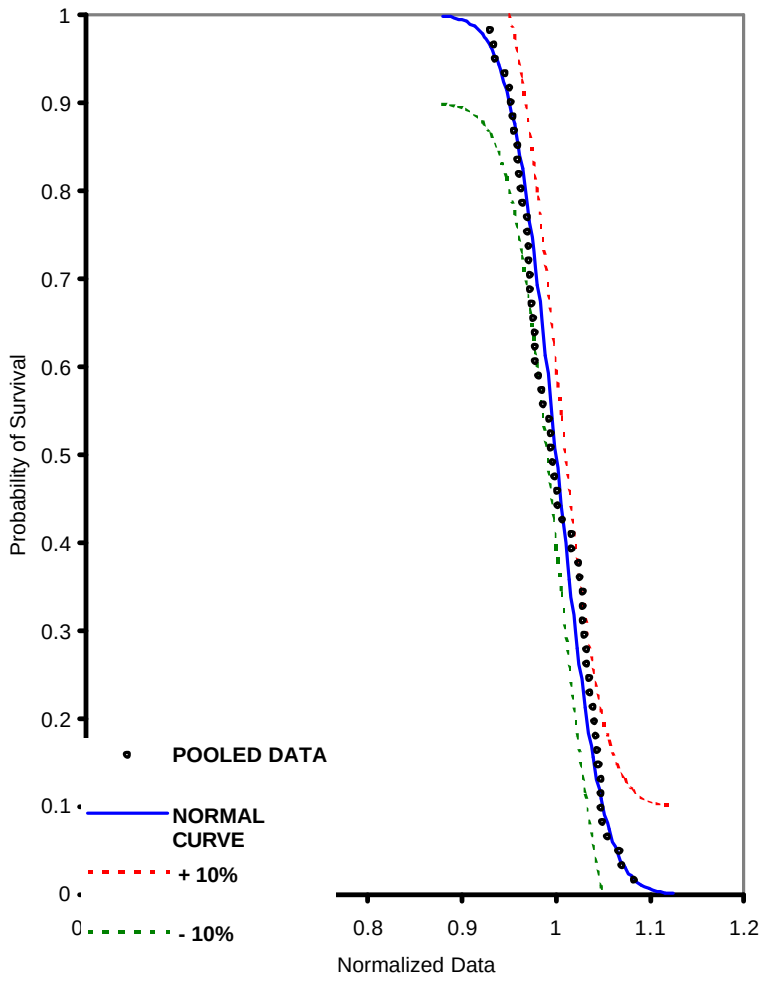

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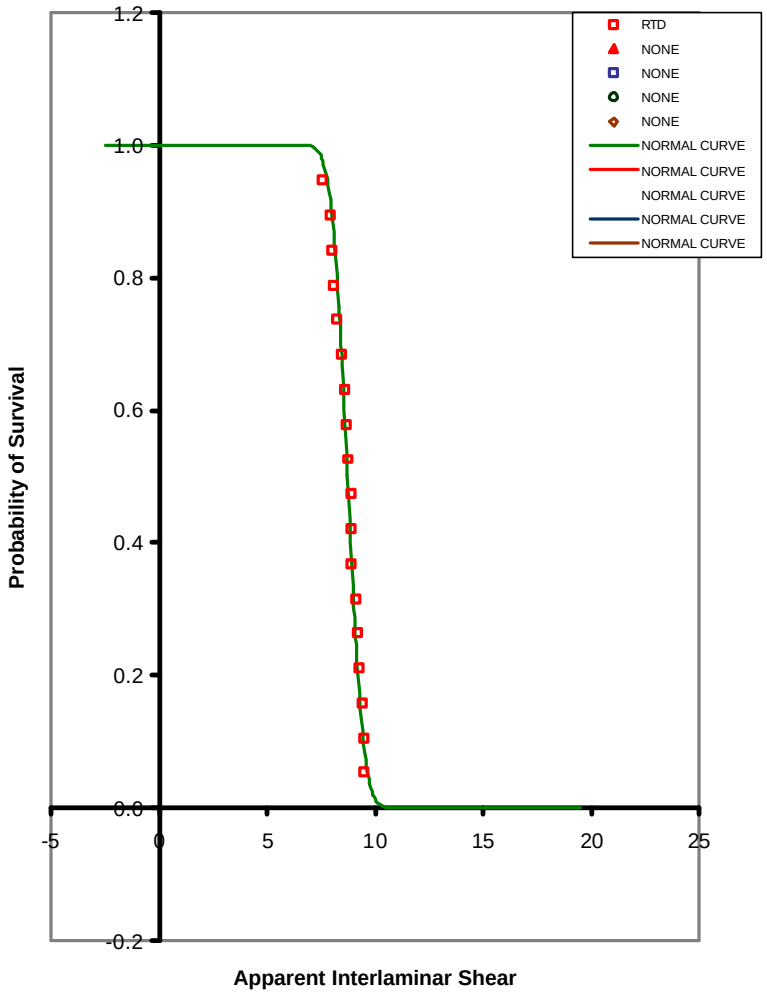

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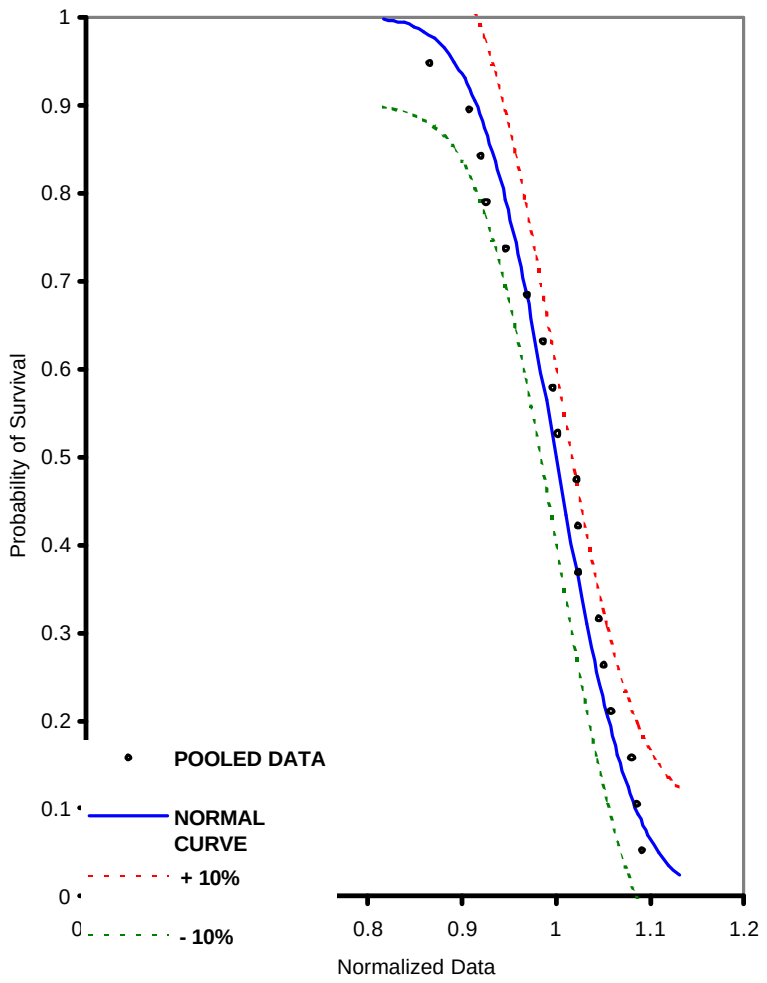


APPENDIX A. PHYSICAL AND MECHANICAL TEST PROCEDURES

A.1. Physical Properties

A.1.1. Uncured Resin Content

Three (100 mm X 100 mm) uncured samples were taken across the width of the prepreg ply sheet, from the start and end of the batch. These samples were tested for resin weight percentage in accordance with TCWIN-Q-P004, using N-Methyl Pyrrolidone (NMP) solvent to extract the resin matrix, and SACMA SRM 23-94, Method A.

A.1.2. Uncured Volatile Content

The volatile content weight fraction was determined in accordance with TCWIN-Q-P001 that meets the intent of ASTM D3530. Three (100 mm X 100 mm) uncured samples were taken across the width of the prepreg ply sheet, from the start and end of the batch.

A.1.3. Resin Gel Time

Three (6 mm X 6 mm) uncured samples were taken across the width of the prepreg ply sheet, from the start and end of the prepreg material batch. The gel time property was performed in accordance with ASTM D3532 and TCWIN-U-P007.

A.1.4. Resin Flow

The resin flow property was determined in accordance with SACMA SRM 22-94 and TCWIN-U-P008.

A.1.5. Uncured Fiber Areal Weight

The surface areas of resin content samples tested in accordance with 2.2.1 were precisely measured in accordance with TCWIN-Q-P004 and SACMA SRM 23R-94. The fiber areal weight (g/m^2) was calculated by dividing the mass of the resin free fibrous residue by the measured surface area.

A.1.6. Infrared Spectroscopy

The infrared spectroscopy signature tests were performed in accordance with TCWIN-U-C002 that meets the intent of ASTM D1252 and ASTM D168.

A.1.7. High Performance Liquid Chromatography (HPLC)

HPLC signature tests were performed in accordance with TCWIN-U-C004 and SACMA SRM 20R-94.

A.1.8. Differential Scanning Calorimetry (DSC)

DSC was performed to provide thermal property, specifically onset and peak temperature, data for prepreg material. The DSC tests were conducted in accordance with SACMA SRM 25R-94 and TCWIN-U-C003.

A.1.9. Cured Neat Resin Density

Testing the specimens in accordance with ASTM D792 Method A and TCWIN-U-M215 determined the cured neat resin density. The density was calculated as follows:

$$r_{\text{Resin}} = r_L \left(\frac{W_1}{W_1 - W_2} \right)$$

where: ρ_{Resin} = Resin density, g/cc
ρ_L = density of ethanol or water, g/cc
W_1 = weight of sample in air
W_2 = weight of sample in ethanol or water

A.1.10. Fiber Volume

The fiber volume of each mechanical test laminate was determined in accordance with ASTM D3171-90. The calculation was performed in accordance with the following equation;

$$V_F = r_C * \left(\frac{W_{CF}}{r_F} \right)$$

where: V_F = calculated fiber volume, %
ρ_C = laminate density, g/cc (same method as 2.2.9)
W_{CF} = weight of fibrous carbon fiber residue of acid digestion, g
ρ_F = nominal carbon fiber density, g/cc = 1.79 for T700G

A.1.11. Resin Volume

The resin volume of each mechanical test laminate was determined in accordance with ASTM D3171-90. The calculation was performed in accordance with the following equation;

$$V_F = r_C * \left(\frac{100 - W_{CF}}{r_R} \right)$$

where: V_F = calculated fiber volume, %(v)
ρ_C = laminate density, g/cc (same method as 2.2.9)
W_{CF} = weight of fibrous carbon fiber residue of acid digestion, g
ρ_R = nominal cured neat resin density, g/cc = 1.267

A.1.12. Void Content

The void content of each mechanical test laminate was determined in accordance with ASTM D2734-94. The calculation was performed in accordance with the following equation;

$$V_V = 100 - \left[r_C * \left(\frac{100 - W_{CF}}{r_R} + \frac{W_{CF}}{r_F} \right) \right]$$

where: V_V = Void content, %(v)
ρ_C = laminate density, g/cc (same method as 2.2.9)
W_{CF} = weight of fibrous carbon fiber residue of acid digestion, g
ρ_F = nominal carbon fiber density, g/cc = 1.79 for T700G
ρ_R = nominal cured neat resin density, g/cc = 1.267

A.1.13. Cured Laminate Tg by DMA

The dry and wet Tg by DMA was determined on three specimens per batch in accordance with SACMA SRM 18R-94. The wet Tg specimens were conditioned in accordance with method described in paragraph 2.1.7.1. The resultant wet Tg data reflected the plasticization of resin matrix due to moisture absorption that is anticipated for any operational environment.

A.2. TENSILE PROPERTIES

Note: The following descriptions below apply to both 0° (Warp) and 90° (Fill) Tensile specimens unless otherwise specified.

A.2.1. 0° (Warp) and 90° (Fill) Tensile Properties

The 0° (warp) and 90° (fill) tensile tests were conducted in accordance with ASTM D3039 and TCWIN-U-M201. Six test specimens, 4 for tensile strength & modulus and 2 for tensile strength only, were tested for each test condition. Test specimens

from one batch were tested at -65°F (Dry). Test specimens from three batches were tested at 75°F (Dry), 180°F (Dry) and 180°F (Wet).

Twelve plies were used to fabricate the initial test panels, for zero-degree $(warp)_{12}$ and ninety-degree $(fill)_{12}$ ply orientations. The panels were tabbed in accordance with para. 2.1.5. The zero-degree and ninety-degree test specimens were wet cut to 9.0 inches nominal length and 1.00 inch nominal width in accordance with TCWIN-Q-M101.

The widths of the test specimens were measured with digital ¼" diameter flat anvil and spindle micrometer. The thickness of the specimens were measured with digital ¼" diameter hemispherical anvil and spindle micrometer. The measurements were recorded onto TCFOR-Q-033. The width and thickness measurements were entered into the test frame computer along with the material type, batch number, test condition and specimen identification.

The 0° (warp) tensile test specimens were strain gauged with CEA-06-125UT-120 biaxial strain gage, except the –65 °F test specimens that were strain gauge with CEA-06-125UT-350 biaxial strain gage by Intec. The 90° (fill) tensile test specimens were strain gauged with C-960401-A axial strain gage, except the –65 °F test specimens that were strain gauge with CEA-06-125UW-350 axial strain gage by Intec. Instron 4505 load frame, operated in stroke control mode, was used to apply loading to the specimens at a crosshead rate of 0.05 inch/minute. For 0° (warp) tensile specimens, the loads, crosshead displacements, longitudinal strains and transverse strains were recorded throughout each test using a calibrated, computerized data assimilation system. For 90° (fill) tensile specimens, the loads, crosshead displacements and transverse strains only were recorded throughout each test using a calibrated, computerized data assimilation system.

A.2.1.1. Tensile Calculations

The ultimate tensile strengths, moduli and the poisson's ratio (zero-degree only) were calculated by transferring the raw data recorded, for example, ultimate loads, from the Instron computer into a Microsoft Excel spreadsheet program, in accordance with the following equations:

A.2.1.1.1. Tensile Strength (Un-normalized)

The un-normalized tensile strength was calculated using the following equation:

$$s_{ULT} = \frac{P}{b * d * \left(\frac{1{,}000\, psi}{ksi} \right)}$$

where: σ_{ULT} = the ultimate tensile stress (ksi)
P = the maximum load, (lb.)
b = the averaged measured width of the specimen (inch)
d = the averaged measured thickness of the specimen (inch)

A.2.1.1.2. Tensile Strength (Normalized)

The normalized tensile strength was calculated using the following equation:

$$s_{ULT} = \frac{P}{b * d * \left(\frac{1{,}000\,psi}{ksi}\right)} x \frac{CPT_{specimen}}{CPT_{batchaverage}}$$

A.2.1.1.3. Tensile Modulus of Elasticity (Un-normalized)

The un-normalized longitudinal tensile modulus of elasticity was calculated using the following equation:

$$E_{11T} = \frac{P_{0.3\%} - P_{0.1\%}}{b * d * \left(e_{0.3\%} - e_{0.1\%}\right) * \left(\frac{1{,}000{,}000\,psi}{msi}\right)}$$

where: E_{11T} = the tensile modulus of elasticity (msi)
b = the averaged measured width of the specimen (inch)
d = the averaged measured thickness of the specimen (inch)
$P_{0.3\%}$ = the applied load at 3000 microstrain (kips)
$P_{0.1\%}$ = the applied load at 1000 microstrain (kips)
$\varepsilon_{0.3\%}$ = 0.3% measured longitudinal strain = 3000 microinches/inch (µin/in)
$\varepsilon_{0.1\%}$ = 0.1% measured longitudinal strain = 1000 microinches/inch (µin/in)

A.2.1.1.4. Tensile Modulus of Elasticity (Normalized)

The normalized longitudinal tensile modulus of elasticity was calculated using the following equation:

$$E_{11T} = \frac{P_{0.3\%} - P_{0.1\%}}{b * d * \left(e_{0.3\%} - e_{0.1\%}\right) * \left(\frac{1{,}000{,}000\,psi}{msi}\right)} x \frac{CPT_{specimen}}{CPT_{batchaverage}}$$

A.2.1.1.5. 0° (Warp) Tensile Poisson's Ratio

The poisson's ratio (ν_{12}) of 0° (warp) tensile specimen was calculated as follows:

$$\upsilon_{12} = \frac{e_{Y2} - e_{Y1}}{0.002}$$

where: υ_{12} = major Poisson's ratio
ε_{Y1} = transverse strain at stress 1, inch/inch
ε_{Y2} = transverse strain at stress 2, inch/inch
0.002 = the longitudinal strain range (ε_{X2}-ε_{X1})=0.003–0.001 in/in

A.3. COMPRESSIVE STRENGTH

Note: The following descriptions apply to both 0° (Warp) and 90° (Fill) Compressive Strength specimens unless otherwise specified.

A.3.1. 0° (Warp) and 90° (Fill) Compressive Strength Properties

The 0° (warp) and 90° (fill) compressive strength tests were conducted in accordance with SACMA SRM 1R-94 and TCWIN-U-M204. Six compressive strength specimens were tested for each test condition. Test specimens from one batch were tested at -65°F (Dry). Test specimens from three batches were tested at 75°F (Dry), 180°F (Dry) and 180°F (Wet).

Twelve plies were used to fabricate the initial test panels, for zero-degree $(warp)_{12}$ and ninety-degree $(fill)_{12}$ ply orientations. The panels were tabbed in accordance with para. 2.1.5. The test specimens were wet cut, to nominal length of 3.18 inches and a nominal width of 0.50 inch. The test specimens were machined at NIAR, Wichita State University in accordance with SACMA SRM 1-94.

The widths of the specimens were measured with digital ¼" diameter flat anvil and spindle micrometer. The thickness of the specimens used in calculations was the average of measurements on untabbed test panel with digital ¼" diameter hemispherical anvil and spindle micrometer. The measurements were recorded onto TCFOR-Q-033. The width and thickness measurements were entered into the test frame computer along with the material type, batch number, test condition and specimen identification.

A modified ASTM D695 anti-buckling fixture was used to augment specimen stability during the compressive tests. Instron 4510 load frame, operated in stroke control mode, was used to apply loading to the specimens at 0.05 inch/minute crosshead rate. The loads and displacements were recorded throughout each test using a calibrated, computerized data assimilation system.

A.3.1.1. Compressive Strength Calculations

The ultimate compressive strengths were calculated by transferring the raw data recorded, for example, ultimate loads, from the Instron 4510 into a Microsoft Excel spreadsheet program, in accordance with the following equations:

A.3.1.1.1. Compressive Strength Calculation (Un-normalized)

The un-normalized 0° (warp) & 90° (fill) ultimate compressive strengths were calculated in accordance with the following formula:

$$F = \frac{P}{b * t}$$

where: F = the ultimate compressive strength (ksi)
P = the ultimate compressive load (klb. or kips)
b = the averaged measured specimen width (inch)
t = the average thickness measured on untabbed compression panel

A.3.1.1.2. Compressive Strength Calculation (Normalized)

The 0° (warp) & 90° (fill) compressive strengths were normalized in accordance with the following formula:

$$F = \frac{P}{b * t} x \frac{CPT_{specimen}}{CPT_{batchaverage}}$$

A.4. COMPRESSIVE MODULUS

Note: The following descriptions apply to both 0° (Warp) and 90° (Fill) Compressive Modulus specimens unless otherwise specified.

A.4.1. 0° (Warp) and 90° (Fill) Compression Modulus Properties

The 0° (warp) and 90° (fill) compressive modulus tests were conducted in accordance with SACMA SRM 1R-94 and TCWIN-U-M206. Two test specimens were tested for each test condition. Test specimens from one batch were tested at -65°F (Dry). Test specimens from three batches were tested at 75°F (Dry), 180°F (Dry) and 180°F (Wet).

Fourteen plies were used to fabricate the initial test panels, for zero-degree $(warp)_{14}$ and ninety-degree $(fill)_{14}$ ply orientations. The test specimens were wet cut, to nominal length of 3.18 inches and a nominal width of 0.50 inch, in accordance with TCWIN-Q-M103.

The widths of the test specimens were measured with digital ¼" diameter flat anvil and spindle micrometer. The thickness of the specimens were measured with digital ¼" diameter hemispherical anvil and spindle micrometer. The measurements were recorded onto TCFOR-Q-033. The width and thickness measurements were entered into the test frame computer along with the material type, batch number, test condition and specimen identification.

A modified ASTM D695 anti-buckling fixture was used to augment specimen stability during the compressive tests. Instron 4510 load frame, operated in stroke control mode, was used to apply the loads. The crosshead displacement rate for each test was 0.05 in/min (1.27 mm/min) and the strains were measured with a FAE-12S-12-S6EL-2 uni-axial strain gauge, except for the –65°F test specimens that were strain gauged with CEA-06-125UW-350 uni-axial strain gauge and tested by Intec. The loads and strains were recorded throughout each test using computerized data assimilation system.

A.4.1.1. Compression Modulus Calculations

The compression moduli were calculated by transferring the raw data recorded, for example, longitudinal strains, from the Instron 4510 into a Microsoft Excel spreadsheet program, in accordance with the following equations:

A.4.1.1.1. Compressive Modulus Calculation (Un-normalized)

The un-normalized 0° (warp) & 90° (fill) compressive modulus was calculated as follows:

$$E = \frac{P_{0.3\%} - P_{0.1\%}}{b * d * \left(e_{0.3\%} - e_{0.1\%}\right) * \left(\frac{1{,}000{,}000\, psi}{msi}\right)}$$

where:
- E = compressive modulus (msi)
- $P_{0.3\%}$ = applied load at 3000 microstrain, (lb.)
- $P_{0.1\%}$ = applied load at 1000 microstrain, (lb.)
- b = averaged measured specimen width, (inch)
- d = averaged measured specimen thickness, (inch)
- $\varepsilon_{0.3\%}$ = 0.3% measured strain = 3000 microinches/inch (µin/in)
- $\varepsilon_{0.1\%}$ = 0.1% measured strain = 1000 microinches/inch (µin/in)

A.4.1.1.2. Compressive Modulus Calculation (Normalized)

The 0° (warp) & 90° (fill) compressive modulus normalization was calculated as follows:

$$E = \frac{P_{0.3\%} - P_{0.1\%}}{b * d * \left(e_{0.3\%} - e_{0.1\%}\right) * \left(\frac{1{,}000{,}000\, psi}{msi}\right)} x \frac{CPT_{specimen}}{CPT_{batchaverage}}$$

A.5. IN-PLANE (IOSIPESCU) SHEAR

The in-plane (iosipescu) shear tests were conducted in accordance with ASTM D5379-93 and D5379-98 for new calculation ranges. Six test specimens, 4 for shear strength & modulus and 2 for shear strength only, were tested for each test condition. Test specimens from one batch were tested at -65°F (Dry). Test specimens from three batches were tested at 75°F (Dry), 180°F (Dry) and 180°F (Wet).

Sixteen plies were used to fabricate the initial test panels, in the $(Warp/Fill)_{4S}$ ply stacking sequence. The test specimens were wet cut, to nominal length of 3.0 inches and to nominal width of 0.75 inch. The specimen width is further machined to symmetrical centrally located v-notched width of 0.45 inch, in accordance with ASTM D5379-93.

The symmetrical centrally notched widths of the test specimens were measured with digital needlepoint and spindle micrometer. The thickness of the specimens were measured with digital ¼" diameter hemispherical anvil and spindle micrometer. The measurements were recorded onto TCFOR-Q-033. The width and thickness measurements were entered into the test frame computer along with the material type, batch number, test condition and specimen identification.

The test specimens were inserted into the v-notched beam test fixture, with the notch located along the line-of-action of loading by means of an alignment tool that referenced the fixture. The notches influence the shear strain along the loading direction, as the two halves of the fixture were compressed by the load frame while monitoring load.

Instron 4505 load frame, operated in stroke control mode, was used to apply the loads. The crosshead displacement rate for each test was 0.05 in/min (1.27 mm/min). The strains were measured with a EA-06-125-TW-120 rosette strain gauge, except the -65°F test specimens that were strain gauged with EA-06-062TV-350 and tested by Intec. The loads and strains were recorded throughout each test using computerized data assimilation system.

A.5.1. In-plane (Iosipescu) Shear Strength Calculations

The strains were measured using the bonded strain gauge. The shear cord modulus was calculated in accordance with ASTM D5379-98, at 6500 microstrain and 2500 microstrain. The ultimate in-plane (iosipescu) shear strength and moduli were calculated by transferring the raw data recorded, for example, ultimate loads, measured strains, from the instron computer into a Microsoft Excel spreadsheet, in accordance with the following equations:

A.5.1.1. In-plane (Iosipescu) Shear, Ultimate Strength Calculation

$$t_{Ult.} = \frac{P}{b * d * \left(\frac{1{,}000\, psi}{ksi} \right)}$$

where: $\tau_{Ult.}$ = the ultimate in-plane shear strength, ksi
P = the ultimate load, lbs.
b = the measured specimen width, in the symmetrical centrally located notch, inch
d = the average measured specimen thickness, inch

A.5.1.2. In-plane (Iosipescu) Shear, Modulus Calculation

$$G_{12} = \frac{P_{0.65\%} - P_{0.25\%}}{b * d * (g_{0.65\%} - g_{0.25\%}) * \left(\frac{1{,}000{,}000\, psi}{msi} \right)}$$

where: G_{12} = shear chord modulus of elasticity (Msi)
$P_{0.65\%}$ = applied load at 6500 microstrain (lbs.)
$P_{0.25\%}$ = applied load at 2500 microstrain (lbs.)
b = the measured specimen width, in the symmetrical centrally located notch (inch)
d = the average measured specimen thickness (inch)
$\gamma_{0.65\%} = |\varepsilon_{+45}| + |\varepsilon_{-45}|$ = shear strain at 6500 microstrain
$\gamma_{0.25\%} = |\varepsilon_{+45}| + |\varepsilon_{-45}|$ = shear strain at 2500 microstrain

A.6. SHORT BEAM SHEAR

The short beam shear tests were conducted in accordance with ASTM 2344-89. Six test specimens from three batches were tested at 75°F (Dry) only.

Twelve plies were used to fabricate the initial test panels, in the zero-degree ply stacking sequence, $(warp)_{12}$. The test specimens were wet cut, to nominal length of 6*average thickness, in inches and to nominal width of 0.25 inch.

Instron 4505 load frame, operated in stroke control mode, was used to apply the loads. The crosshead displacement rate for each test was 0.05 in/min (1.27 mm/min). The loads and displacements were recorded throughout each test using computerized data assimilation system.

A.6.1. Short Beam Shear Strength Calculations

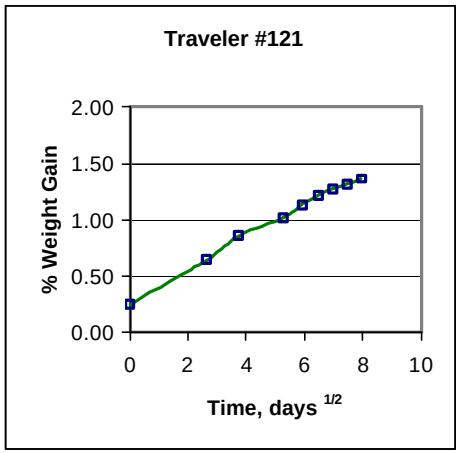
The short beam shear strengths were calculated by transferring the raw data recorded from the Instron 4505 computer into Microsoft Excel spreadsheet program, in accordance with the following equation:

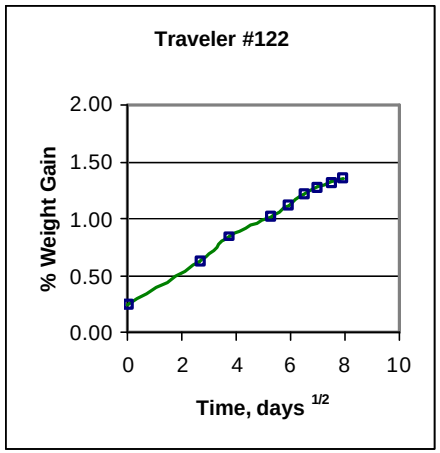
A.6.1.1. Short Beam Shear Strength Calculation

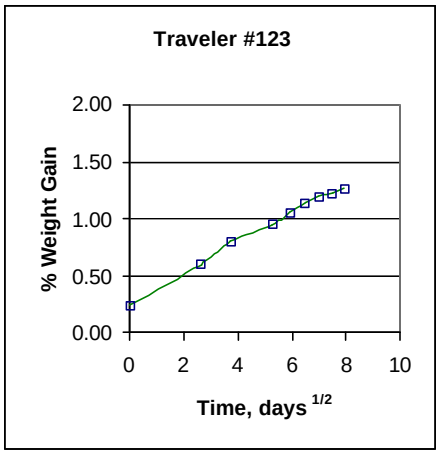
$$F = \frac{3 * P}{4 * b * t * \left(\frac{1{,}000\, psi}{ksi} \right)}$$

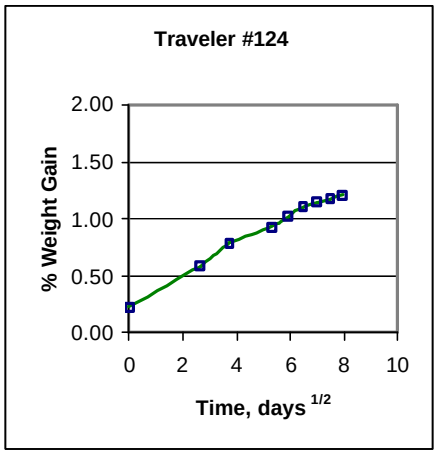
where: F = the short beam shear strength (ksi)
P = the ultimate load (lbs.)
b = the measured specimen width (inch)
t = the measured specimen thickness (inch)

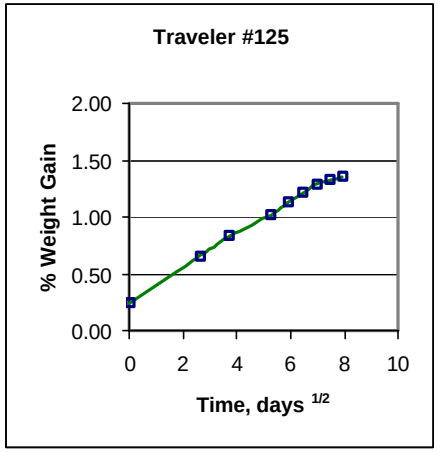
APPENDIX B. MOISTURE CONDITIONING HISTORY CHARTS

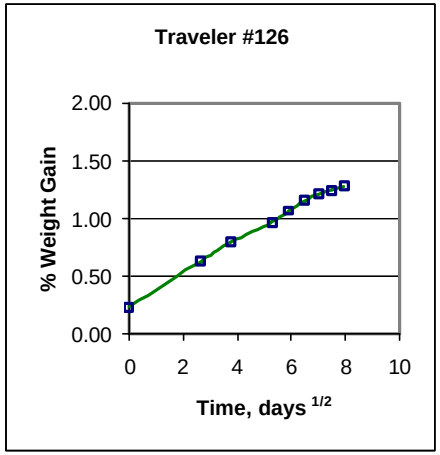


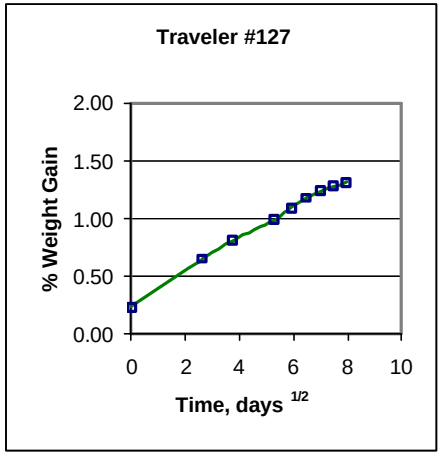


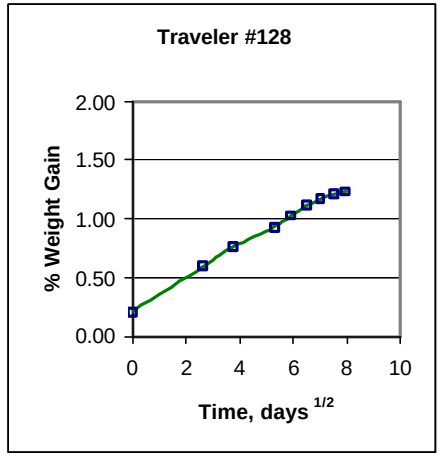


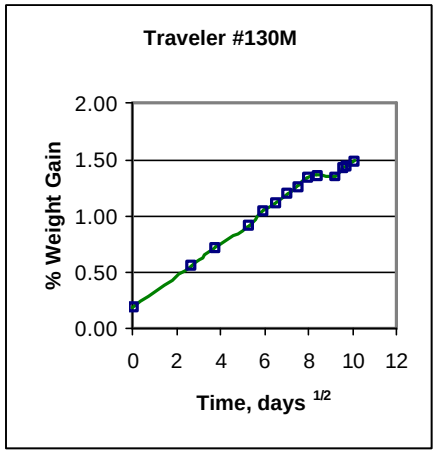


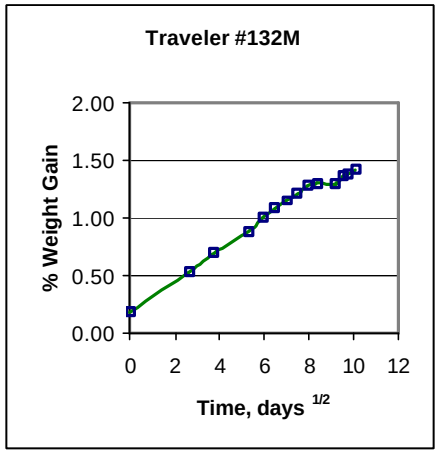


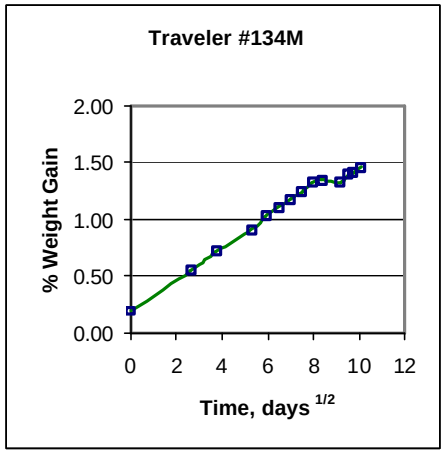


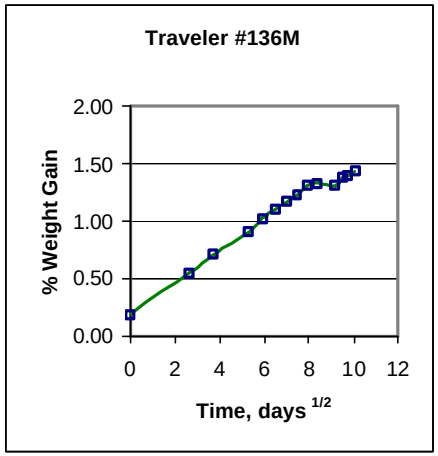


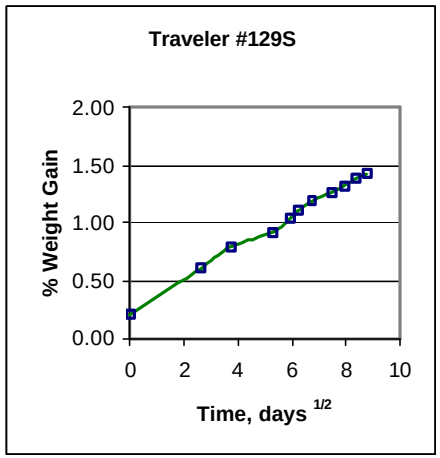


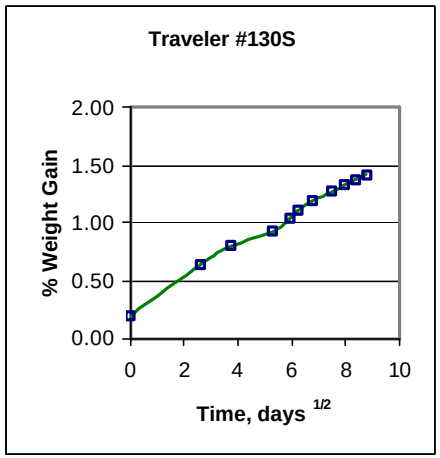


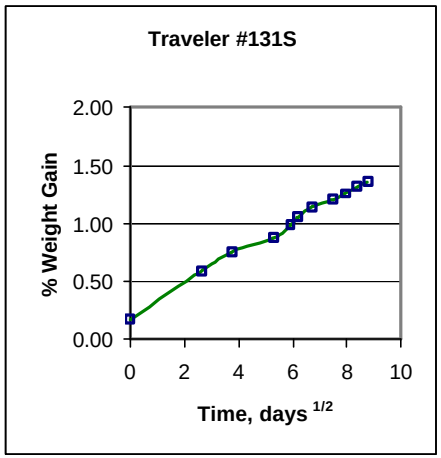


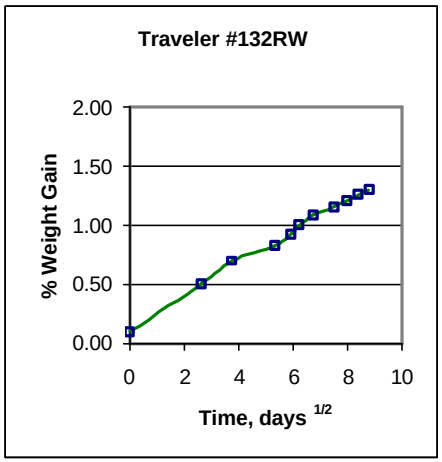


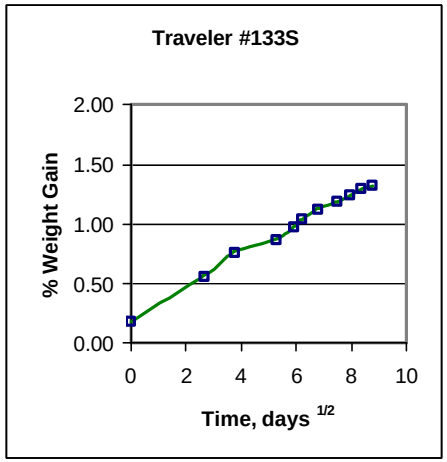


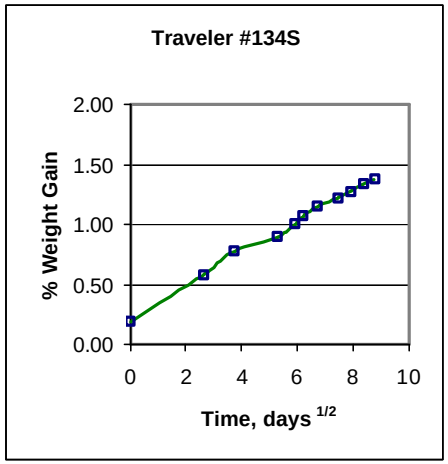


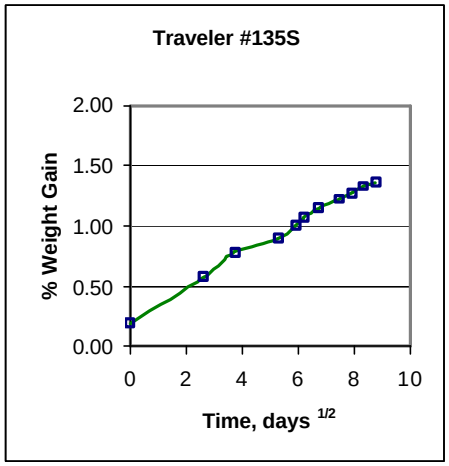


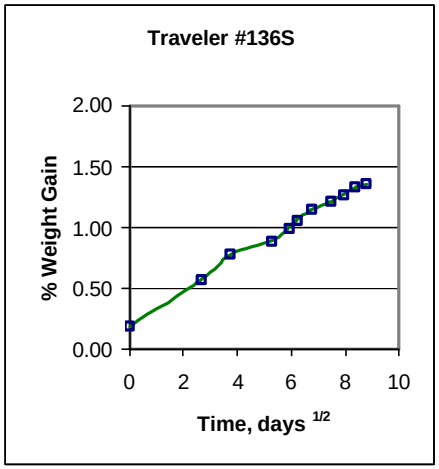


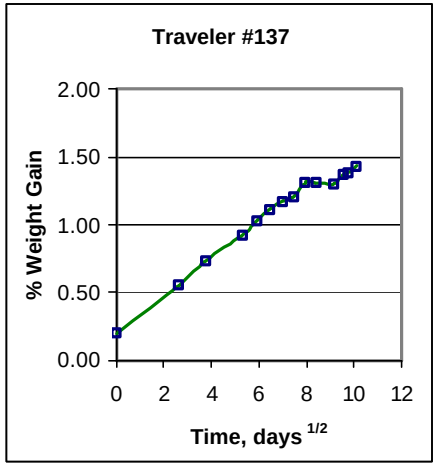


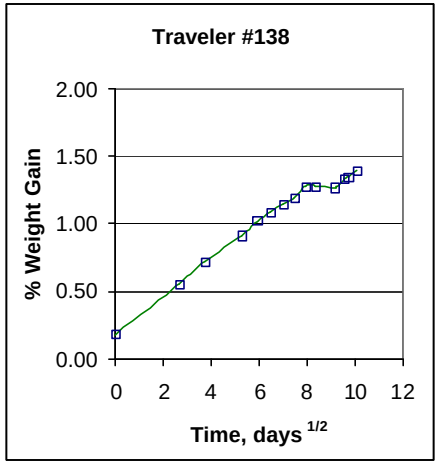


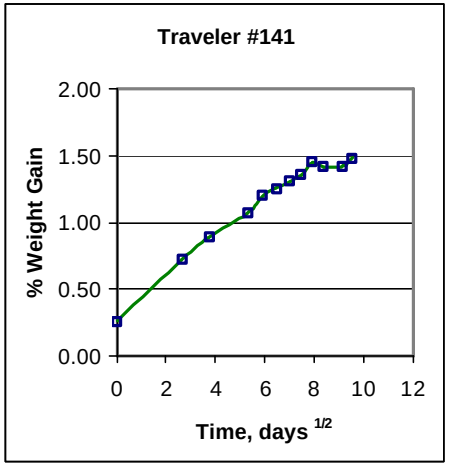


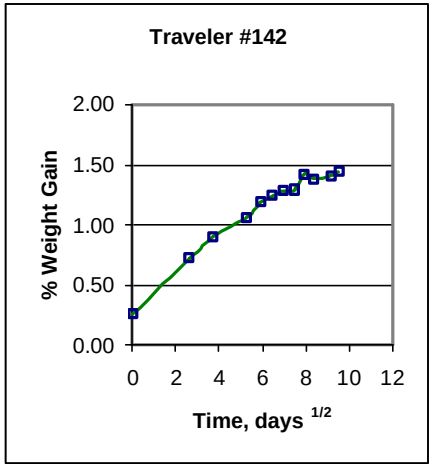


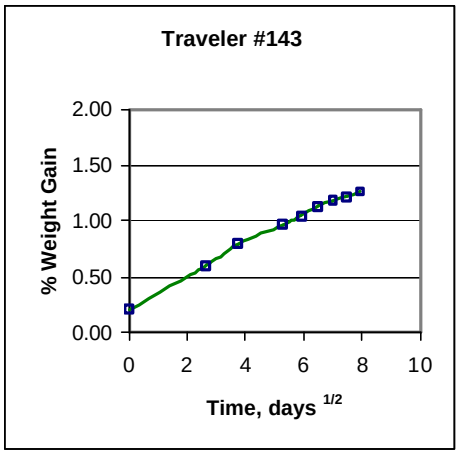


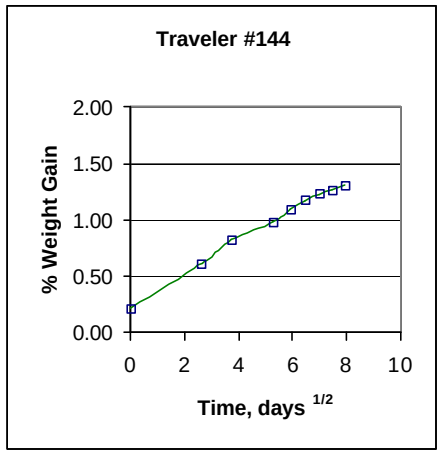


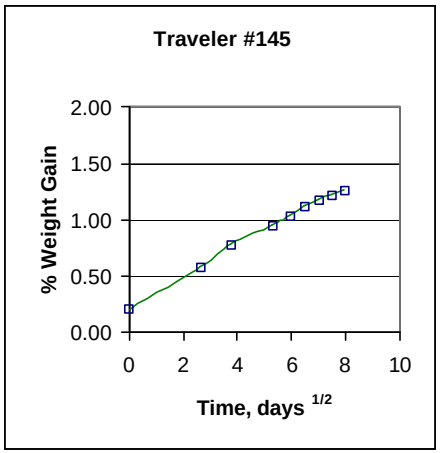


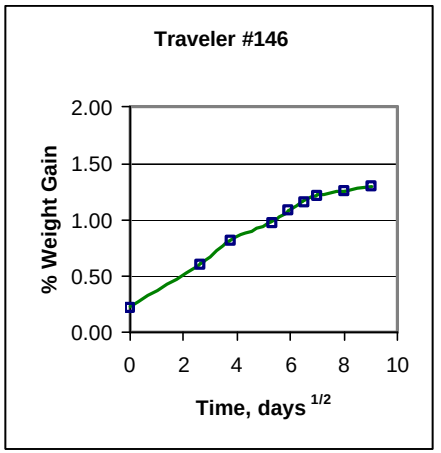


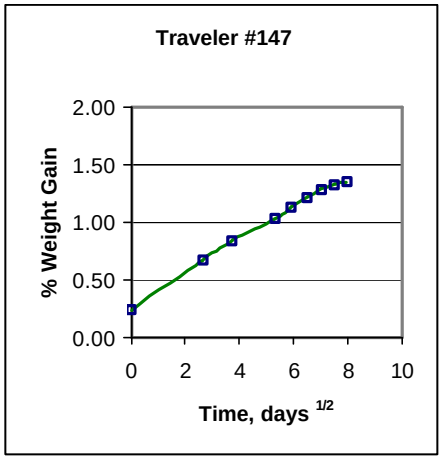


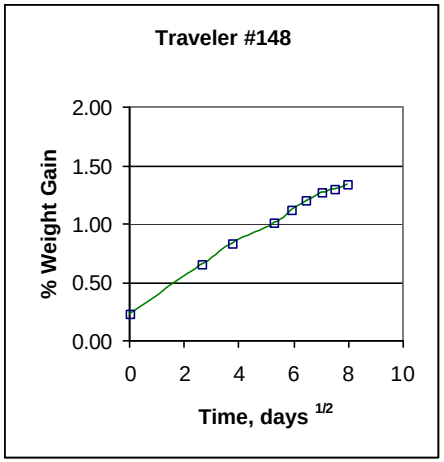


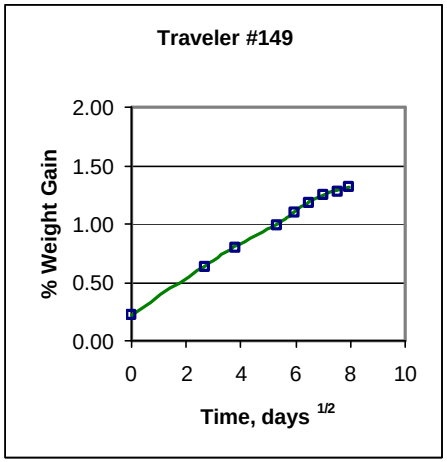


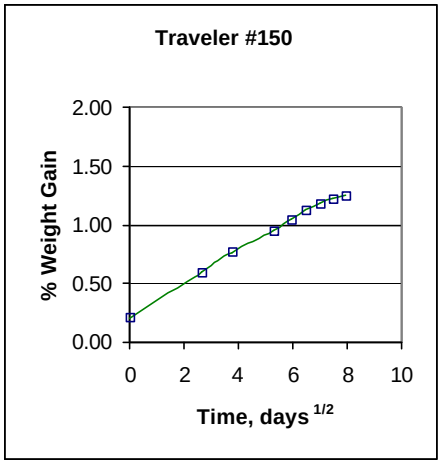


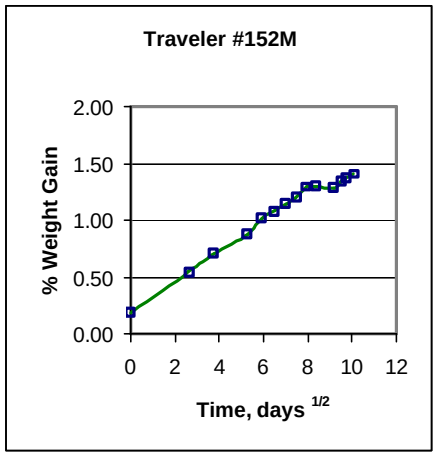


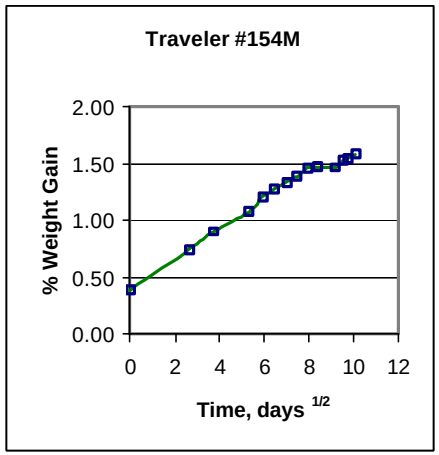


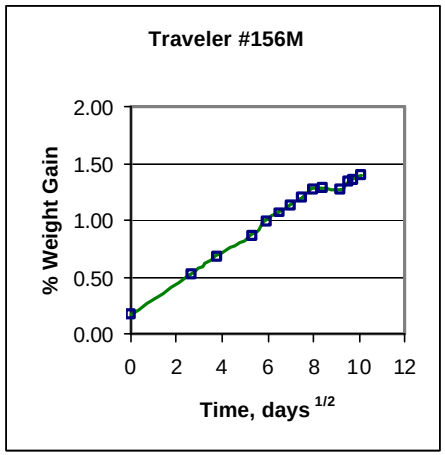


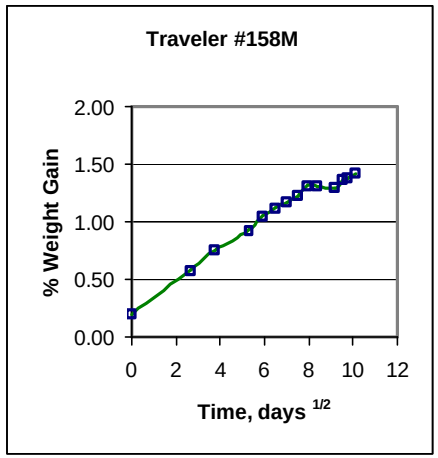


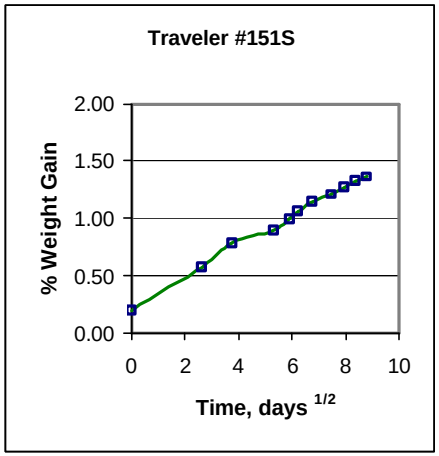


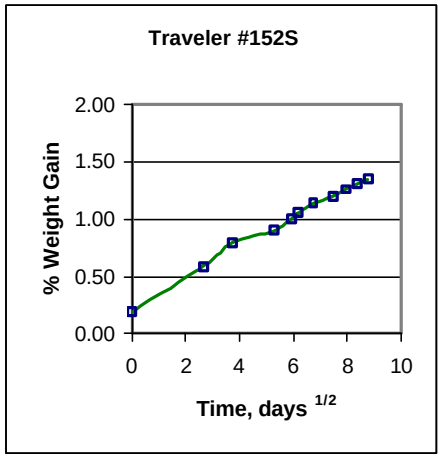


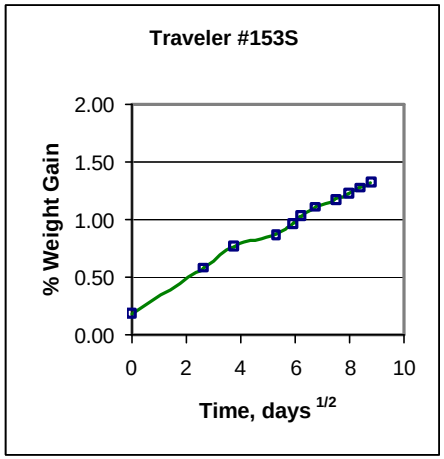


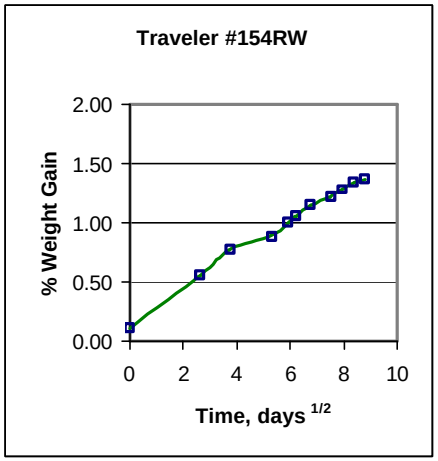


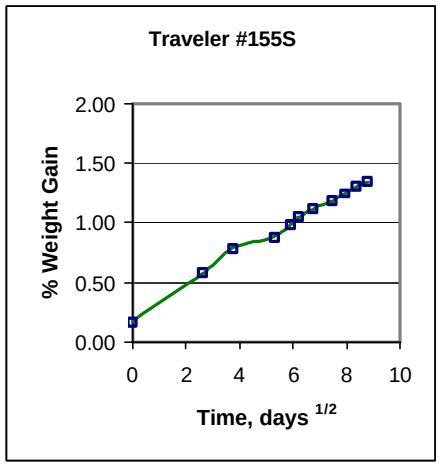


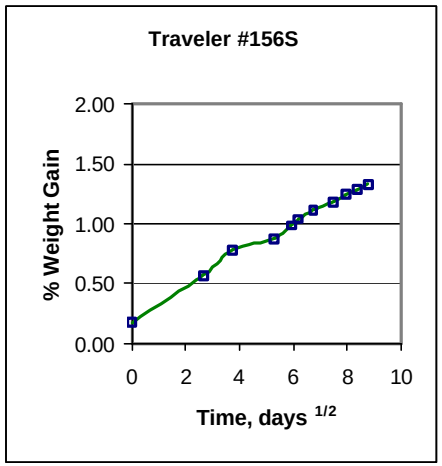


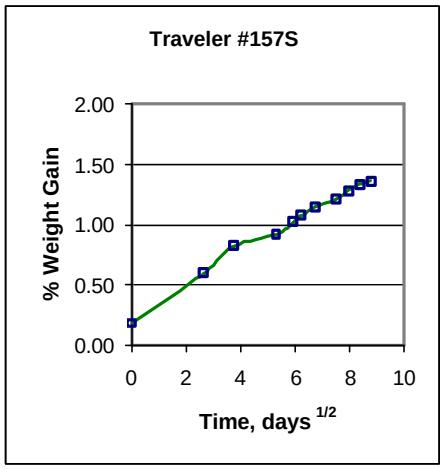


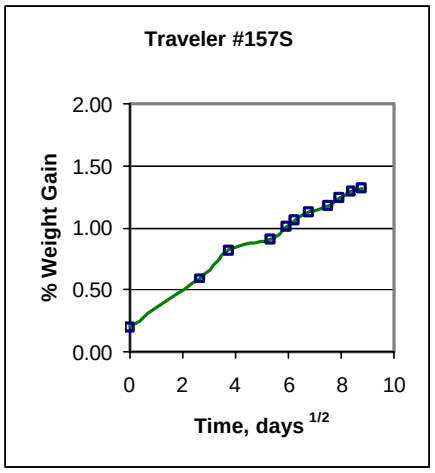


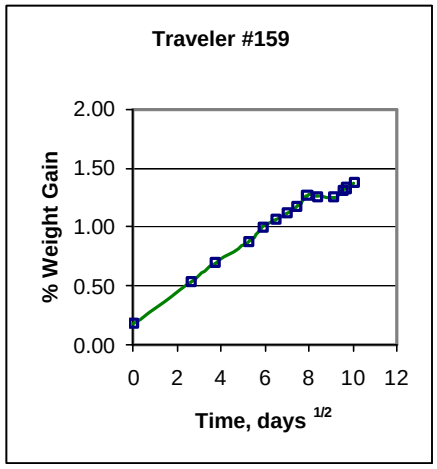


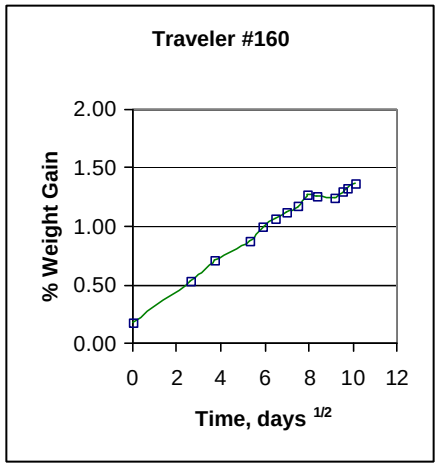


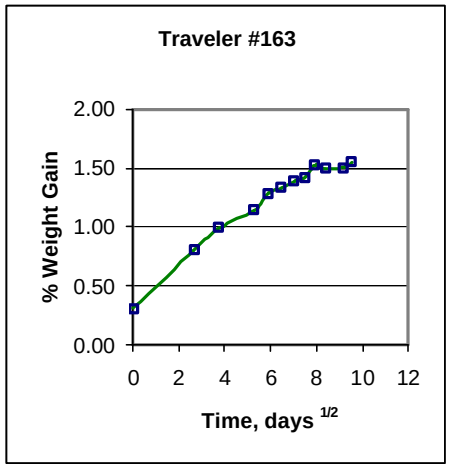


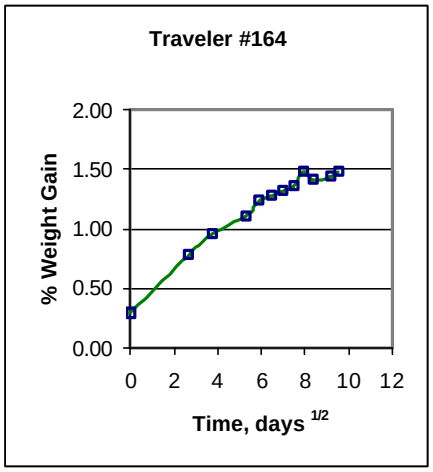


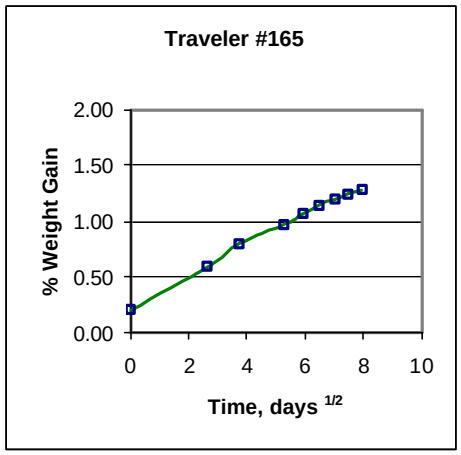


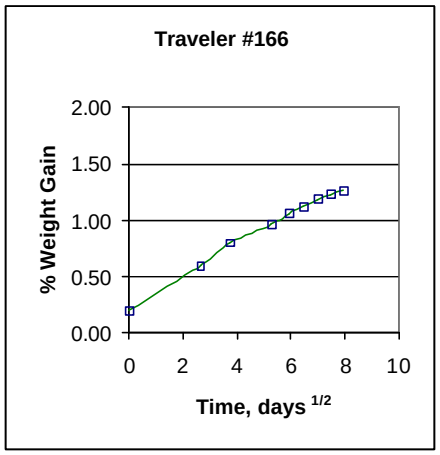


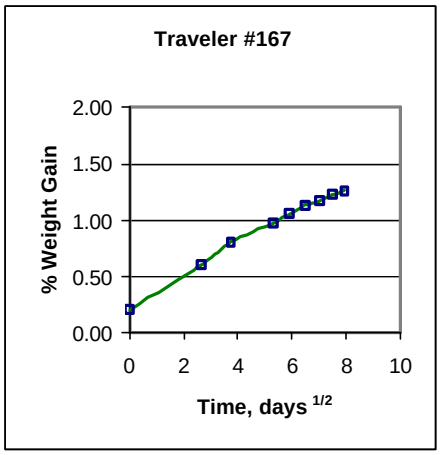


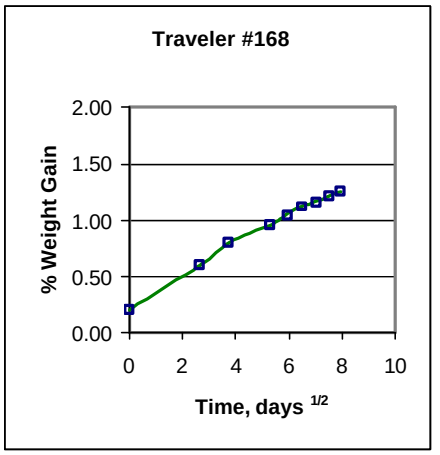


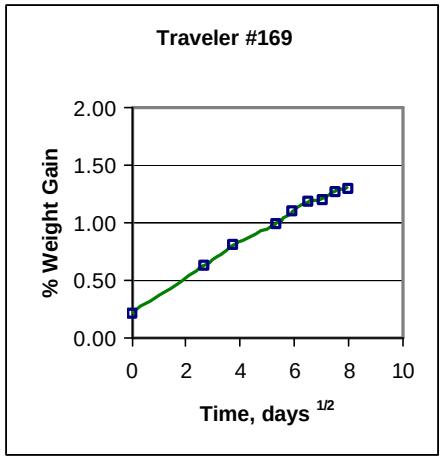


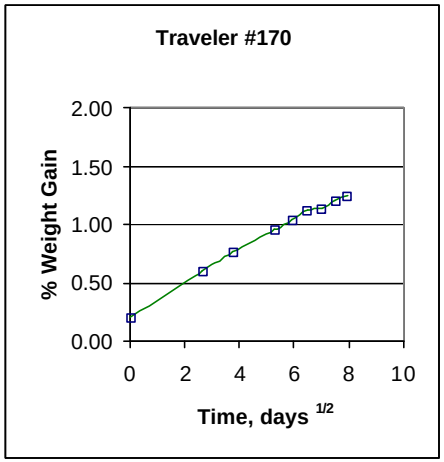


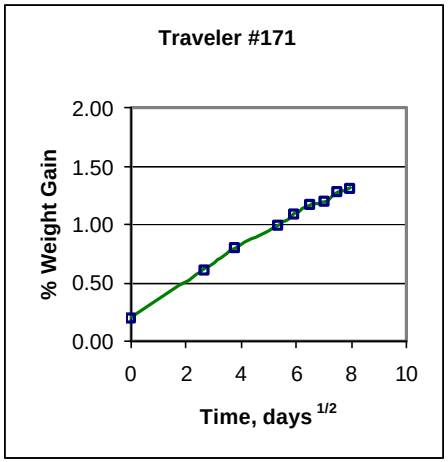


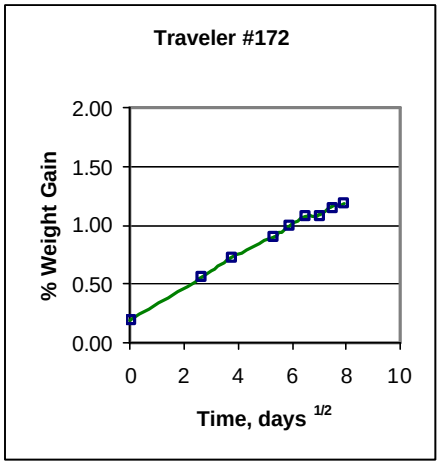


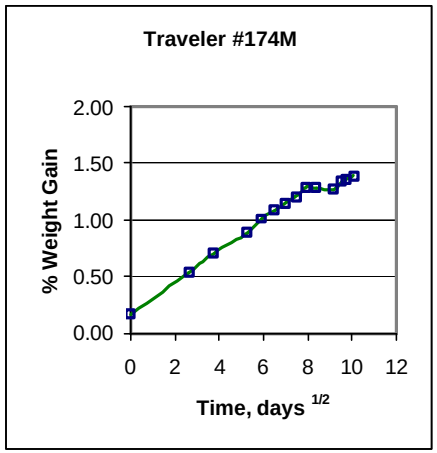


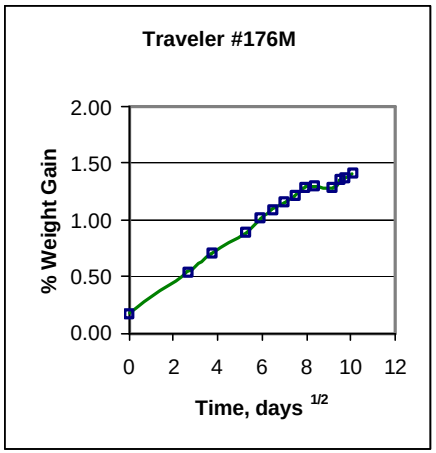


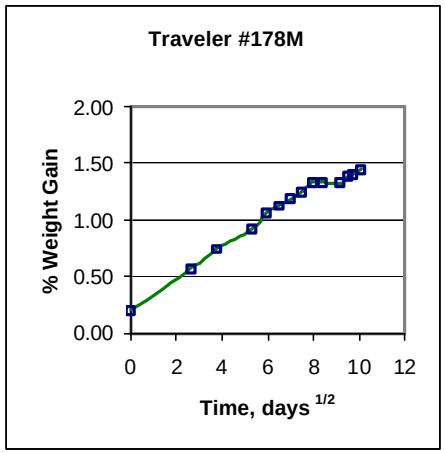


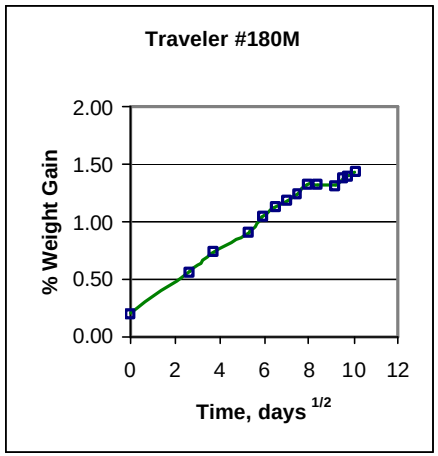


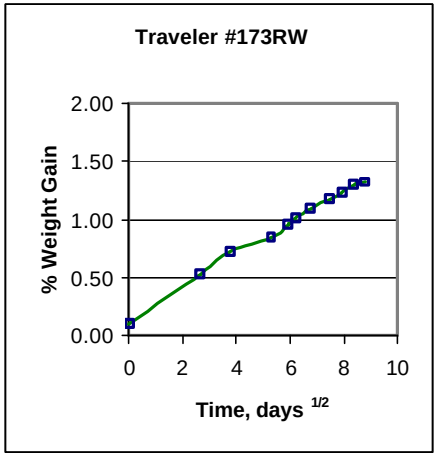


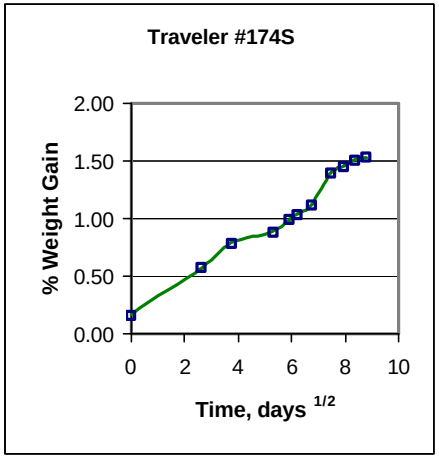


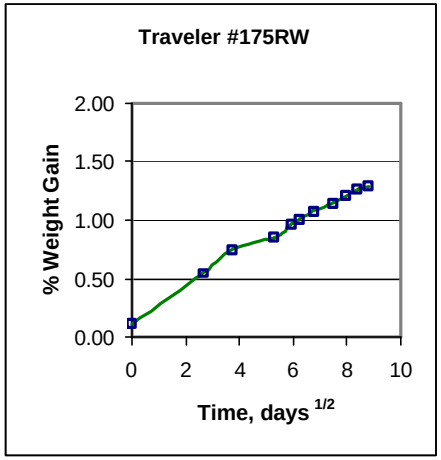


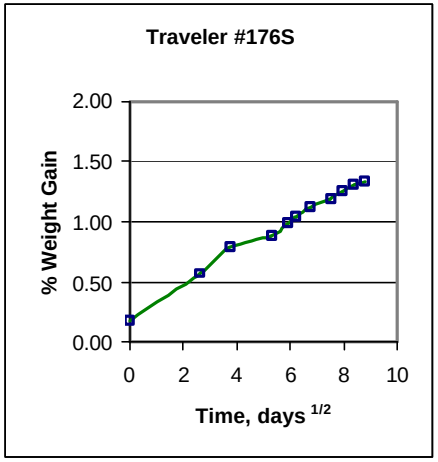


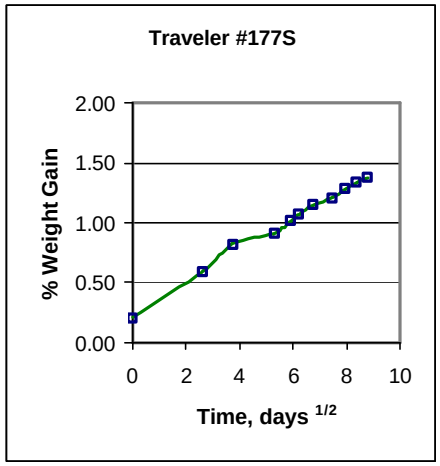


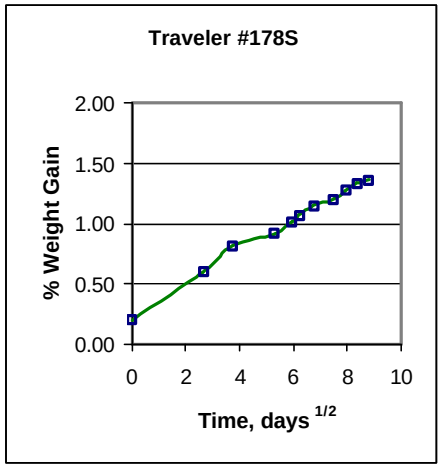


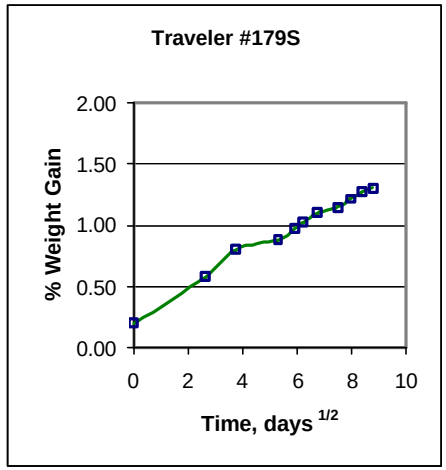


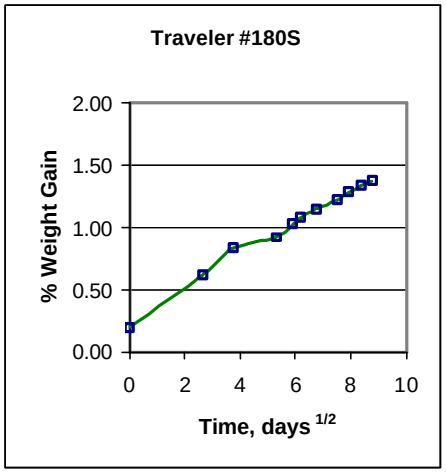


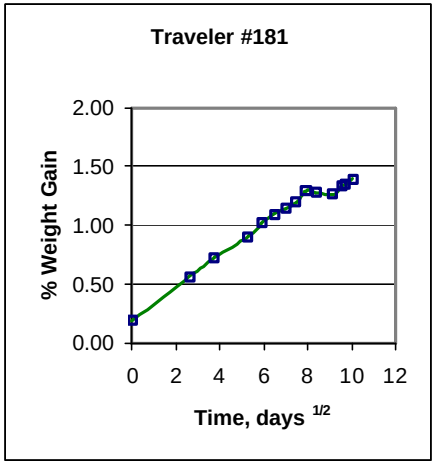


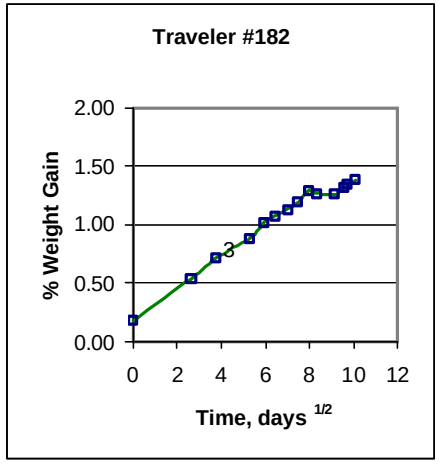


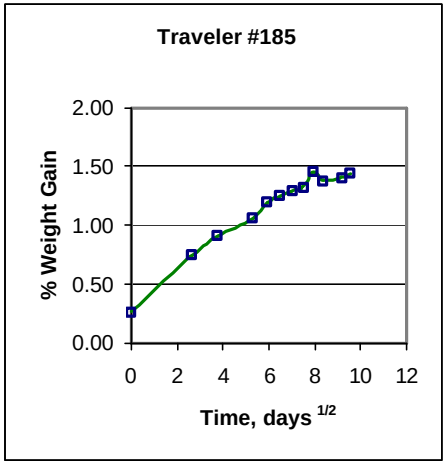


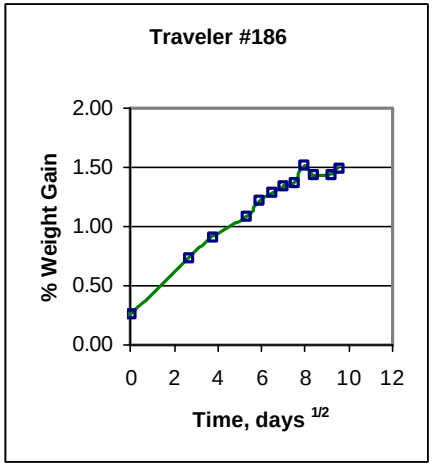












APPENDIX C. PHYSICAL TEST RESULTS

Summary of Chemical and Physical Tests - Uncured Material Properties

Material Batch	Physical					Chemical								
	Uncured Resin Content (%)	Fiber Areal Weight (g/m^2)	Prepreg Volatile Content (%)	Gel Time (minutes)	Resin Flow (%)	IR	HPLC (% Area)					DSC (°F)	
							P_1	P_2	P_3	P_4	P_5	Onset	Peak
AF991102	39.0	292	0.17	9.9	24.5	scan	9.9	8.6	5.9	60.5	15.2	291	326
AF991103	38.0	296	0.16	10.0	23.0	on	10.0	8.6	5.9	60.4	15.2	290	326
AF991104	37.8	291	0.17	10.7	23.5	file	9.9	8.6	6.2	60.4	15.2	291	327
Grand Average	38.3	293	0.17	10.2	23.7		9.9	8.6	6.0	60.4	15.2	291	326
Requirement	38 ± 3	295 ± 10	2.0 max	5 - 25	10 min		TBD					TBD	TBD

Summary of Chemical and Physical Tests - Cured Material Properties

Material Batch	Resin Density (g/cc)	Glass Transition Temperature by DMA (°F)	
		Dry	Wet
AF991102	1.265	290	261
AF991103	1.265	290	262
	1.260	289	259
Grand Average	1.263	290	261
Requirement	1.26 ± 0.03	TBD	TBD *

* FAA Recommended Hot/Wet Tg: 230°F, Based on Maximum Operation Temperature of 180°F + 50°F

Summary of Chemical and Physical Tests - Cured Material Properties, Batch AF991102

Batch No./ Panel ID	Test Type	Laminate Density (g/cc)	Fiber Volume (%vol)	Resin Volume (%vol)	Void Content (%vol)	Cured Ply Thickness (in.)	Autoclave Cure Run ID -
AF991102							
A1-911-081	0° Tens	1.787	43.4	53.4	3.22	0.0106	99-708
A2-911-081	0° Tens	1.811	44.2	53.6	2.23	0.0105	99-710
B1-911-081	0° Tens	1.817	45.5	51.4	3.09	0.0104	99-707
B2-911-081	0° Tens	1.803	45.4	50.5	4.05	0.0105	99-707
A1-911-081	90° Tens	1.892	47.9	52.6	0.00	0.0105	99-708
A2-911-081	90° Tens	1.822	45.9	51.1	3.02	0.0105	99-708
B1-911-081	90° Tens	1.812	45.1	51.9	3.03	0.0103	99-711
B2-911-081	90° Tens	1.830	45.4	52.8	1.85	0.0105	99-711
A1-911-081	0° Comp	1.781	42.7	54.2	3.07	0.0107	99-706
A2-911-081	0°Comp	1.754	41.6	54.4	4.02	0.0109	99-706
B1-911-081	0°Comp	1.808	44.7	52.4	2.92	0.0107	99-707
B2-911-081	0°Comp	1.845	46.6	51.5	1.94	0.0102	00-070
A1-911-081	90°Comp	1.815	45.3	51.8	2.96	0.0106	99-706
A2-911-081	90°Comp	1.793	43.5	53.7	2.83	0.0105	99-706
B1-911-081	90°Comp	1.813	43.8	54.6	1.61	0.0106	99-709
B2-911-081	90°Comp	1.806	44.7	52.3	3.07	0.0104	99-709
A1-911-081	IPS	1.794	43.7	53.2	3.05	0.0104	99-710
B1-911-081	IPS	1.766	43.9	50.6	5.47	0.0105	99-709
A1-911-081	ILSS	1.750	41.7	53.9	4.41	0.0104	99-706
B1-911-081	ILSS	1.810	44.1	53.8	2.13	0.0108	99-709
Average		1.805	44.4	52.7	2.90	0.0105	-
Standard Deviation		0.032	1.5	1.3	1.14	0.0002	-
COV, %		1.75	3.46	2.41	39.46	1.53	-
Requirement		TBD	TBD	TBD	TBD	TBD	-

Summary of Chemical and Physical Tests - Cured Material Properties, Batch AF991103

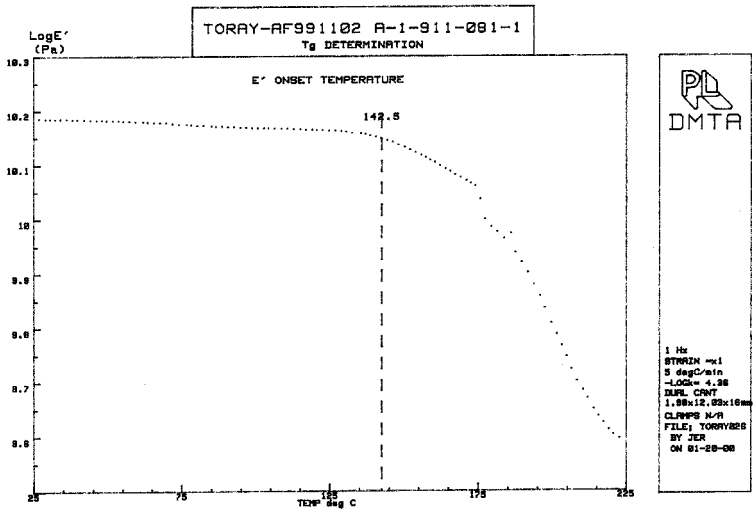
Batch No./ Panel ID	Test Type	Laminate Density (g/cc)	Fiber Volume (%vol)	Resin Volume (%vol)	Void Content (%vol)	Cured Ply Thickness (in.)	Autoclave Cure Run ID -
AF991103							
A1-911-082	0° Tens	1.830	46.4	50.6	2.97	0.0104	99-714
A2-911-082	0° Tens	1.805	44.7	52.1	3.19	0.0103	99-714
B1-911-082	0° Tens	1.837	46.9	50.2	2.94	0.0102	99-713
B2-911-082	0° Tens	1.814	44.8	52.6	2.59	0.0103	99-713
A1-911-082	90° Tens	1.788	43.4	53.4	3.18	0.0103	99-714
A2-911-082	90° Tens	1.800	44.4	52.4	3.24	0.0104	99-714
B1-911-082	90° Tens	1.817	45.1	52.3	2.63	0.0103	99-713
B2-911-082	90° Tens	1.849	46.9	51.2	1.94	0.0102	99-713
A1-911-082	0° Comp	1.805	44.0	53.6	2.41	0.0104	99-712
A2-911-082	0°Comp	1.744	44.2	48.3	7.50	0.0100	99-712
B1-911-082	0°Comp	1.811	45.7	50.7	3.66	0.0100	99-713
B2-911-082	0°Comp	1.792	43.8	53.0	3.28	0.0102	00-070
A1-911-082	90°Comp	1.805	43.8	53.9	2.28	0.0102	99-712
A2-911-082	90°Comp	1.807	44.8	52.1	3.09	0.0102	99-712
B1-911-082	90°Comp	1.796	43.8	53.3	2.95	0.0108	99-713
B2-911-082	90°Comp	1.798	44.8	51.3	3.87	0.0105	99-713
A1-911-082	IPS	1.836	46.2	51.6	2.26	0.0104	99-716
B1-911-082	IPS	1.835	46.2	51.5	2.30	0.0103	99-715
A1-911-082	ILSS	1.803	44.4	52.5	3.05	0.0104	99-712
B1-911-082	ILSS	1.802	44.3	52.7	2.99	0.0104	99-715
Average		1.809	44.9	52.0	3.12	0.0103	-
Standard Deviation		0.023	1.1	1.3	1.14	0.0002	-
COV, %		1.26	2.41	2.59	36.61	1.60	-
Requirement		TBD	TBD	TBD	TBD	TBD	-

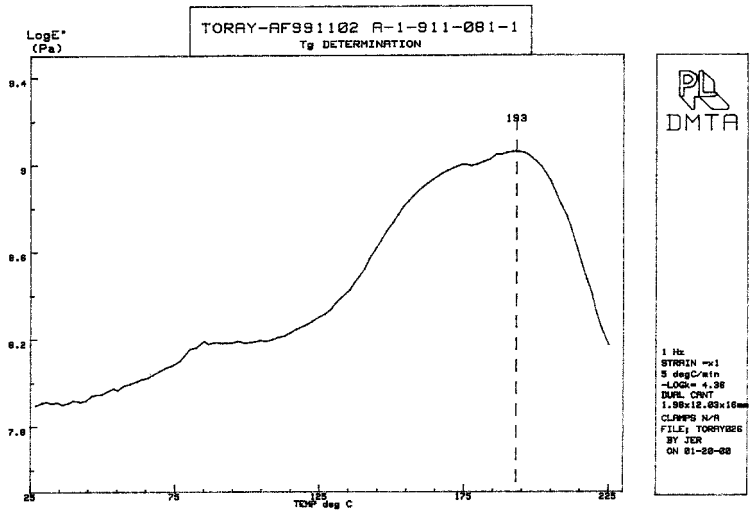
Summary of Chemical and Physical Tests - Cured Material Properties, Batch AF991104

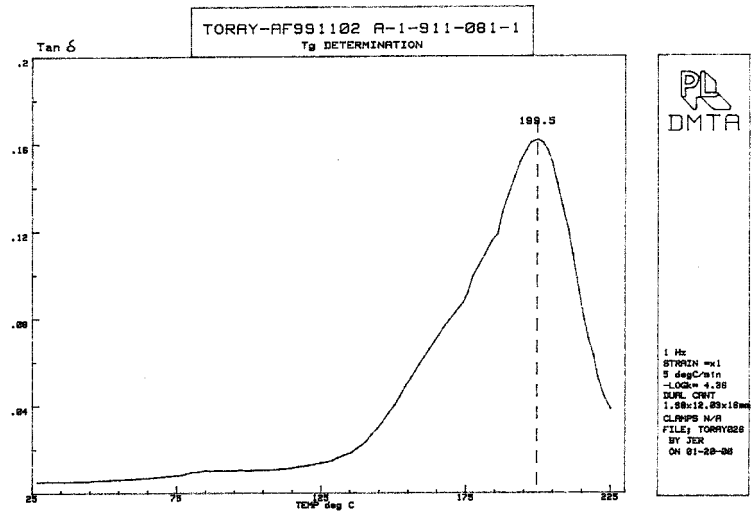
Batch No./ Panel ID	Test Type	Laminate Density (g/cc)	Fiber Volume (%vol)	Resin Volume (%vol)	Void Content (%vol)	Cured Ply Thickness (in.)	Autoclave Cure Run ID -
AF991104							
A1-911-083	0° Tens	1.788	44.2	51.8	3.99	0.0102	99-716
A2-911-083	0° Tens	1.804	45.3	50.9	3.85	0.0103	99-716
B1-911-083	0° Tens	1.826	45.8	51.5	2.67	0.0103	99-717
B2-911-083	0° Tens	1.832	46.7	50.3	3.03	0.0102	99-717
A1-911-083	90° Tens	1.789	44.4	51.5	4.11	0.0103	99-718
A2-911-083	90° Tens	1.811	45.9	50.1	4.01	0.0103	99-718
B1-911-083	90° Tens	1.809	44.6	52.7	2.73	0.0104	99-717
B2-911-083	90° Tens	1.864	48.2	49.8	2.04	0.0102	99-717
A1-911-083	0° Comp	1.824	45.1	52.8	2.08	0.0106	00-071
A2-911-083	0°Comp	1.778	44.5	50.3	5.15	0.0106	99-716
B1-911-083	0°Comp	1.822	47.2	48.5	4.39	0.0103	00-070
B2-911-083	0°Comp	1.796	44.7	51.4	3.87	0.0103	99-717
A1-911-083	90°Comp	1.808	45.2	51.3	3.46	0.0104	99-718
A2-911-083	90°Comp	1.794	45.3	50.0	4.67	0.0104	99-718
B1-911-083	90°Comp	1.818	47.2	48.1	4.72	0.0106	99-719
B2-911-083	90°Comp	1.797	44.9	51.1	4.04	0.0104	99-719
A1-911-083	IPS	1.815	45.3	51.7	3.01	0.0102	99-716
B1-911-083	IPS	1.815	45.3	51.7	3.02	0.0102	99-719
A1-911-083	ILSS	1.723	43.6	47.9	8.52	0.0098	99-718
B1-911-083	ILSS	1.764	42.9	52.5	4.56	0.0106	99-719
Average		1.804	45.3	50.8	3.90	0.0103	-
Standard Deviation		0.029	1.3	1.4	1.40	0.0002	-
COV, %		1.59	2.77	2.81	35.87	1.70	-
Requirement		TBD	TBD	TBD	TBD	TBD	-

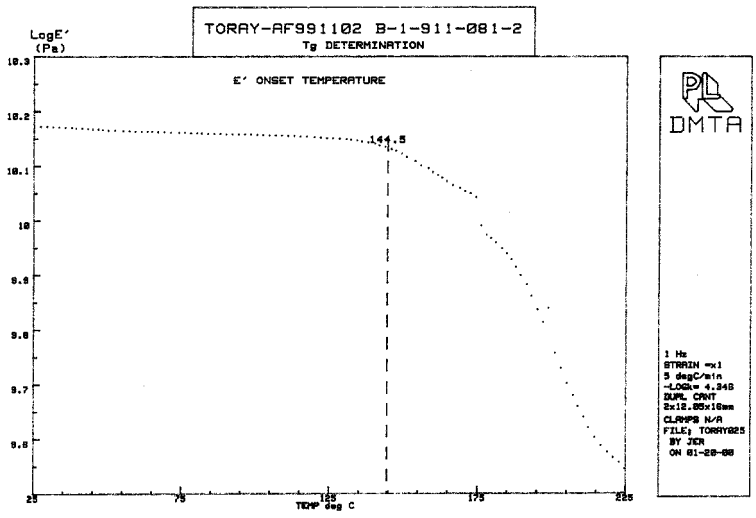
Dynamic Mechanical Analysis (DMA)
Graphs
in determination of
Dry Glass Transition Temperature, Tg (dry)
for

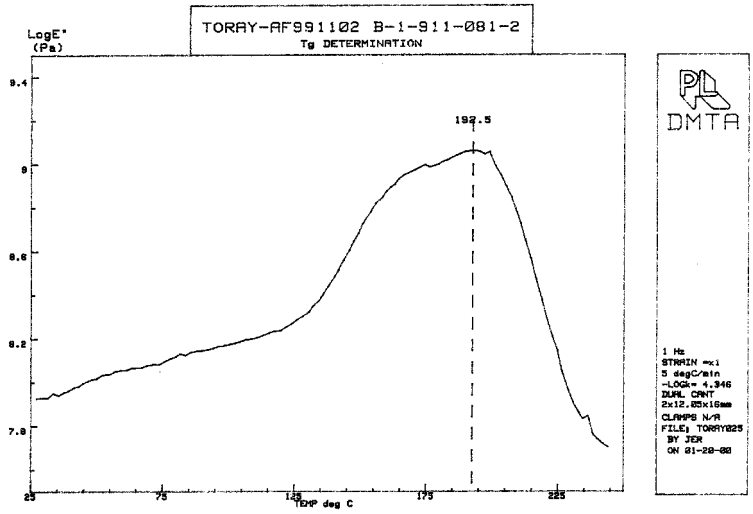
FGF7781-07I
Style 7781/#2510
Fiberglass 8-Harness Woven Fabric Prepreg

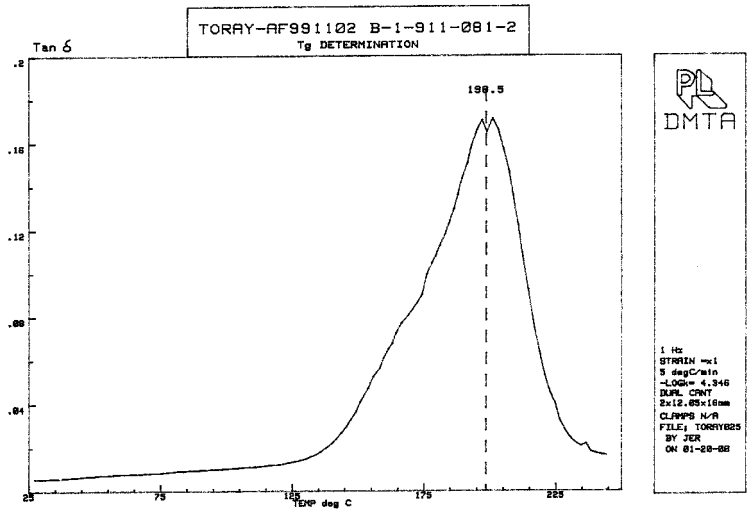


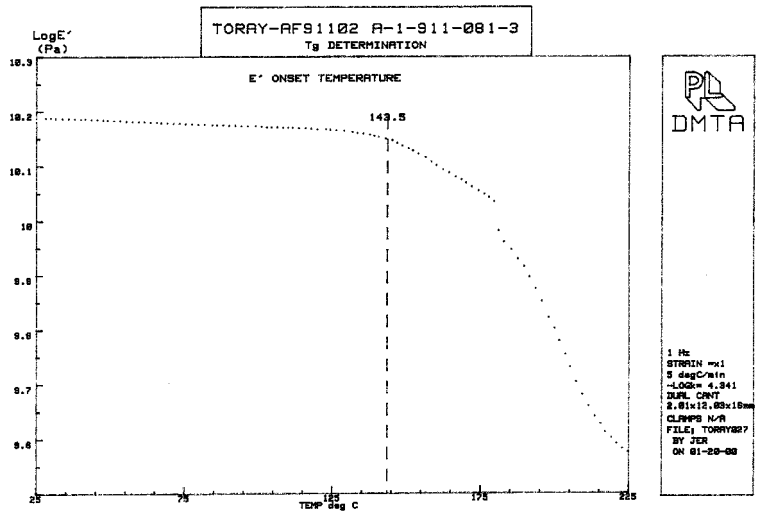


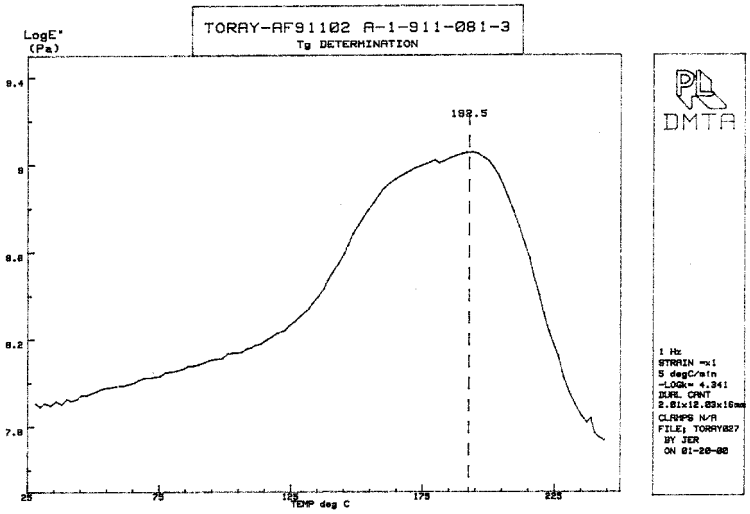


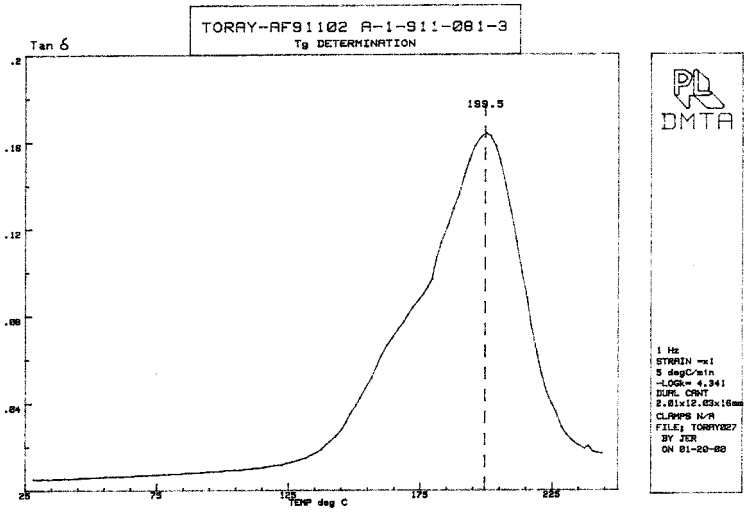


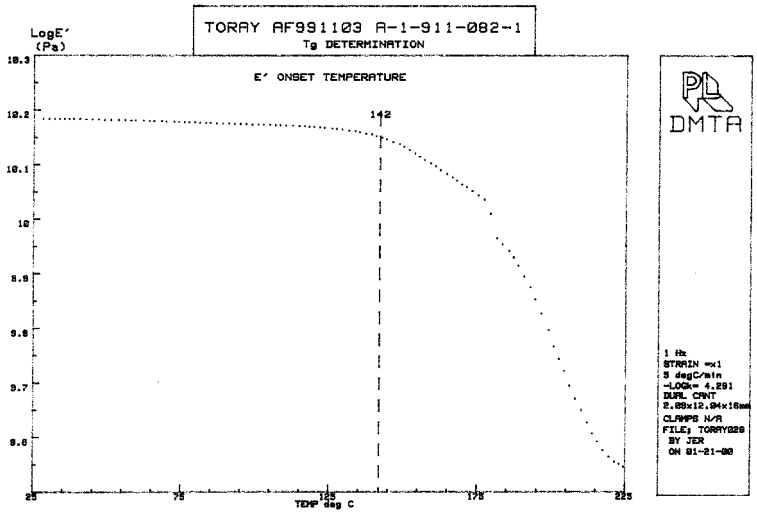


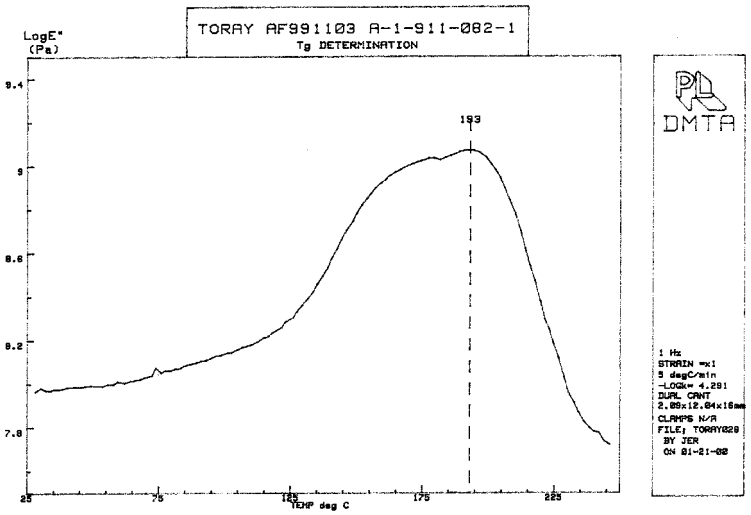


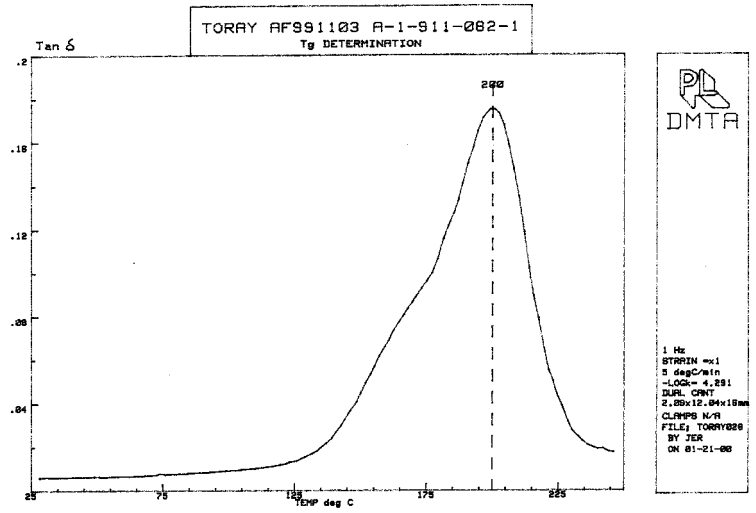


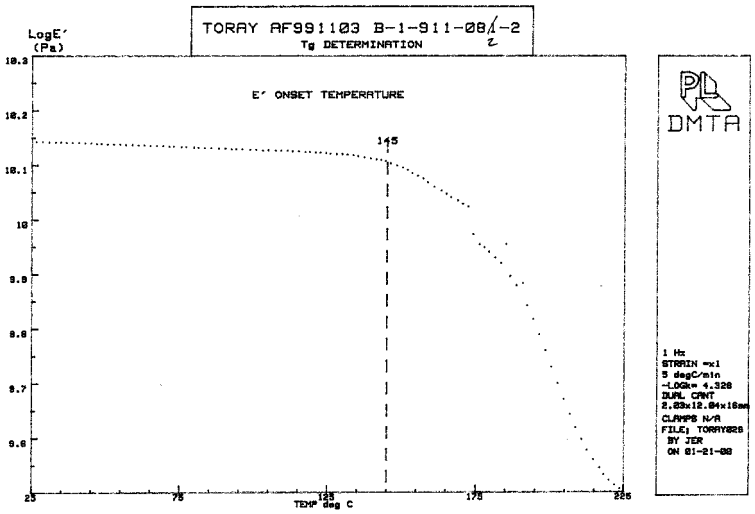


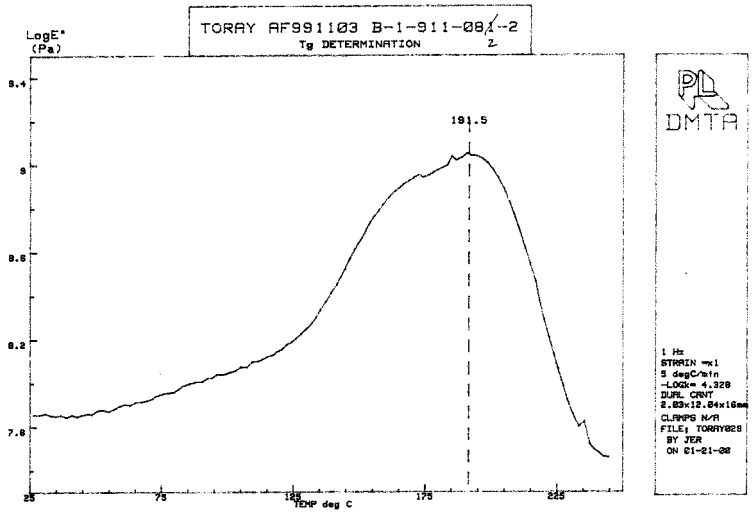


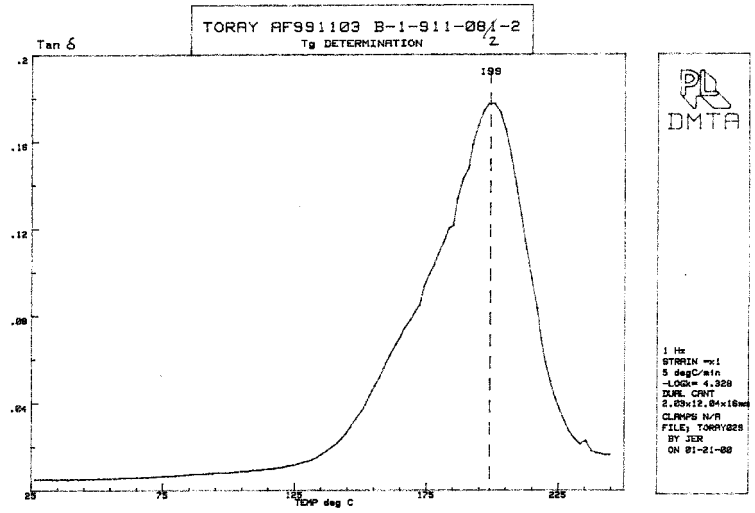


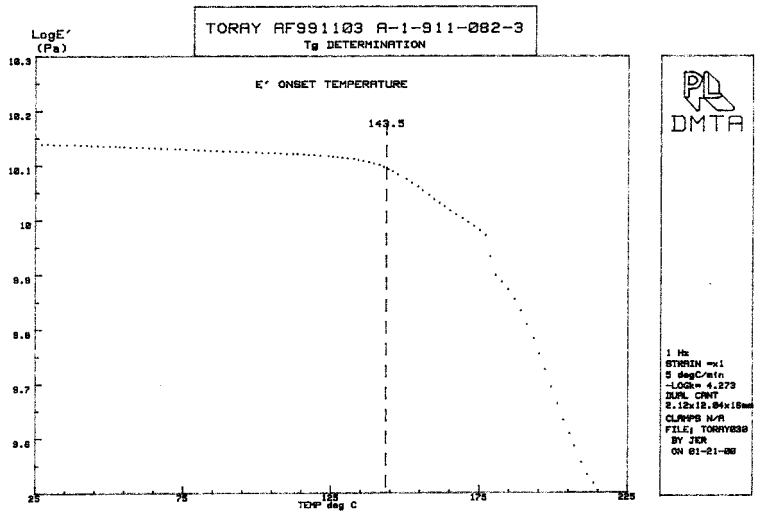


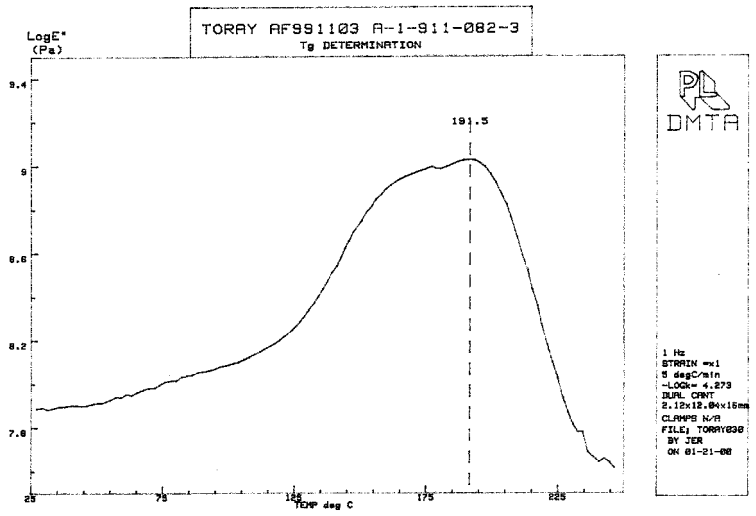


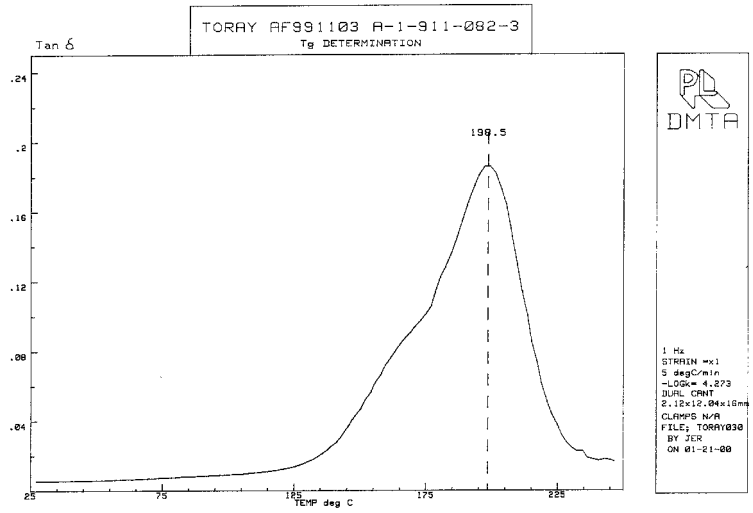


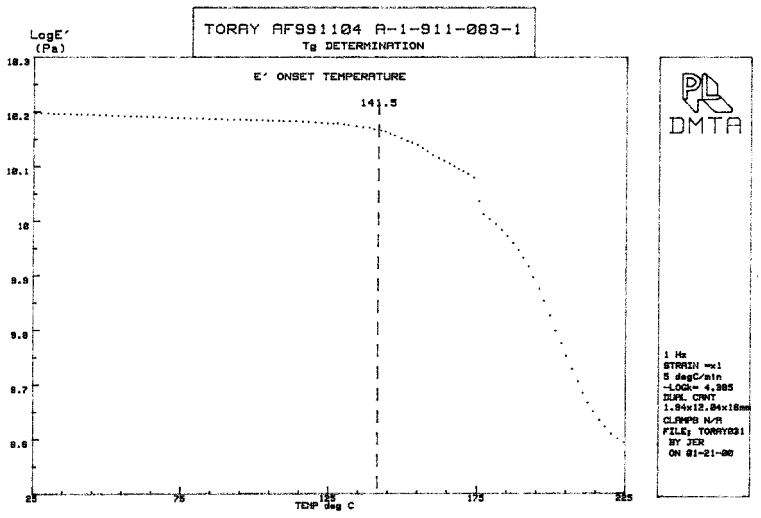


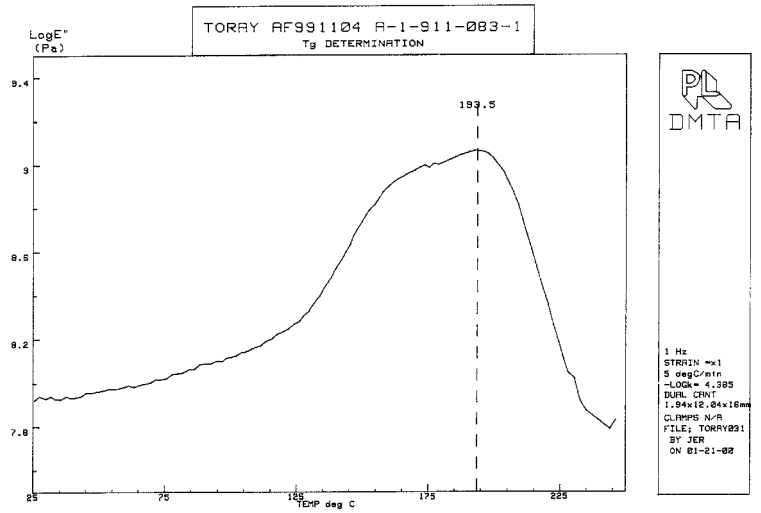


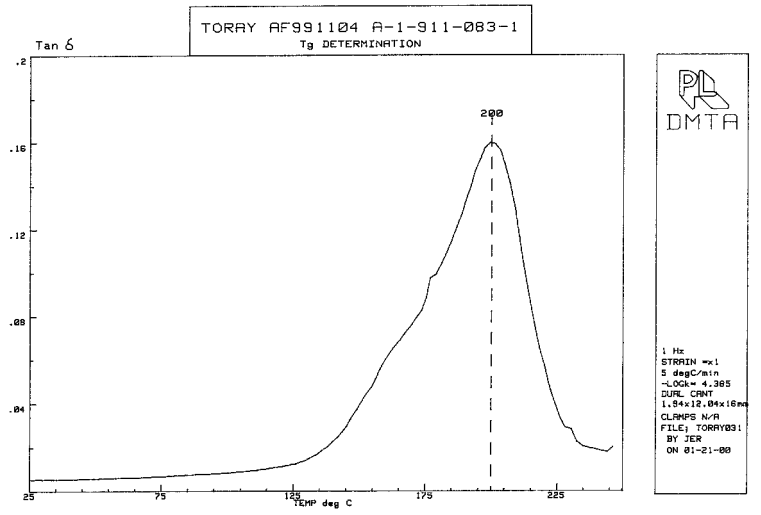


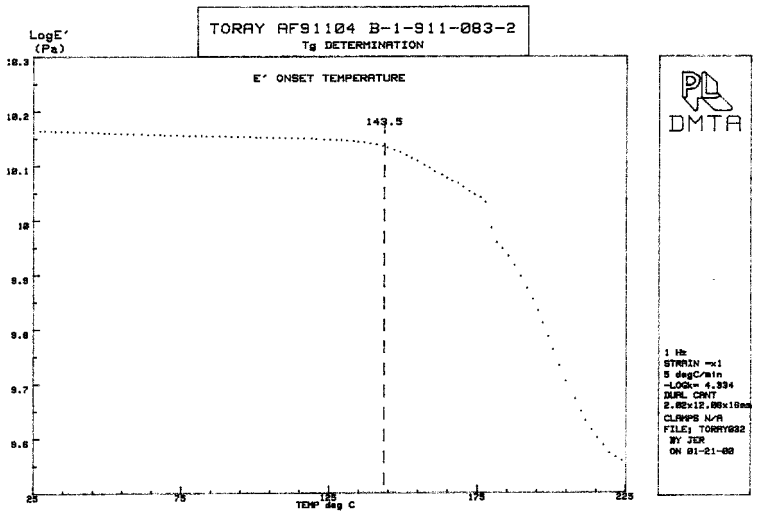


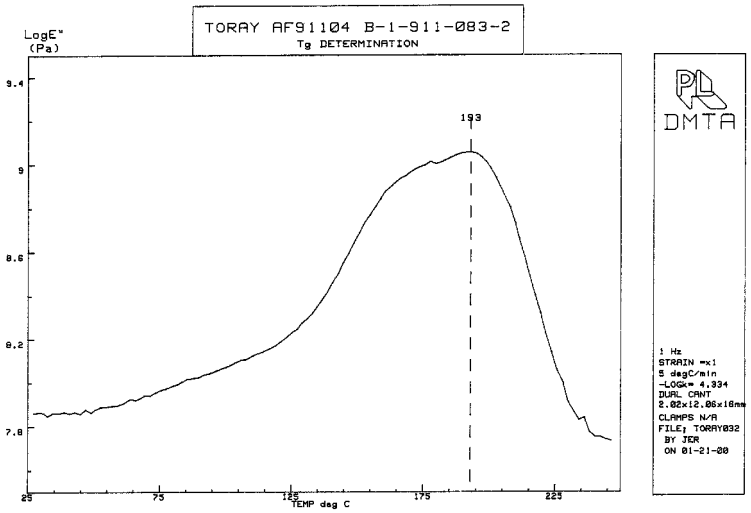


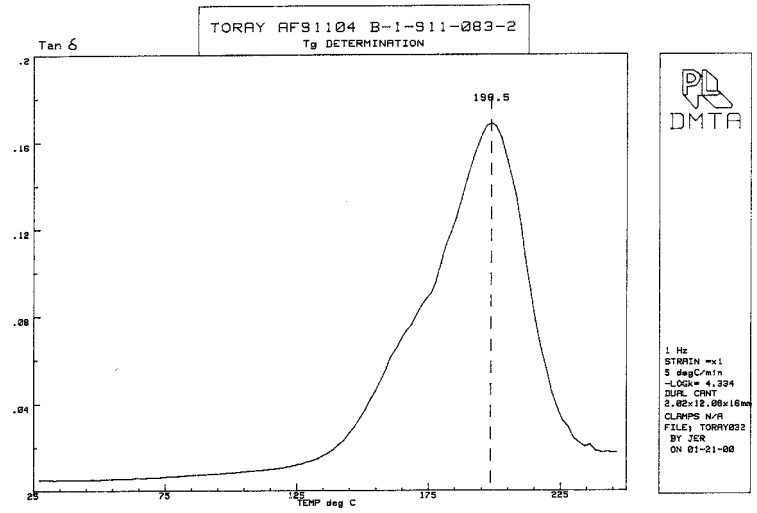


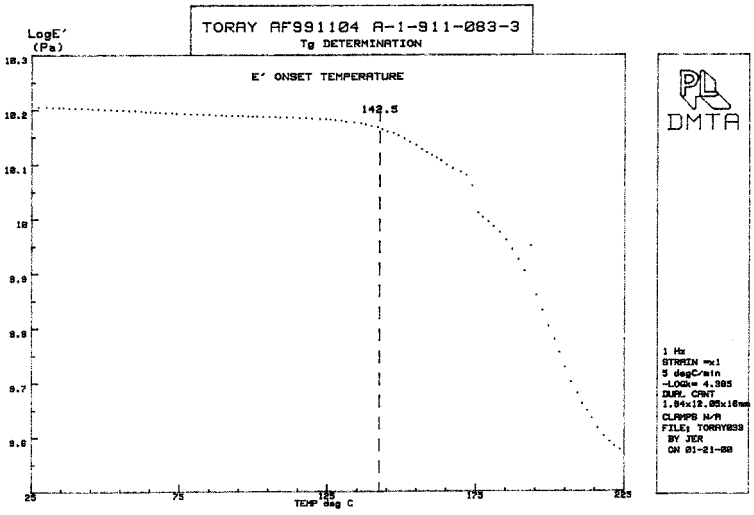


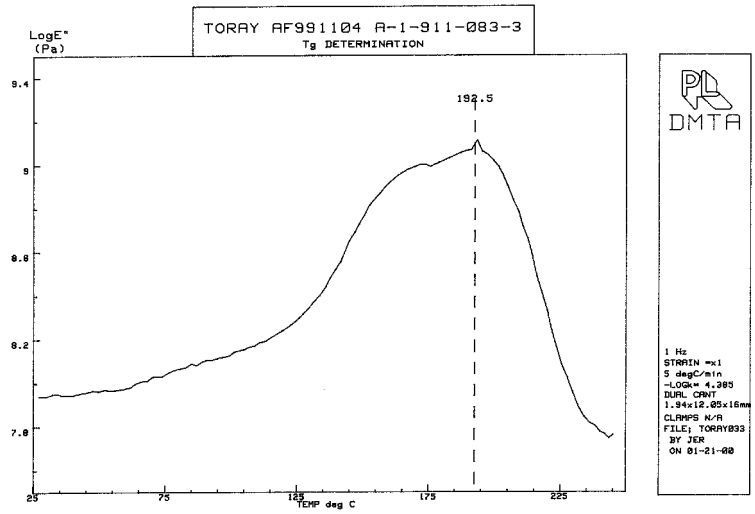


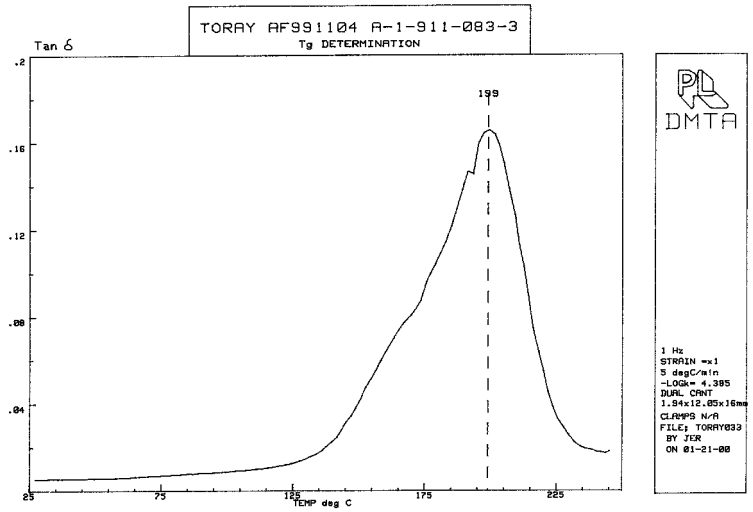






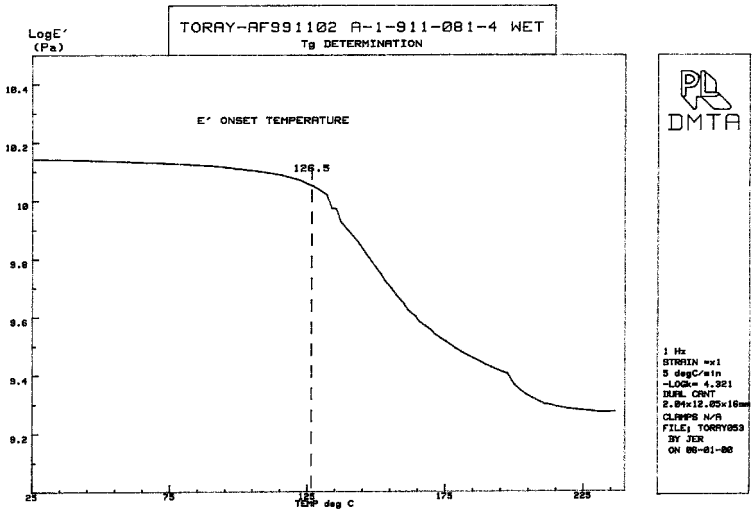


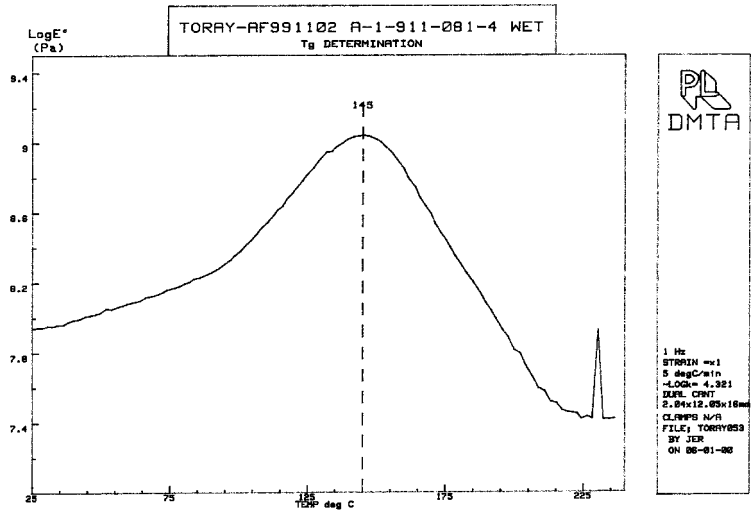


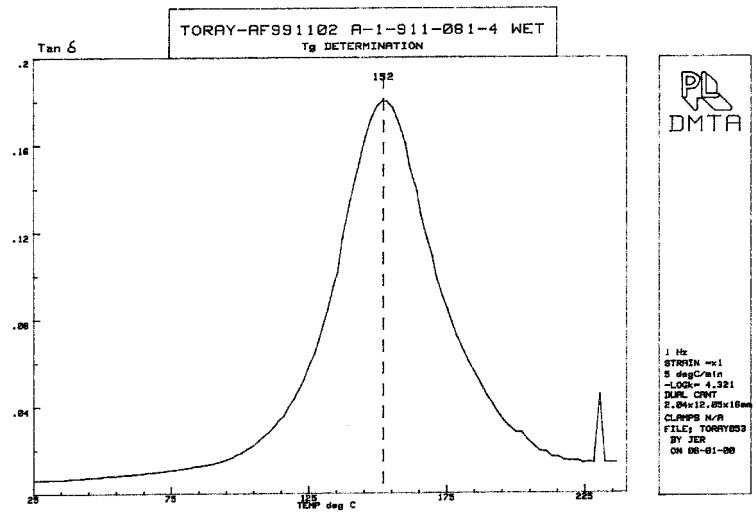


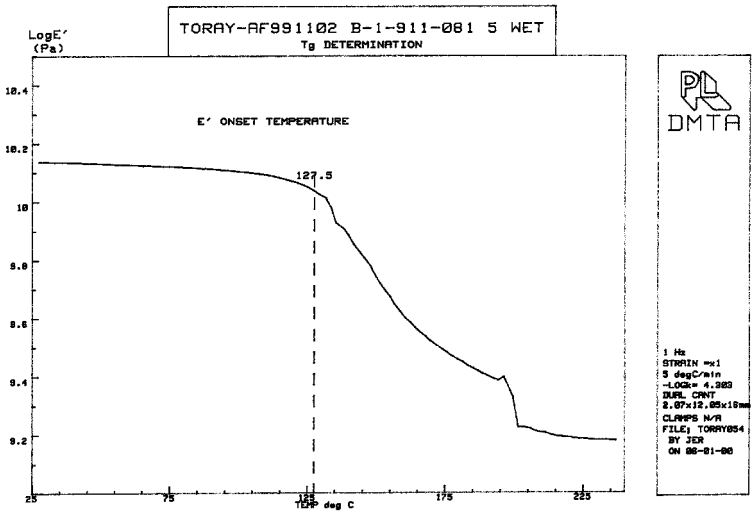
Dynamic Mechanical Analysis (DMA)
Graphs
in determination of
Wet Glass Transition Temperature, Tg (wet)
for

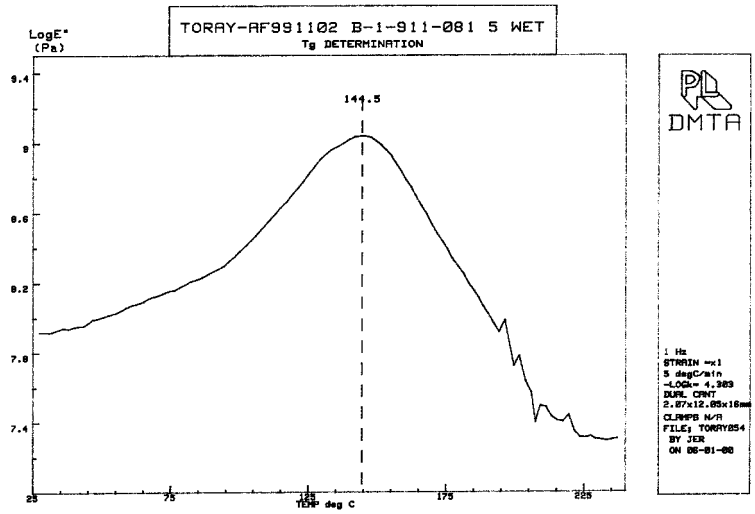
FGF7781-07I
Style 7781/#2510
Fiberglass 8-Harness Woven Fabric Prepreg

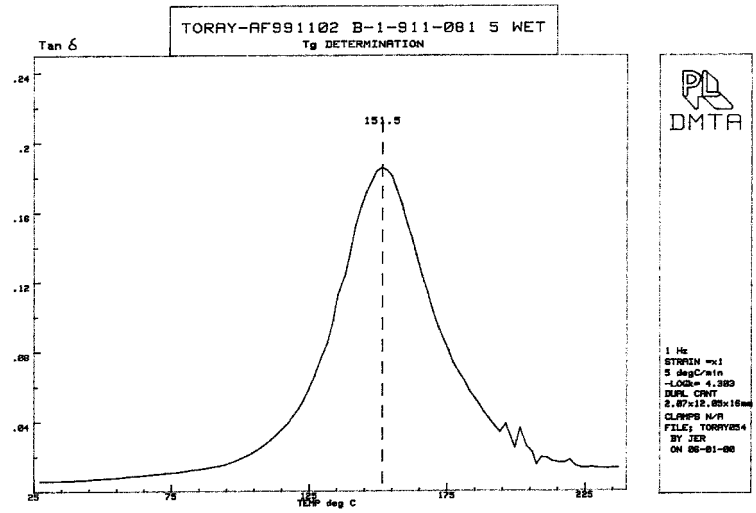


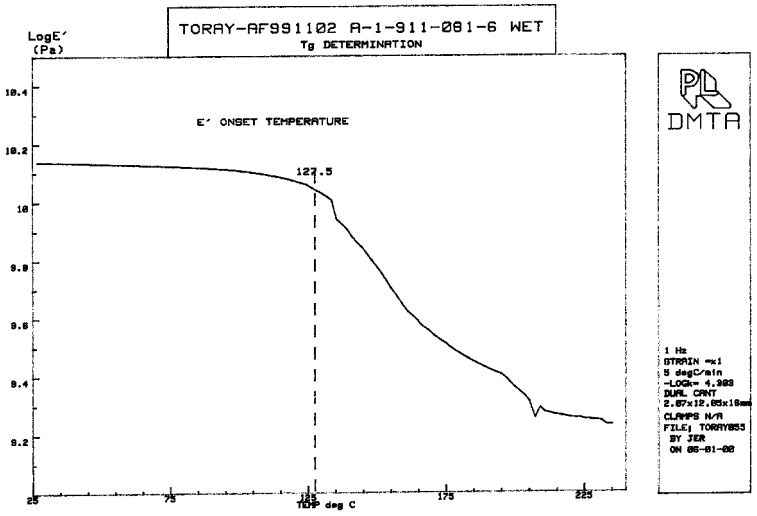


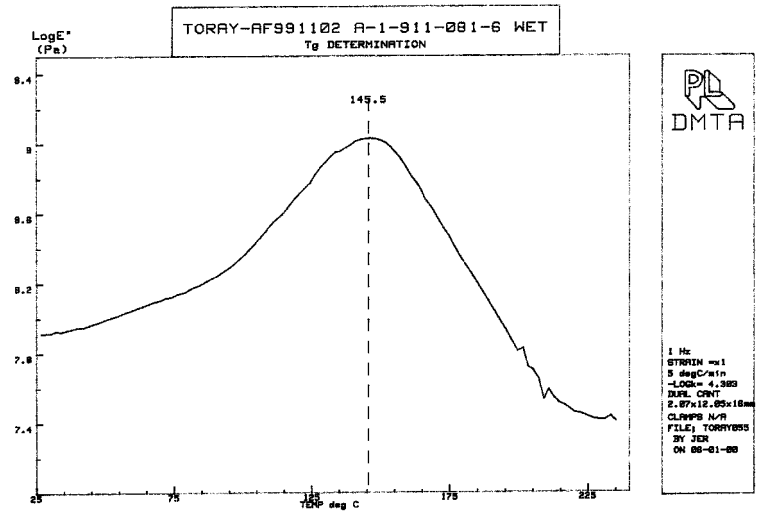


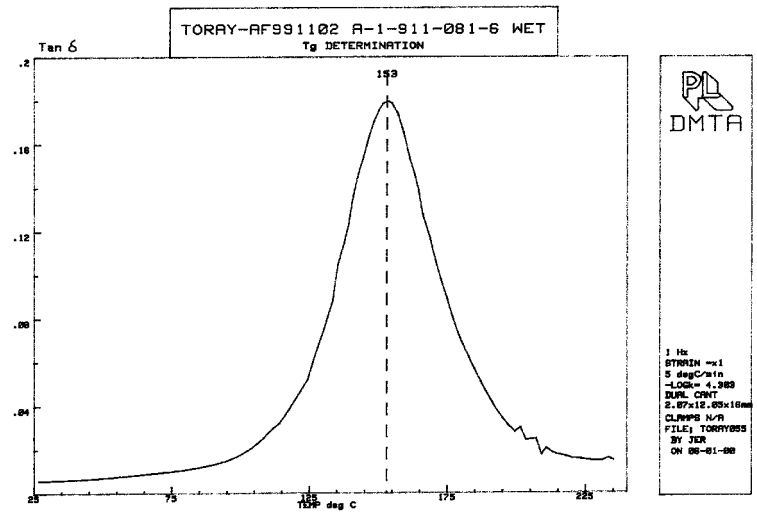


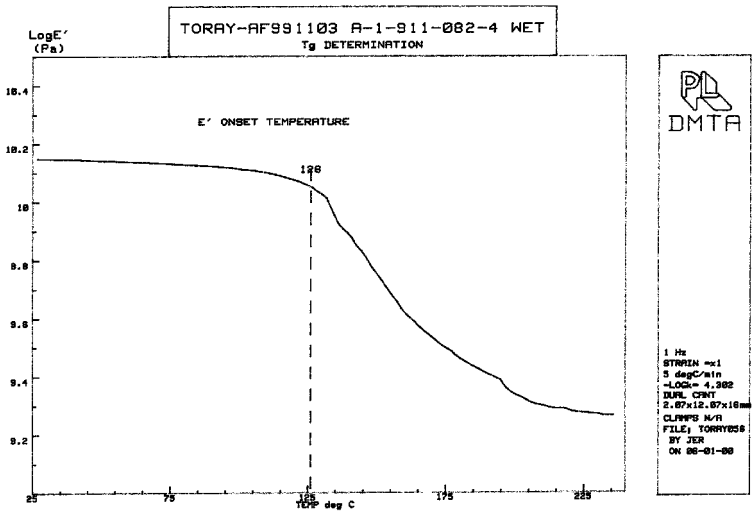


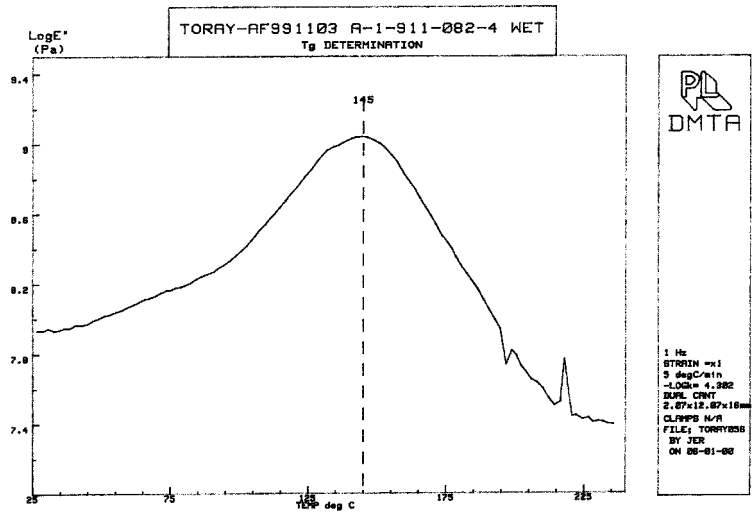


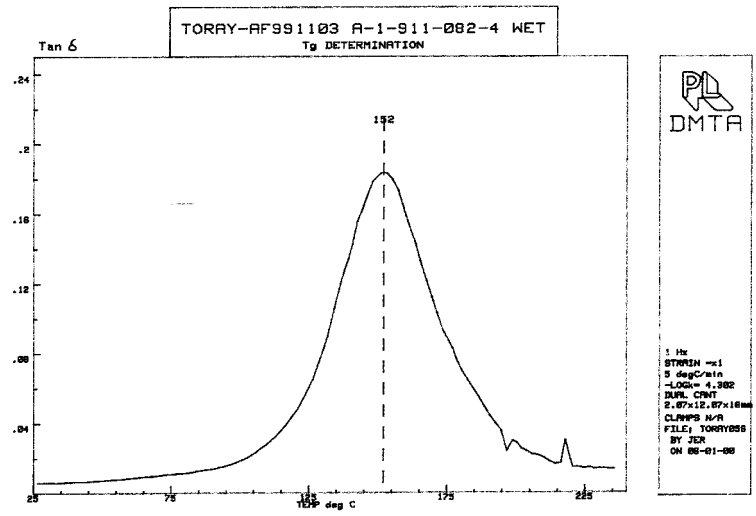


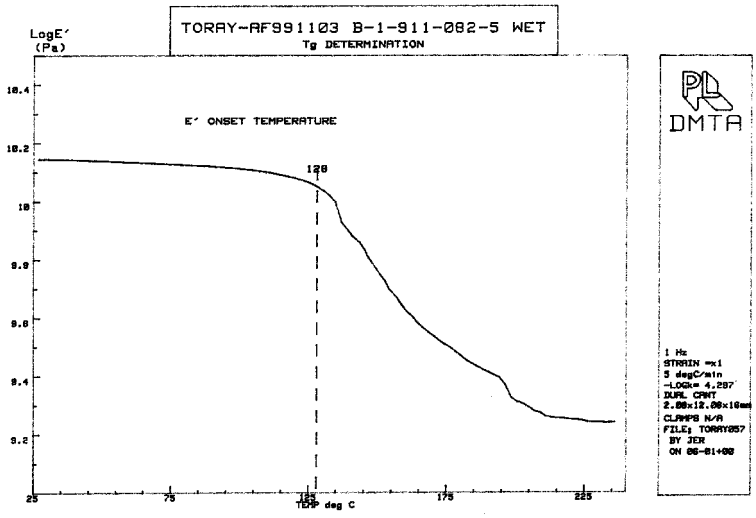


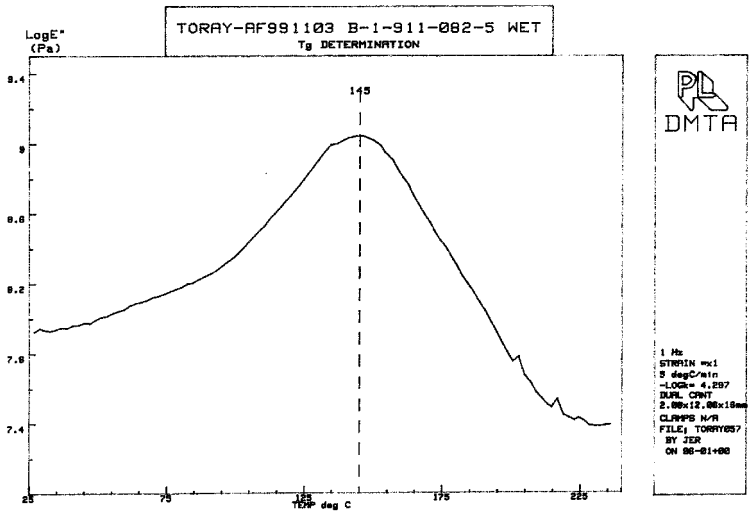


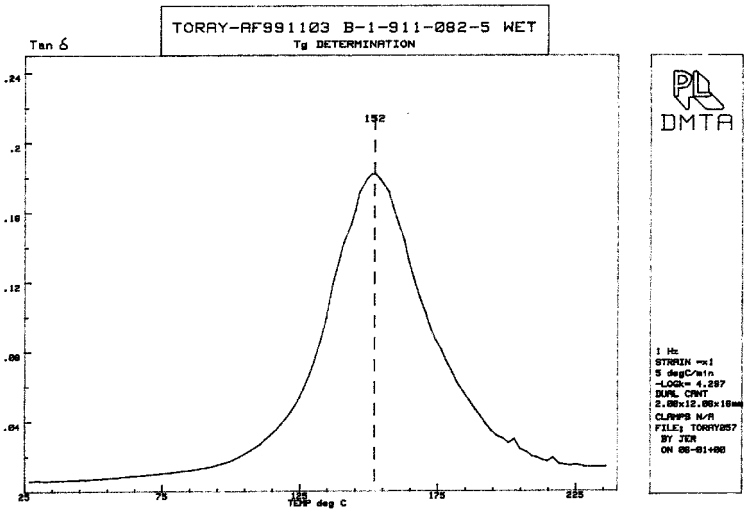


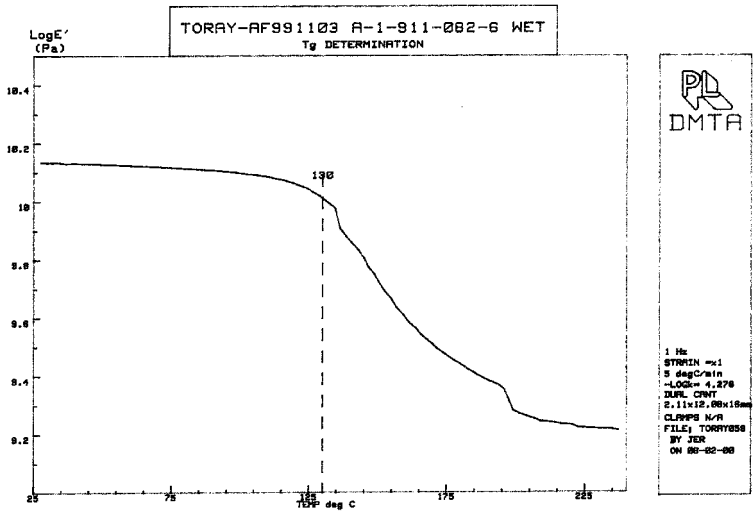


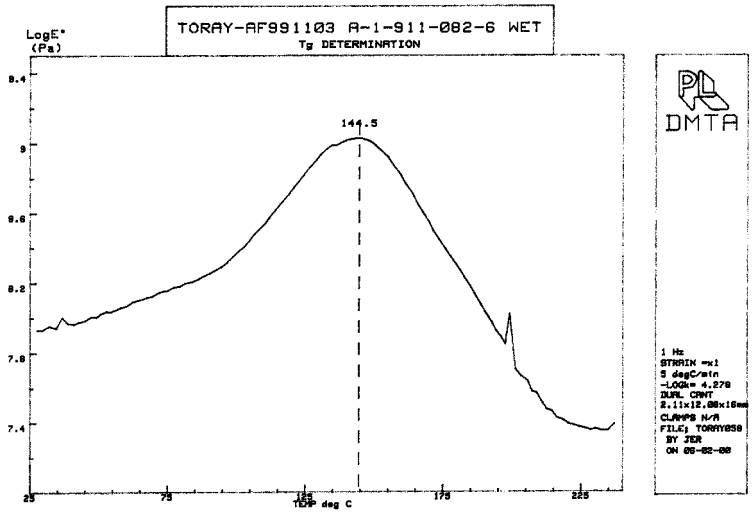


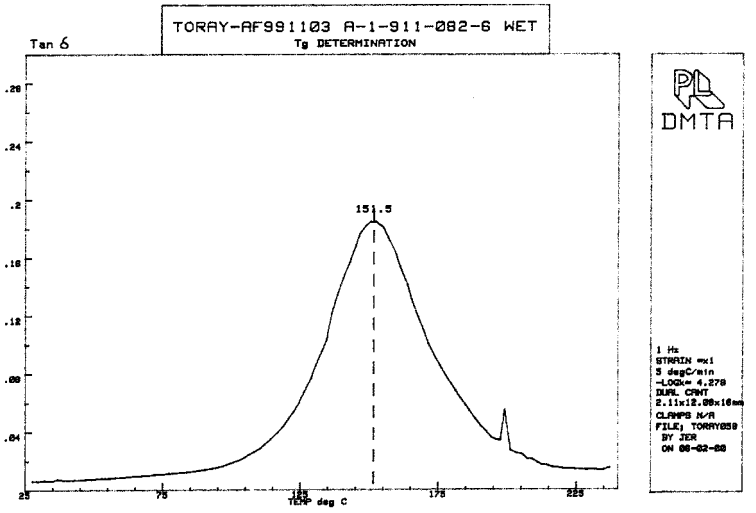


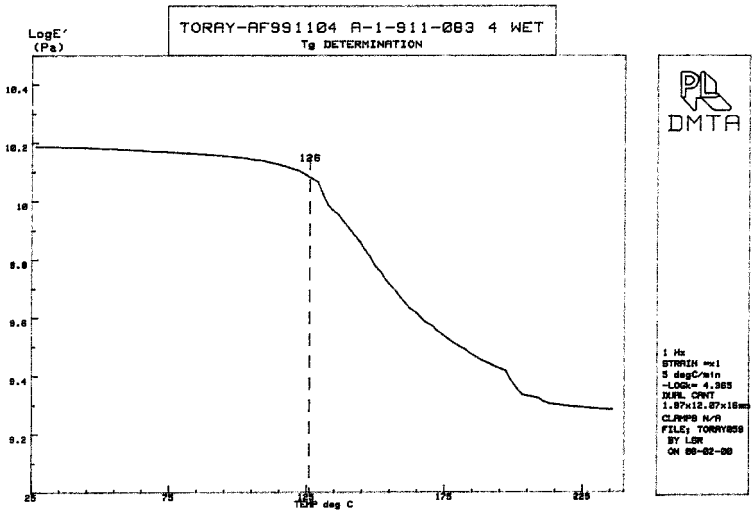


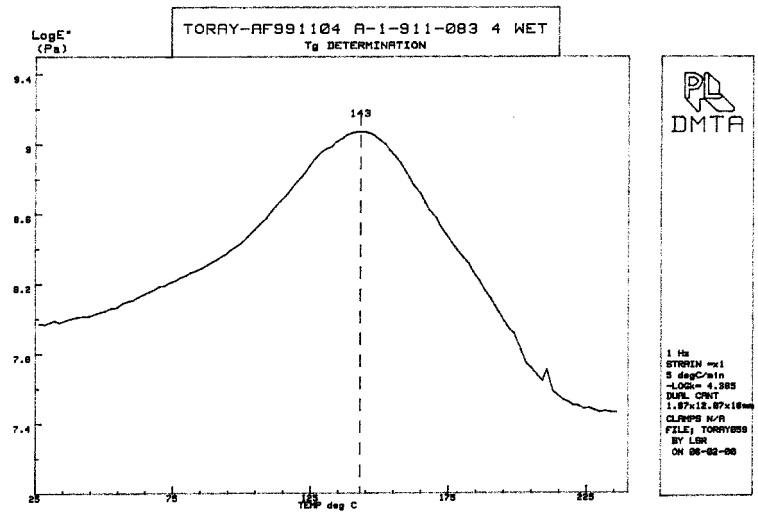


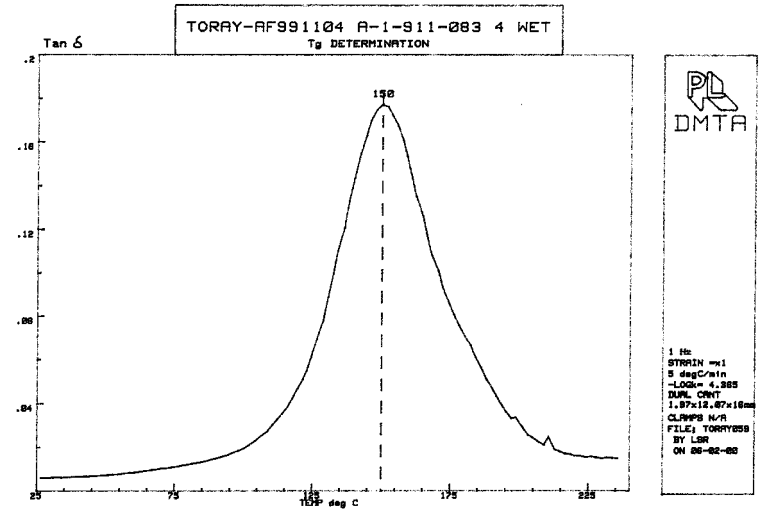


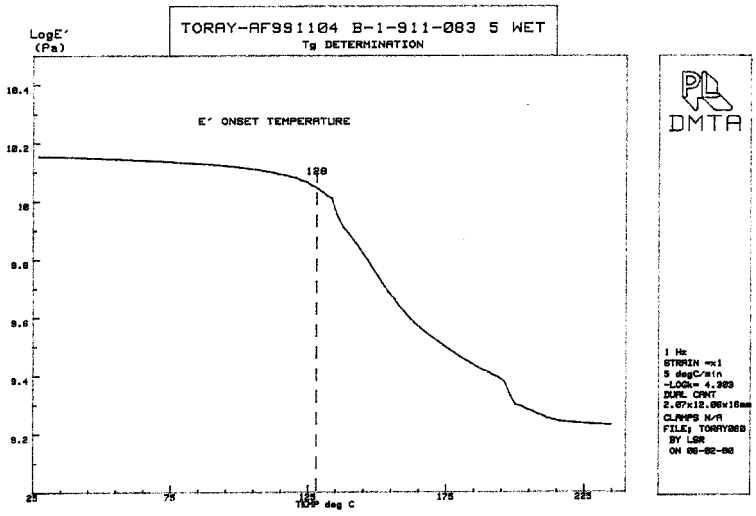


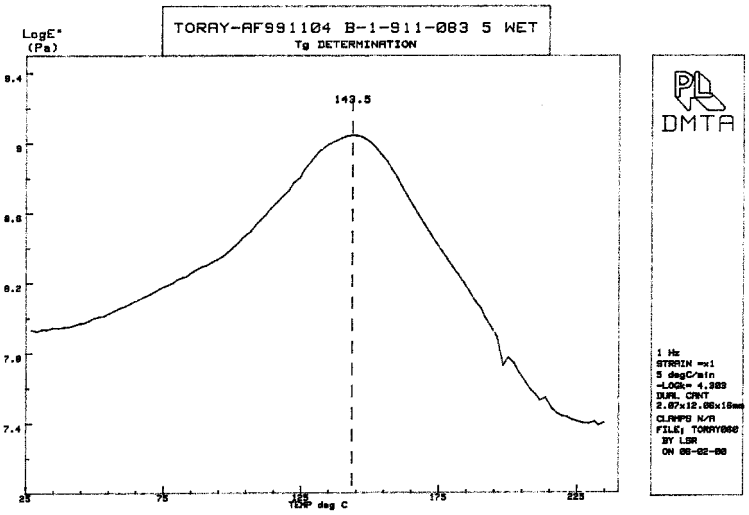


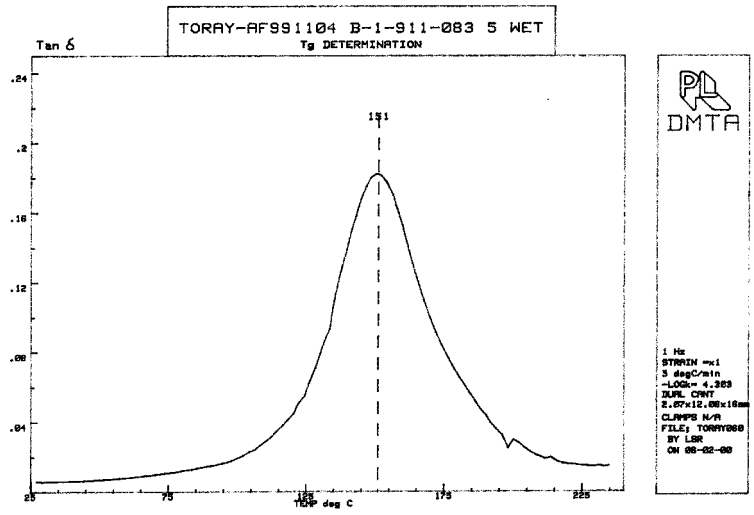


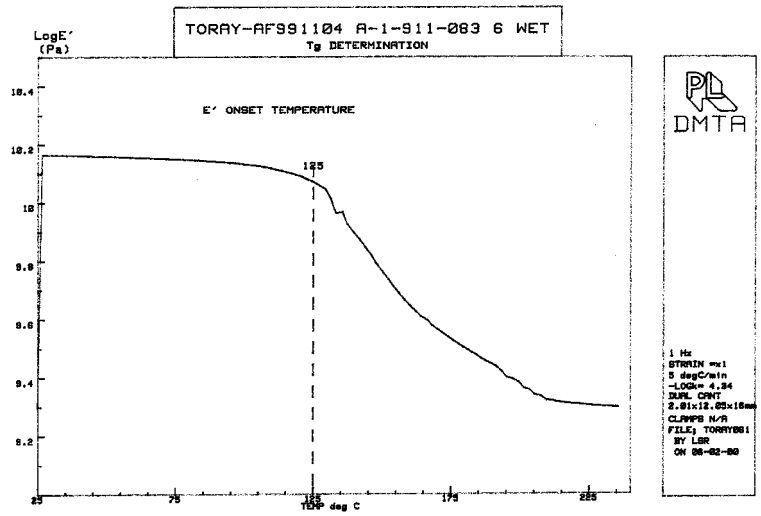


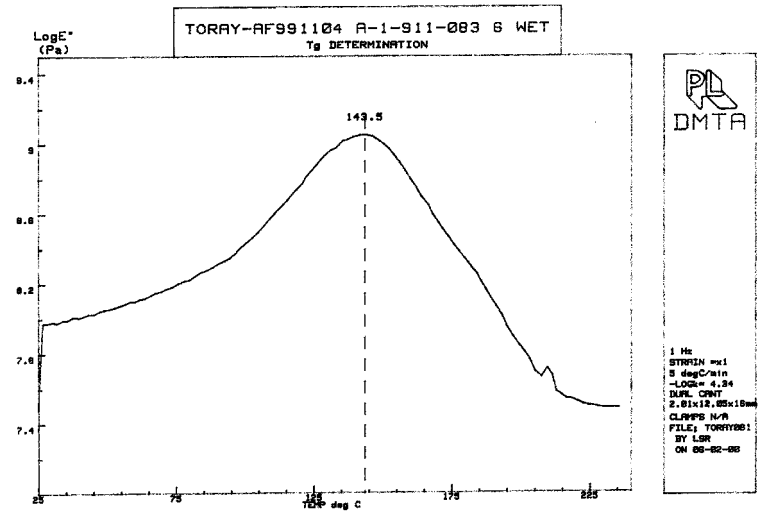


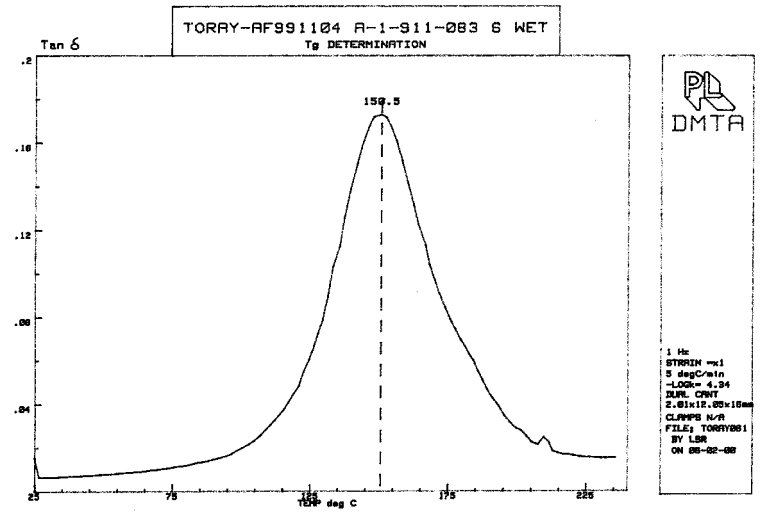












APPENDIX D. STATISTICAL ANALYSIS SUMMARY

COMPANY	Toray
MATERIAL	TCA 7781/#2510 Glass Fabric
PROPERTY	0° Tension - Measured Strength
COMMENTS	
DATE	December 26, 2002

DATA SUMMARY

STATISTIC	TEST CONDITION				
	CTD	RTD	ETD	ETW	
Sample Size	6	18	18	18	
No. of Batches	2	6	6	6	
Mean	82.028	64.484	64.715	49.093	
Std.dev	3.689	2.868	1.381	1.541	
% Co. Variation	4.497	4.448	2.135	3.139	
Minimum	78.027	54.551	62.410	46.076	
Maximum	87.434	67.017	66.953	52.249	
K_b	2.028	1.758	1.758	1.758	
K_a	3.163	2.925	2.925	2.925	
Equal C.V. Basis Values					
B-Basis Value	**76.372**	**60.629**	**60.846**	**46.158**	
A-Basis Value	**73.204**	**58.069**	**58.278**	**44.209**	

Anderson Darling Test for Normality

O.S.L	0.645	0.001	0.075	0.486	
Normality is	Acceptable	Questionable	Acceptable	Acceptable	
O.S.L for pooled data is		**0.0323**	**Normality is**	**Acceptable**	

Check for Normality based on Normal Scores

r^2	0.980	0.829	0.968	0.985	
Normality is	Acceptable	Questionable	Acceptable	Acceptable	
r^2 **for pooled data is**		**0.9376**	**Normality is**	**Acceptable**	

k-sample Anderson Darling Test (ADK < ADC for batches from same population)

ADK	1.018	1.387	2.134	1.178	
ADC	2.105	1.501	1.501	1.501	
SAME POPULATION	**YES**	**YES**	**NO**	**YES**	**N/A**

Equality of Coeff. of Variations: Pooled Data ($F_{CALCULATED} < F_{CRITICAL}$ for equality)

^{a} **LEVEL**	0.05	0.025	0.01
F CALCULATED	1.10		
F CRITICAL	**2.929**	**3.524**	**4.323**

COMMENTS

WICHITA STATE UNIVERSITY

COMPANY	Toray
MATERIAL	TCA 7781/#2510 Glass Fabric
PROPERTY	0° Tension - Normalized Strength
COMMENTS	
DATE	December 26, 2002

DATA SUMMARY

STATISTIC	TEST CONDITION				
	CTD	RTD	ETD	ETW	
Sample Size	6	18	18	18	
No. of Batches	2	6	6	6	
Mean	81.053	64.145	64.919	49.299	
Std.dev	3.067	2.188	0.656	1.595	
% Co. Variation	3.784	3.411	1.010	3.236	
Minimum	76.360	56.124	63.566	46.638	
Maximum	84.062	66.604	65.595	51.721	
K_b	2.028	1.758	1.758	1.758	
K_a	3.163	2.925	2.925	2.925	
Equal C.V. Basis Values					
B-Basis Value	**76.441**	**60.980**	**61.716**	**46.866**	
A-Basis Value	**73.858**	**58.879**	**59.590**	**45.252**	

Anderson Darling Test for Normality

O.S.L	0.569	0.000	0.005	0.565	
Normality is	Acceptable	Questionable	Questionable	Acceptable	
O.S.L for pooled data is		**0.0009**	Normality is **Questionable**		

Check for Normality based on Normal Scores

r^2	0.969	0.765	0.933	0.989	
Normality is	Acceptable	Questionable	Acceptable	Acceptable	
r^2 for pooled data is		**0.9305**	Normality is **Acceptable**		

k-sample Anderson Darling Test (ADK < ADC for batches from same population)

ADK	0.470	0.794	0.658	1.292	
ADC	2.105	1.501	1.501	1.501	
SAME POPULATION	**YES**	**YES**	**YES**	**YES**	**N/A**

Equality of Coeff. of Variations: Pooled Data ($F_{CALCULATED} < F_{CRITICAL}$ for equality)

[a] LEVEL	0.05	0.025	0.01
F CALCULATED	3.47		
F CRITICAL	**2.929**	**3.524**	**4.323**

COMMENTS

*** Equality of C.V.s not satisfied at a significance level of 0.05**
Pooling of data across test environments not permissible
Use Mil-Hdbk-17e method for generating allowables

COV of ETD test samples will be modified to 4.00% using the method prescribed in Appendix E.

WICHITA STATE UNIVERSITY

COMPANY	Toray
MATERIAL	TCA 7781/#2510 Glass Fabric
PROPERTY	0° Tension - Normalized Strength
COMMENTS	
DATE	December 26, 2002

DATA SUMMARY

STATISTIC	TEST CONDITION				
	CTD	RTD	ETD	ETW	
Sample Size	6	18	18	18	
No. of Batches	2	6	6	6	
Mean	81.053	64.145	64.919	49.299	
Std.dev	3.067	2.188	2.597	1.595	
% Co. Variation	3.784	3.411	4.000	3.236	
Minimum	76.360	56.124	59.560	46.638	
Maximum	84.062	66.604	67.595	51.721	
K_b	2.028	1.758	1.758	1.758	
K_a	3.163	2.925	2.925	2.925	
Equal C.V. Basis Values					
B-Basis Value	**75.315**	**60.207**	**60.934**	**46.273**	
A-Basis Value	**72.101**	**57.593**	**58.289**	**44.264**	

Anderson Darling Test for Normality

O.S.L	0.569	0.000	0.005	0.565	
Normality is	Acceptable	Questionable	Questionable	Acceptable	
O.S.L for pooled data is		**0.0044**	**Normality is**	**Questionable**	

Check for Normality based on Normal Scores

r^2	0.969	0.765	0.933	0.989	
Normality is	Acceptable	Questionable	Acceptable	Acceptable	
r^2 for pooled data is		**0.9558**	**Normality is**	**Acceptable**	

k-sample Anderson Darling Test (ADK < ADC for batches from same population)

ADK	0.470	0.794	0.658	1.292	
ADC	2.105	1.501	1.501	1.501	
SAME POPULATION	**YES**	**YES**	**YES**	**YES**	**N/A**

Equality of Coeff. of Variations: Pooled Data ($F_{CALCULATED}$ < $F_{CRITICAL}$ for equality)

[a] LEVEL	0.05	0.025	0.01
F CALCULATED	0.95		
F CRITICAL	**2.929**	**3.524**	**4.323**

COMMENTS

COV of ETD test samples is modified to 4.00% using the method prescribed in Appendix E.

WICHITA STATE UNIVERSITY

COMPANY	Toray
MATERIAL	TCA 7781/#2510 Glass Fabric
PROPERTY	90° Tension - Measured Strength
COMMENTS	
DATE	December 26, 2002

DATA SUMMARY

STATISTIC	TEST CONDITION				
	CTD	RTD	ETD	ETW	<ENTER CONDITION
Sample Size	6	18	18	18	
No. of Batches	2	6	6	6	
Mean	62.640	50.832	54.616	42.377	
Std.dev	3.527	2.051	0.881	1.403	
% Co. Variation	5.630	4.035	1.613	3.311	
Minimum	57.611	46.203	52.979	40.010	
Maximum	66.810	55.134	56.501	43.911	
K_b	2.028	1.758	1.758	1.758	
K_a	3.163	2.925	2.925	2.925	
Equal C.V. Basis Values					
B-Basis Value	**58.373**	**47.830**	**51.390**	**39.874**	
A-Basis Value	**55.983**	**45.837**	**49.248**	**38.213**	

Anderson Darling Test for Normality

O.S.L	0.623	0.504	0.063	0.003	
Normality is	Acceptable	Acceptable	Acceptable	Questionable	
O.S.L for pooled data is		**0.2272**	Normality is **Acceptable**		

Check for Normality based on Normal Scores

r^2	0.978	0.978	0.963	0.935	
Normality is	Acceptable	Acceptable	Acceptable	Acceptable	
r^2 for pooled data is		**0.9876**	Normality is **Acceptable**		

k-sample Anderson Darling Test (ADK < ADC for batches from same population)

ADK	1.018	0.806	0.996	1.654	
ADC	2.105	1.501	1.501	1.501	
SAME POPULATION	**YES**	**YES**	**YES**	**NO**	**N/A**

Equality of Coeff. of Variations: Pooled Data ($F_{CALCULATED} < F_{CRITICAL}$ for equality)

[a] LEVEL	0.05	0.025	0.01
F CALCULATED	2.98		
F CRITICAL	**2.929**	**3.524**	**4.323**

COMMENTS

*** Equality of C.V.s not satisfied at a significance level of 0.05**
Pooling of data across test environments not permissible
Use Mil-Hdbk-17e method for generating allowables

COV of ETD test samples will be modified to 4.00% using the method prescribed in Appendix E.

WICHITA STATE UNIVERSITY

COMPANY	Toray
MATERIAL	TCA 7781/#2510 Glass Fabric
PROPERTY	90° Tension - Measured Strength
COMMENTS	
DATE	December 26, 2002

DATA SUMMARY

STATISTIC	TEST CONDITION				
	CTD	RTD	ETD	ETW	<ENTER CONDITION
Sample Size	6	18	18	18	
No. of Batches	2	6	6	6	
Mean	62.640	50.832	54.616	42.377	
Std.dev	3.527	2.051	2.185	1.403	
% Co. Variation	5.630	4.035	4.000	3.311	
Minimum	57.611	46.203	50.557	40.010	
Maximum	66.810	55.134	59.292	43.911	
K_b	2.028	1.758	1.758	1.758	
K_a	3.163	2.925	2.925	2.925	
Equal C.V. Basis Values					
B-Basis Value	**57.696**	**47.354**	**50.879**	**39.478**	
A-Basis Value	**54.928**	**45.045**	**48.398**	**37.553**	

Anderson Darling Test for Normality

O.S.L	0.623	0.504	0.063	0.003	
Normality is	Acceptable	Acceptable	Acceptable	Questionable	
O.S.L for pooled data is		**0.3187**	**Normality is**	**Acceptable**	

Check for Normality based on Normal Scores

r^2	0.978	0.978	0.963	0.935	
Normality is	Acceptable	Acceptable	Acceptable	Acceptable	
r^2 **for pooled data is**		**0.9930**	**Normality is**	**Acceptable**	

k-sample Anderson Darling Test (ADK < ADC for batches from same population)

ADK	1.018	0.806	0.996	1.654	
ADC	2.105	1.501	1.501	1.501	
SAME POPULATION	**YES**	**YES**	**YES**	**NO**	**N/A**

Equality of Coeff. of Variations: Pooled Data ($F_{CALCULATED} < F_{CRITICAL}$ for equality)

[a] **LEVEL**	0.05	0.025	0.01
F CALCULATED	0.64		
F CRITICAL	**2.929**	**3.524**	**4.323**

COMMENTS

COV of ETD test samples is modified to 4.00% using the method prescribed in Appendix E.

WICHITA STATE UNIVERSITY

COMPANY	Toray
MATERIAL	TCA 7781/#2510 Glass Fabric
PROPERTY	90° Tension - Normalized Strength
COMMENTS	
DATE	December 26, 2002

DATA SUMMARY

STATISTIC	TEST CONDITION				
	CTD	RTD	ETD	ETW	<ENTER CONDITION
Sample Size	6	18	18	18	
No. of Batches	2	6	6	6	
Mean	62.778	50.385	54.527	42.358	
Std.dev	3.315	2.210	0.889	1.195	
% Co. Variation	5.281	4.385	1.630	2.822	
Minimum	58.331	46.083	52.256	39.835	
Maximum	66.553	54.238	56.159	44.299	
K_b	2.028	1.758	1.758	1.758	
K_a	3.163	2.925	2.925	2.925	
Equal C.V. Basis Values					
B-Basis Value	**58.563**	**47.452**	**51.353**	**39.892**	
A-Basis Value	**56.202**	**45.505**	**49.246**	**38.255**	

Anderson Darling Test for Normality

O.S.L	0.372	0.081	0.407	0.165
Normality is	Acceptable	Acceptable	Acceptable	Acceptable

O.S.L for pooled data is 0.3050 Normality is Acceptable

Check for Normality based on Normal Scores

r^2	0.952	0.967	0.968	0.973
Normality is	Acceptable	Acceptable	Acceptable	Acceptable

r^2 for pooled data is 0.9899 Normality is Acceptable

k-sample Anderson Darling Test (ADK < ADC for batches from same population)

ADK	1.018	0.597	0.881	1.755	
ADC	2.105	1.501	1.501	1.501	
SAME POPULATION	YES	YES	YES	NO	N/A

Equality of Coeff. of Variations: Pooled Data ($F_{CALCULATED} < F_{CRITICAL}$ for equality)

[a] LEVEL	0.05	0.025	0.01
F CALCULATED	3.55		
F CRITICAL	**2.929**	**3.524**	**4.323**

COMMENTS

*** Equality of C.V.s not satisfied at a significance level of 0.05**
Pooling of data across test environments not permissible
Use Mil-Hdbk-17e method for generating allowables

COV of ETD test samples will be modified to 4.00% using the method prescribed in Appendix E.

WICHITA STATE UNIVERSITY

COMPANY	Toray
MATERIAL	TCA 7781/#2510 Glass Fabric
PROPERTY	90° Tension - Normalized Strength
COMMENTS	
DATE	December 26, 2002

DATA SUMMARY

STATISTIC	TEST CONDITION				
	CTD	RTD	ETD	ETW	<ENTER CONDITION
Sample Size	6	18	18	18	
No. of Batches	2	6	6	6	
Mean	62.778	50.385	54.527	42.358	
Std.dev	3.315	2.210	2.181	1.195	
% Co. Variation	5.281	4.385	4.000	2.822	
Minimum	58.331	46.083	48.953	39.835	
Maximum	66.553	54.238	58.531	44.299	
K_b	2.028	1.758	1.758	1.758	
K_a	3.163	2.925	2.925	2.925	
Equal C.V. Basis Values					
B-Basis Value	**57.880**	**46.976**	**50.838**	**39.492**	
A-Basis Value	**55.136**	**44.713**	**48.389**	**37.590**	

Anderson Darling Test for Normality

O.S.L	0.372	0.081	0.407	0.165	
Normality is	Acceptable	Acceptable	Acceptable	Acceptable	
O.S.L for pooled data is		**0.6595**	Normality is **Acceptable**		

Check for Normality based on Normal Scores

r^2	0.952	0.967	0.968	0.973	
Normality is	Acceptable	Acceptable	Acceptable	Acceptable	
r^2 for pooled data is		**0.9937**	Normality is **Acceptable**		

k-sample Anderson Darling Test (ADK < ADC for batches from same population)

ADK	1.018	0.597	0.881	1.755	
ADC	2.105	1.501	1.501	1.501	
SAME POPULATION	YES	YES	YES	NO	N/A

Equality of Coeff. of Variations: Pooled Data ($F_{CALCULATED} < F_{CRITICAL}$ for equality)

[a] LEVEL	0.05	0.025	0.01
F CALCULATED	1.03		
F CRITICAL	**2.929**	**3.524**	**4.323**

COMMENTS

COV of ETD test samples is modified to 4.00% using the method prescribed in Appendix E.

WICHITA STATE UNIVERSITY

COMPANY	Toray
MATERIAL	TCA 7781/#2510 Glass Fabric
PROPERTY	0° Compression - Measured Strength
COMMENTS	
DATE	December 26, 2002

DATA SUMMARY

STATISTIC	TEST CONDITION				
	CTD	**RTD**	**ETD**	**ETW**	
Sample Size	6	18	18	18	
No. of Batches	2	6	6	1	
Mean	90.463	76.492	63.040	50.506	
Std.dev	4.122	4.733	2.973	2.942	
% Co. Variation	4.556	6.187	4.715	5.825	
Minimum	86.575	64.216	57.697	46.021	
Maximum	98.281	84.268	68.122	55.185	
K_b	2.028	1.758	1.758	1.758	
K_a	3.163	2.925	2.925	2.925	
Equal C.V. Basis Values					
B-Basis Value	**80.590**	**69.254**	**57.075**	**45.727**	
A-Basis Value	**75.060**	**64.449**	**53.115**	**42.554**	

Anderson Darling Test for Normality

O.S.L	0.201	0.366	0.507	0.418	
Normality is	Acceptable	Acceptable	Acceptable	Acceptable	
O.S.L for pooled data is		**0.7081**	**Normality is**	**Acceptable**	

Check for Normality based on Normal Scores

r^2	0.897	0.965	0.990	0.985	
Normality is	Questionable	Acceptable	Acceptable	Acceptable	
r^2 **for pooled data is**		**0.9916**	**Normality is**	**Acceptable**	

k-sample Anderson Darling Test (ADK < ADC for batches from same population)

ADK	1.018	1.742	1.815		
ADC	2.105	1.501	1.501		
SAME POPULATION	**YES**	**NO**	**NO**	**N/A**	**N/A**

Equality of Coeff. of Variations: Pooled Data ($F_{CALCULATED}$ < $F_{CRITICAL}$ for equality)

[a] **LEVEL**	0.05	0.025	0.01
F CALCULATED	0.62		
F CRITICAL	**2.929**	**3.524**	**4.323**

COMMENTS

WICHITA STATE UNIVERSITY

COMPANY	Toray
MATERIAL	TCA 7781/#2510 Glass Fabric
PROPERTY	0° Compression - Normalized Strength
COMMENTS	
DATE	December 26, 2002

DATA SUMMARY

STATISTIC	TEST CONDITION				
	CTD	**RTD**	**ETD**	**ETW**	
Sample Size	6	18	18	18	
No. of Batches	2	6	6	6	
Mean	88.358	76.225	63.047	50.915	
Std.dev	5.388	4.135	2.202	3.486	
% Co. Variation	6.098	5.425	3.493	6.847	
Minimum	83.755	67.247	57.336	44.988	
Maximum	98.202	83.342	67.058	56.070	
K_b	2.028	1.758	1.758	1.758	
K_a	3.163	2.925	2.925	2.925	
Equal C.V. Basis Values					
B-Basis Value	**78.767**	**69.051**	**57.114**	**46.123**	
A-Basis Value	**73.396**	**64.289**	**53.175**	**42.942**	

Anderson Darling Test for Normality

O.S.L	0.181	0.769	0.229	0.338	
Normality is	Acceptable	Acceptable	Acceptable	Acceptable	
O.S.L for pooled data is		**0.2619**	**Normality is**	**Acceptable**	

Check for Normality based on Normal Scores

r^2	0.900	0.990	0.960	0.981	
Normality is	Acceptable	Acceptable	Acceptable	Acceptable	
r^2 **for pooled data is**		**0.9904**	**Normality is**	**Acceptable**	

k-sample Anderson Darling Test (ADK < ADC for batches from same population)

ADK	2.484	1.583	1.286	2.555	
ADC	2.105	1.501	1.501	1.501	
SAME POPULATION	**NO**	**NO**	**YES**	**NO**	**N/A**

Equality of Coeff. of Variations: Pooled Data ($F_{CALCULATED} < F_{CRITICAL}$ for equality)

[a] **LEVEL**	0.05	0.025	0.01
F CALCULATED	1.95		
F CRITICAL	**2.929**	**3.524**	**4.323**

COMMENTS

WICHITA STATE UNIVERSITY

COMPANY	Toray
MATERIAL	TCA 7781/#2510 Glass Fabric
PROPERTY	90° Compression - Measured Strength
COMMENTS	
DATE	December 26, 2002

DATA SUMMARY

STATISTIC	TEST CONDITION				
	CTD	RTD	ETD	ETW	<ENTER CONDITION
Sample Size	6	18	18	21	
No. of Batches	2	6	6	6	
Mean	78.981	65.436	53.591	42.572	
Std.dev	0.921	3.073	2.740	2.228	
% Co. Variation	1.166	4.696	5.113	5.233	
Minimum	77.709	58.504	48.596	37.135	
Maximum	80.153	69.420	58.405	45.890	
K_b	2.024	1.754	1.754	1.728	
K_a	3.155	2.915	2.915	2.894	
Equal C.V. Basis Values					
B-Basis Value	**71.457**	**60.034**	**49.167**	**39.110**	
A-Basis Value	**67.251**	**56.456**	**46.237**	**36.773**	

Anderson Darling Test for Normality

O.S.L	0.786	0.221	0.374	0.132
Normality is	Acceptable	Acceptable	Acceptable	Acceptable
O.S.L for pooled data is	**0.0273**	**Normality is Acceptable**		

Check for Normality based on Normal Scores

r^2	0.996	0.972	0.983	0.969
Normality is	Acceptable	Acceptable	Acceptable	Acceptable
r^2 **for pooled data is**	**0.9827**	**Normality is Acceptable**		

k-sample Anderson Darling Test (ADK < ADC for batches from same population)

ADK	0.470	1.069	1.688	1.601	
ADC	2.105	1.501	1.501	1.521	
SAME POPULATION	**YES**	**YES**	**NO**	**NO**	**N/A**

Equality of Coeff. of Variations: Pooled Data ($F_{CALCULATED} < F_{CRITICAL}$ for equality)

^{a} **LEVEL**	0.05	0.025	0.01
F CALCULATED	1.88		
F CRITICAL	**2.920**	**3.511**	**4.302**

COMMENTS

WICHITA STATE UNIVERSITY

COMPANY	Toray
MATERIAL	TCA 7781/#2510 Glass Fabric
PROPERTY	90° Compression - Normalized Strength
COMMENTS	
DATE	December 26, 2002

DATA SUMMARY

STATISTIC	TEST CONDITION				
	CTD	RTD	ETD	ETW	<ENTER CONDITION
Sample Size	6	18	18	21	
No. of Batches	2	6	6	6	
Mean	78.791	65.437	53.588	43.063	
Std.dev	1.046	2.840	2.453	2.213	
% Co. Variation	1.328	4.341	4.578	5.139	
Minimum	77.024	58.551	48.635	38.384	
Maximum	80.123	68.895	57.225	46.263	
K_b	2.024	1.754	1.754	1.728	
K_a	3.155	2.915	2.915	2.894	
Equal C.V. Basis Values					
B-Basis Value	**71.737**	**60.361**	**49.431**	**39.772**	
A-Basis Value	**67.794**	**56.998**	**46.677**	**37.550**	

Anderson Darling Test for Normality

O.S.L	0.630	0.211	0.034	0.325
Normality is	Acceptable	Acceptable	Acceptable	Acceptable
O.S.L for pooled data is	**0.0150**	**Normality is Acceptable**		

Check for Normality based on Normal Scores

r^2	0.965	0.965	0.956	0.980
Normality is	Acceptable	Acceptable	Acceptable	Acceptable
r^2 **for pooled data is**	**0.9790**	**Normality is Acceptable**		

k-sample Anderson Darling Test (ADK < ADC for batches from same population)

ADK	1.018	0.907	1.361	1.941	
ADC	2.105	1.501	1.501	1.521	
SAME POPULATION	**YES**	**YES**	**YES**	**NO**	**N/A**

Equality of Coeff. of Variations: Pooled Data ($F_{CALCULATED} < F_{CRITICAL}$ for equality)

[a] **LEVEL**	0.05	0.025	0.01
F CALCULATED	2.14		
F CRITICAL	**2.920**	**3.511**	**4.302**

COMMENTS

WICHITA STATE UNIVERSITY

COMPANY	Toray
MATERIAL	TCA 7781/#2510 Glass Fabric
PROPERTY	In-Plane Shear
COMMENTS	
DATE	December 26, 2002

DATA SUMMARY

STATISTIC	TEST CONDITION				
	CTD	RTD	ETD	ETW	
Sample Size	6	18	18	18	
No. of Batches	2	6	6	6	
Mean	23.739	18.446	15.348	11.649	
Std.dev	0.907	0.384	0.326	0.117	
% Co. Variation	3.822	2.084	2.122	1.002	
Minimum	22.770	17.807	14.771	11.489	
Maximum	24.862	19.236	15.749	11.853	
K_b	2.028	1.758	1.758	1.758	
K_a	3.163	2.925	2.925	2.925	
Equal C.V. Basis Values					
B-Basis Value	**22.767**	**17.791**	**14.803**	**11.235**	
A-Basis Value	**22.223**	**17.357**	**14.441**	**10.961**	

Anderson Darling Test for Normality

O.S.L	0.369	0.423	0.135	0.164	
Normality is	Acceptable	Acceptable	Acceptable	Acceptable	
O.S.L for pooled data is		**0.5180**	Normality is **Acceptable**		

Check for Normality based on Normal Scores

r^2	0.952	0.986	0.972	0.975	
Normality is	Acceptable	Acceptable	Acceptable	Acceptable	
r^2 for pooled data is		**0.9939**	Normality is **Acceptable**		

k-sample Anderson Darling Test (ADK < ADC for batches from same population)

ADK	1.018	1.163	1.184	0.977	
ADC	2.105	1.501	1.501	1.501	
SAME POPULATION	**YES**	**YES**	**YES**	**YES**	**N/A**

Equality of Coeff. of Variations: Pooled Data ($F_{CALCULATED} < F_{CRITICAL}$ for equality)

^{a} LEVEL	0.05	0.025	0.01
$F_{CALCULATED}$	6.11		
$F_{CRITICAL}$	**2.929**	**3.524**	**4.323**

COMMENTS

*** Equality of C.V.s not satisfied at a significance level of 0.05**
Pooling of data across test environments not permissible
Use Mil-Hdbk-17e method for generating allowables

COVs of RTD, ETD, and ETW test samples will be modified to 4.00% using the method prescribed in Appendix E.

WICHITA STATE UNIVERSITY

COMPANY	Toray
MATERIAL	TCA 7781/#2510 Glass Fabric
PROPERTY	In-Plane Shear
COMMENTS	
DATE	December 26, 2002

DATA SUMMARY

STATISTIC	TEST CONDITION				
	CTD	RTD	ETD	ETW	
Sample Size	6	18	18	18	
No. of Batches	2	6	6	6	
Mean	23.739	18.446	15.348	11.649	
Std.dev	0.907	0.738	0.614	0.466	
% Co. Variation	3.822	4.000	4.000	4.000	
Minimum	22.770	17.220	14.261	11.012	
Maximum	24.862	19.963	16.104	12.466	
K_b	2.028	1.758	1.758	1.758	
K_a	3.163	2.925	2.925	2.925	
Equal C.V. Basis Values					
B-Basis Value	**21.870**	**17.187**	**14.300**	**10.854**	
A-Basis Value	**20.824**	**16.352**	**13.605**	**10.326**	

Anderson Darling Test for Normality

O.S.L	0.369	0.423	0.135	0.164	
Normality is	Acceptable	Acceptable	Acceptable	Acceptable	
O.S.L for pooled data is		**0.0159**	**Normality is**	**Acceptable**	

Check for Normality based on Normal Scores

r^2	0.952	0.986	0.972	0.975	
Normality is	Acceptable	Acceptable	Acceptable	Acceptable	
r^2 for pooled data is		**0.9855**	**Normality is**	**Acceptable**	

k-sample Anderson Darling Test (ADK < ADC for batches from same population)

ADK	1.018	1.163	1.184	0.977	
ADC	2.105	1.501	1.501	1.501	
SAME POPULATION	**YES**	**YES**	**YES**	**YES**	**N/A**

Equality of Coeff. of Variations: Pooled Data ($F_{CALCULATED} < F_{CRITICAL}$ for equality)

[a] **LEVEL**	0.05	0.025	0.01
F CALCULATED	0.06		
F CRITICAL	**2.929**	**3.524**	**4.323**

COMMENTS

COVs of RTD, ETD, and ETW test samples are modified to 4.00% using the method prescribed in Appendix E.

WICHITA STATE UNIVERSITY

COMPANY	Toray
MATERIAL	TCA 7781/#2510 Glass Fabric
PROPERTY	Apparent Interlaminar Shear
COMMENTS	
DATE	December 26, 2002

DATA SUMMARY

STATISTIC	TEST CONDITION				
	RTD				
Sample Size	18				
No. of Batches	6				
Mean	8.712				
Std.dev	0.576				
% Co. Variation	6.616				
Minimum	7.542				
Maximum	9.508				
K_b	1.993				
K_a	3.409				
Equal C.V. Basis Values					
B-Basis Value	**7.564**				
A-Basis Value	**6.747**				

Anderson Darling Test for Normality

O.S.L	0.476				
Normality is	Acceptable				
O.S.L for pooled data is	**0.4759**	**Normality is**	**Acceptable**		

Check for Normality based on Normal Scores

r^2	0.985				
Normality is	Acceptable				
r^2 **for pooled data is**	**0.9847**	**Normality is**	**Acceptable**		

k-sample Anderson Darling Test (ADK < ADC for batches from same population)

ADK	1.941				
ADC	1.501				
SAME POPULATION	**NO**	**N/A**	**N/A**	**N/A**	**N/A**

Equality of Coeff. of Variations: Pooled Data ($F_{CALCULATED}$ < $F_{CRITICAL}$ for equality)

[a] **LEVEL**	0.05	0.025	0.01
F CALCULATED	N/A*		
F CRITICAL			

COMMENTS

***. Number of test conditions < 2, equality of c.v not applicable**

Pooling of data a N/A*

Use Mil-Hdbk-17e method for generating allowables

WICHITA STATE UNIVERSITY

APPENDIX E. METHOD FOR TRANSFORMING VARIANCES OF TEST SAMPLES (SUPPLEMENT TO DOT/FAA/AR-47/00)

The following Appendix describes a procedure to supplement the process described in DOT/FAA/AR-47/00 for the case in which the variances are found to be unequal per section 5.3.1.3 of that document. A supplemental is given below which provides guidance in the situation of unequal variances and describes procedures to obtain a conservative design allowable. Note that these procedures must be combined with engineering judgment and that the failure modes must remain the same across environments.

The follow excerpt is taken from DOT/FAA/AR-47/00, section 5.3.1.3 and is used as the basis for this procedure:

> ***In general, a coefficient of variation between 4% and 10% is typical of composite materials. Experiences with large data sets have shown that this range is representative of most composite material systems. Lower coefficients of variation may be caused by the specimen fabrication and testing by a single laboratory while higher coefficients may point to lack of material and processing control. In cases where the coefficients of variation of the pooled data set are higher or lower than this range, the reason for the higher or lower coefficient of variation should be investigated before determining design allowable values from the pooled data set. For the coefficient of variation lower than 4%, an assigned value of 4% may be considered as an alternative engineering solution.***

Using this philosophy, the data in this report, which demonstrates unequal variances per section 5.3.1.3 of DOT/FAA/AR-47/00 will be modified by the supplemental procedure described in this appendix with the revised presented below. ***The coefficient of variation to be used in this case will be 4% as suggested by DOT/FAA/AR-47/00.***

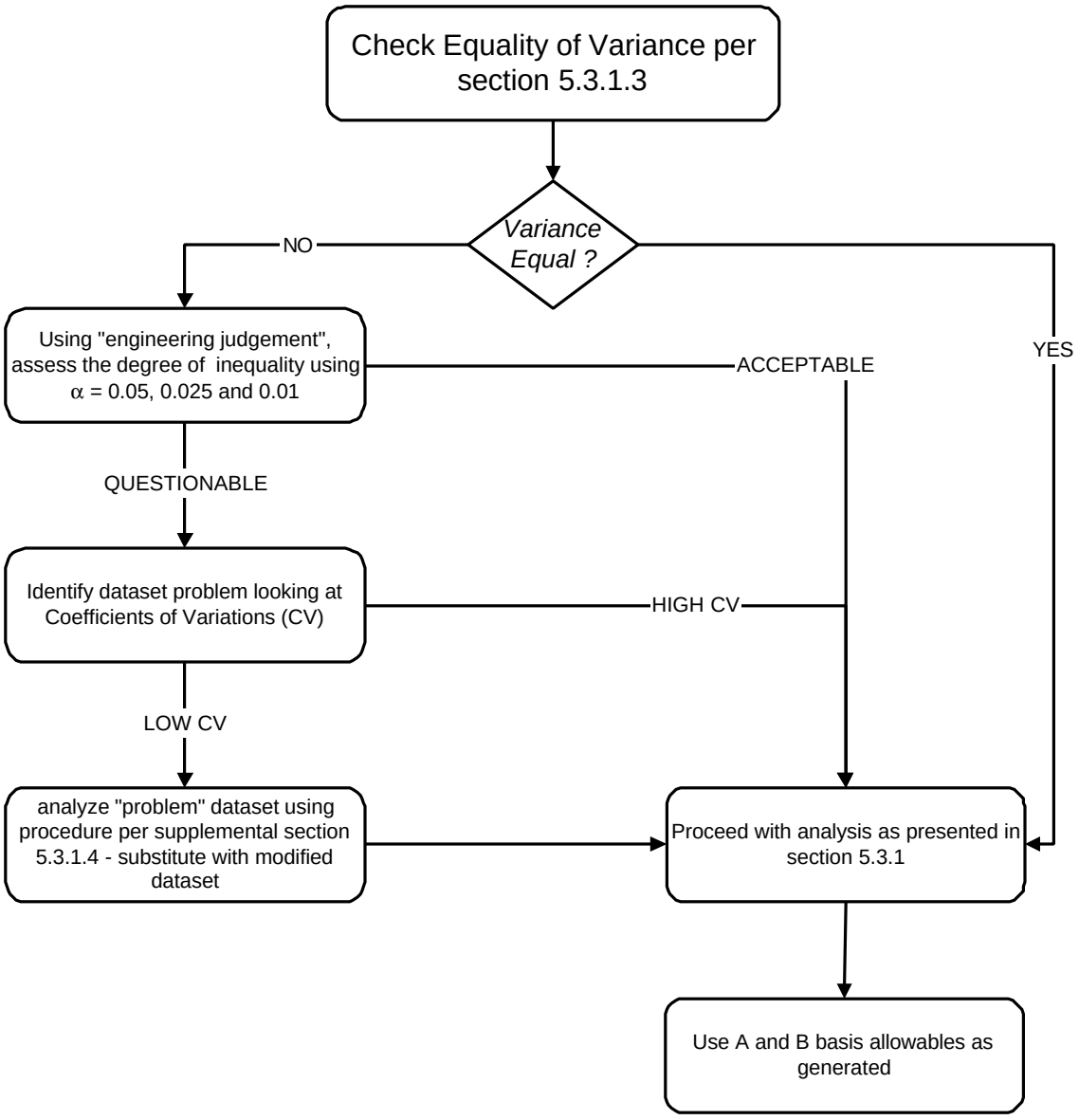


Figure E.1. Procedures to obtain design allowables in the case of variance inequality

A simple procedure for modifying the variance of a test sample to any desired value is presented. This procedure is useful in the case in which an environmental pooled dataset does not pass the equality of variance test per section 5.3.1.3 of DOT/FAA/AR-47/00. Consider a test sample x_i of n specimens with an average value of $\bar{x}$. Let the variance of this sample be CV which is given by

$$CV = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}} \qquad \textbf{eq. 1}$$

Let the desired variance of the sample be CV^*. Consider a transformation of the form

$$x_i^* = x_i + a(x_i)\Delta \qquad \textbf{eq. 2}$$

where x_i^* is the transformed data, Δ is a constant and $a(x_i)$ is a weighting function. Let the weighting function be

$$a(x_i) = (x_i - \bar{x}) \qquad \textbf{eq. 3}$$

The new variance for the transformed data is then given by

$$CV^* = \sqrt{\frac{\sum_{i=1}^{n}(x_i^* - \bar{x}^*)^2}{n-1}} \qquad \textbf{eq. 4}$$

where $\bar{x}^*$ is the average value of the transformed sample. Substituting equations (2) and (3) into equation (4) we obtain

$$CV^* = \sqrt{\frac{\sum_{i=1}^{n}\left[\{x_i + (x_i - \bar{x})\Delta\} - \bar{x}^*\right]^2}{n-1}} \qquad \textbf{eq. 5}$$

If we further let $\bar{x}^* = \bar{x}$, equation (5) reduces to

$$CV^* = \sqrt{\frac{(1+\Delta)^2 \sum_{i=1}^{n} (x_i - \bar{x})^2}{n-1}} \qquad \textbf{eq. 6}$$

which gives

$$\Delta = \frac{CV^*}{CV} - 1 \qquad \textbf{eq. 7}$$

Thus, a sample with a known variance *CV* can be transformed using equation (2) to obtain the desired variance *CV**. The constant for transformation Δ, can be calculated using equation (7).

For example, consider a typical test sample of size n=10 with an average value of 146.27 and a corresponding CV of 0.0184 as shown in the table E.1. The sample is transformed as per the previous discussions to obtain a transformed sample with a CV* of 0.04 (desired value). The transformation is illustrated using a probability of survival plot shown in Figure E.2. It can be observed that the original normal curve has been rotated and stretched due to the transformation.

Table E.1: A typical data sample and transformed data.

i	x_i	$x_i - \bar{x}$	x_i^*	
1	142.3	-3.97	137.63	$\Delta = \frac{0.040}{0.0184} - 1 = 1.174$
2	143.2	-3.07	139.59	
3	144.1	-2.17	141.55	
4	144.8	-1.47	143.07	
5	145.9	-0.37	145.46	
6	146.8	0.53	147.42	
7	147.5	1.23	148.95	
8	148.2	1.93	150.47	
9	149.6	3.33	153.52	
10	150.3	4.03	155.04	
$\bar{x}$	146.27	$\bar{x}^*$	146.27	
CV	0.0184	CV*	0.040	

In order to further investigate the effects of the above transformation on the normality of the data, the Anderson- Darling test for normality was conducted for both the original and transformed data. The test indicated no change in the Observed Significance Level (O.S.L = 0.758) for both the samples. Thus, the

transformation not only maintains the average value of the sample but also retains the normality of the sample.

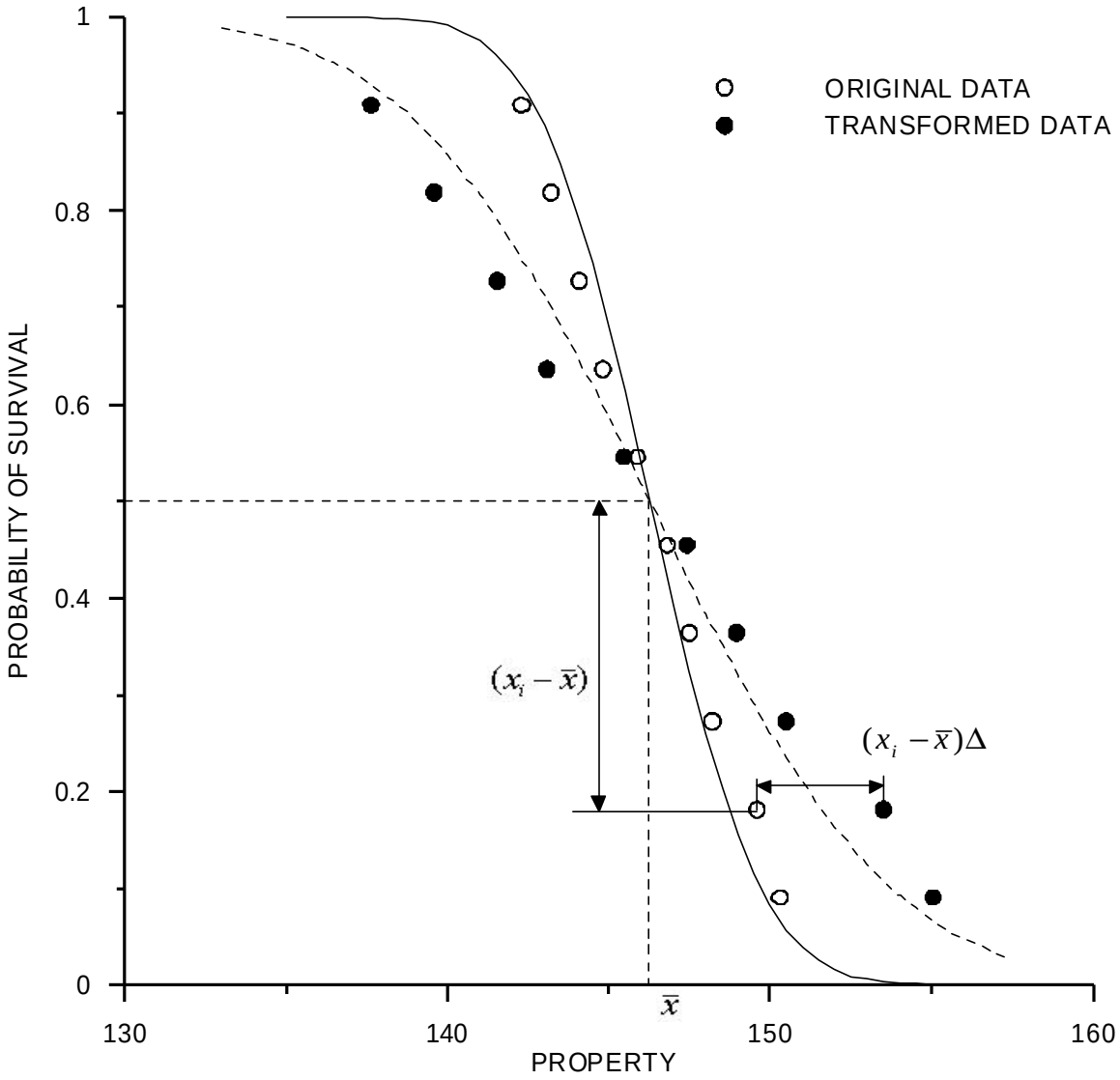


Figure E.2: Original and transformed data points

Once this sample has been transformed to the desired coefficient of variation, it may replaced and the data analyzed per the method described in section 5.3.1 of DOT/FAA/AR-47/00. It should be noted that this "replacement" is only for the calculation of basis values and the original data should be retained for all follow-on testing concerning material equivalence and acceptance.

APPENDIX F. RAW TESTING SUMMARIES

0° (Warp) Tension Properties, -65°F (Dry)

Material Type: FGF7781-07I
Batch Number: AF991102
Test Method: ASTM D3039
Specimen Preconditioning: as machined
Test Conditions: -65°F/Dry
Ply Orientation: $(warp)_{10}$
Testing Facility: Intec
Test Date: 2/23/2000

Test Operator: Bryan Mines, Emmanuel Domingo
Test Frame: H, I
Test Speed: 0.05 in/min
Control Mode: Stroke
Strain Gage: One biaxial gage (CEA-06-125UT-350)
Fiber Volume(normalizing): 44.2%
CPT (average): 0.0104 in.
Fiber Volume(batch average): 44.4%

Specimen Number	*Specimen Thickness*	*Specimen Width*	*Ultimate Tensile Load*	*Ultimate Tensile Strength*		*Load @ 0.1% Strain*	*Load @ 0.3% Strain*	*Tensile Modulus (0.1-0.3% strain)*		*Poisson's Ratio (0.1-0.3% strain)*	*Failure Location & Comments*
				Actual	*Norm.*			*Actual*	*Norm.*		
	(in.)	*(in.)*	*(lbs.)*	*(ksi)*	*(ksi)*	*(lbs.)*	*(lbs.)*	*(msi)*	*(msi)*		
A2-911-081-1-2	0.1050	0.9930	8350	80.1	80.9	383.0	1128	3.58	3.61	0.140	Delam/Tension failure
A2-911-081-1-1	0.1048	0.9930	8120	78.0	78.6	402.5	1213	3.82	3.85	0.190	Delam/Tension failure
B1-911-081-1-1	0.0997	0.9900	8630	87.4	83.8	354.6	1066	3.69	3.54	0.140	Delam/Tension failure
B2-911-081-1-1	0.1006	0.9910	7870	78.9	76.4	386.0	1162	3.91	3.78	0.180	Delam/Tension failure
A1-911-081-1-2	0.1058	0.9940	8690	82.6	84.1	-	-	-	-	-	Delam/Tension failure
B1-911-081-1-2	0.1010	0.9930	8530	85.1	82.6	-	-	-	-	-	Delam/Tension failure
Average	0.1028	0.9923	8365	82.0	81.1			3.75	3.70	0.163	
Std. Dev.	0.0027	0.0015	319	3.69	3.07			0.145	0.145	0.026	
COV, %	2.59	0.15	3.81	4.50	3.78			3.86	3.91	16.2	

0° (Warp) Tension Properties, 75°F (Dry)

Material Type: FGF7781-07I
Batch Number: AF991102
Test Method: ASTM D3039
Specimen Preconditioning: as machined
Test Conditions: RT/Dry
Ply Orientation: $(warp)_{10}$
Testing Facility: Toray Composites (America)
Test Date: 2/24/2000

Test Operator: John Smith
Test Frame: Instron 4505
Test Speed: 0.05 in/min
Control Mode: Stroke
Strain Gage: One biaxial gage (CEA-06-125UT-350)
Fiber Volume(normalizing): 44.2%
CPT (average): 0.0104 in.
Fiber Volume(batch average): 44.4%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ultimate Tensile Load (lbs.)	Ultimate Tensile Strength Actual (ksi)	Ultimate Tensile Strength Norm. (ksi)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Tensile Modulus (0.1-0.3% strain) Actual (msi)	Tensile Modulus (0.1-0.3% strain) Norm. (msi)	Poisson's Ratio (0.1-0.3%) strain)	Failure Location & Comments
A1-911-081-1-3	0.1060	0.9935	6628	63.0	64.1	389.1	1098	3.37	3.43	0.144	Failure in gage area
A2-911-081-1-3	0.1058	0.9907	6601	63.0	64.1	382.3	1096	3.40	3.46	0.144	Failure in gage area
B1-911-081-1-3	0.1031	0.9934	6787	66.3	65.7	417.0	1134	3.50	3.47	0.141	Failure in gage area
B2-911-081-1-3	0.1070	0.9933	5798	54.6	56.1	364.0	1065	3.30	3.39	0.140	Failure in gage area
A1-911-081-1-4	0.1063	0.9905	6552	62.2	63.6	-	-	-	-	-	Failure in gage area
B1-911-081-1-4	0.1047	0.9908	6863	66.2	66.6	-	-	-	-	-	Failure in gage area
Average	0.1055	0.9920	6538	62.5	63.4			3.39	3.44	0.142	
Std. Dev.	0.0014	0.0015	381	4.28	3.73			0.08	0.03	0.002	
COV, %	1.32	0.15	5.83	6.84	5.88			2.50	1.01	1.58	

Material Type: FGF7781-07I
Batch Number: AF991103
Test Method: ASTM D3039
Specimen Preconditioning: as machined
Test Conditions: RT/Dry
Ply Orientation: $(warp)_{10}$
Testing Facility: Toray Composites (America)
Test Date: 3/21/2000

Test Operator: John Smith
Test Frame: Instron 4505
Test Speed: 0.05 in/min
Control Mode: Stroke
Strain Gage: One biaxial gage (CEA-06-125UT-120)
Fiber Volume(normalizing): 44.2%
CPT (average): 0.0104 in.
Fiber Volume(batch average): 44.9%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ultimate Tensile Load (lbs.)	Ultimate Tensile Strength Actual (ksi)	Ultimate Tensile Strength Norm. (ksi)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Tensile Modulus (0.1-0.3% strain) Actual (msi)	Tensile Modulus (0.1-0.3% strain) Norm. (msi)	Poisson's Ratio (0.1-0.3%) strain)	Failure Location & Comments
A1-911-082-1-1	0.1046	0.9931	6586	63.4	63.8	388.3	1095	3.40	3.42	0.137	Failure in gage area
A2-911-082-1-1	0.1017	0.9931	6729	66.6	65.2	383.2	1093	3.51	3.44	0.142	Failure in gage area
B1-911-082-1-1	0.1022	0.9931	6804	67.0	65.9	436.1	1145	3.49	3.43	0.139	Failure in gage area
B2-911-082-1-1	0.1027	0.9933	6604	64.7	63.9	372.0	1071	3.43	3.38	0.140	Failure in gage area
A1-911-082-1-2	0.1054	0.9932	6733	64.3	65.2	-	-	-	-	-	Failure in gage area
B1-911-082-1-2	0.1030	0.9932	6719	65.7	65.1	-	-	-	-	-	Failure in gage area
Average	0.1033	0.9932	6696	65.3	64.8			3.46	3.42	0.139	
Std. Dev.	0.0014	0.0001	84	1.40	0.81			0.05	0.02	0.002	
COV, %	1.39	0.01	1.25	2.15	1.25			1.56	0.69	1.54	

Material Type: FGF7781-07I
Batch Number: AF991104
Test Method: ASTM D3039
Specimen Preconditioning: as machined
Test Conditions: RT/Dry
Ply Orientation: $(warp)_{10}$
Testing Facility: Toray Composites (America)
Test Date: 3/21/2000

Test Operator: John Smith
Test Frame: Instron 4505
Test Speed: 0.05 in/min
Control Mode: Stroke
Strain Gage: One biaxial gage (CEA-06-125UT-120)
Fiber Volume(normalizing): 44.2%
CPT (average): 0.0104 in.
Fiber Volume(batch average): 45.3%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ultimate Tensile Load (lbs.)	Ultimate Tensile Strength Actual (ksi)	Ultimate Tensile Strength Norm. (ksi)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Tensile Modulus (0.1-0.3% strain) Actual (msi)	Tensile Modulus (0.1-0.3% strain) Norm. (msi)	Poisson's Ratio (0.1-0.3%) strain)	Failure Location & Comments
A1-911-083-1-1	0.1011	0.9931	6579	65.5	63.7	405.2	1109	3.50	3.41	0.141	Failure in gage area
A2-911-083-1-1	0.0995	0.9932	6608	66.8	64.0	444.8	1154	3.59	3.43	0.135	Failure in gage area
B1-911-083-1-1	0.1026	0.9929	6586	64.7	63.8	430.3	1131	3.44	3.39	0.140	Failure in gage area
B2-911-083-1-1	0.1036	0.9932	6747	65.6	65.3	380.7	1088	3.44	3.43	0.136	Failure in gage area
A1-911-083-1-2	0.1014	0.9933	6690	66.4	64.8	-	-	-	-	-	Failure in gage area
B1-911-083-1-2	0.1027	0.9933	6598	64.7	63.9	-	-	-	-	-	Failure in gage area
Average	0.1018	0.9932	6635	65.6	64.2			3.49	3.41	0.138	
Std. Dev.	0.0014	0.0001	68	0.89	0.66			0.07	0.02	0.003	
COV, %	1.41	0.01	1.03	1.36	1.02			2.02	0.55	2.11	

0° (Warp) Tension Properties, 180°F (Dry)

Material Type: FGF7781-07I
Batch Number: AF991102
Test Method: ASTM D3039
Specimen Preconditioning: as machined
Test Conditions: 180°F/Dry
Ply Orientation: $(warp)_{10}$
Testing Facility: Toray Composites (America)
Test Date: 3/3/2000

Test Operator: John Smith
Test Frame: Instron 4505
Test Speed: 0.05 in/min
Control Mode: Stroke
Strain Gage: One biaxial gage (CEA-06-125UT-120)
Fiber Volume(normalizing): 44.2%
CPT (average): 0.0104 in.
Fiber Volume(batch average): 44.4%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ultimate Tensile Load (lbs.)	Ultimate Tensile Strength Actual (ksi)	Ultimate Tensile Strength Norm. (ksi)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Tensile Modulus (0.1-0.3% strain) Actual (msi)	Tensile Modulus (0.1-0.3% strain) Norm. (msi)	Poisson's Ratio (0.1-0.3%) strain)	Failure Location & Comments
A1-911-081-1-5	0.1062	0.9935	6643	63.0	64.3	369.6	1049	3.22	3.29	0.126	Failure in gage area
A2-911-081-1-5	0.1066	0.9933	6767	63.9	65.5	400.4	1096	3.29	3.37	0.131	Failure in gage area
B1-911-081-1-5	0.1061	0.9935	6580	62.4	63.7	401.7	1092	3.27	3.34	0.130	Failure in gage area
B2-911-081-1-5	0.1085	0.9936	6778	62.9	65.6	366.3	1046	3.15	3.29	0.133	Failure in gage area
A2-911-081-1-4	0.1061	0.9934	6687	63.4	64.7	-	-	-	-	-	Failure in gage area
B2-911-081-1-4	0.1087	0.9911	6738	62.5	65.4	-	-	-	-	-	Failure in gage area
Average	0.1070	0.9931	6699	63.0	64.9			3.23	3.32	0.130	
Std. Dev.	0.0012	0.0010	77	0.57	0.77			0.06	0.04	0.003	
COV, %	1.15	0.10	1.15	0.90	1.18			1.89	1.21	2.32	

Material Type: FGF7781-07I
Batch Number: AF991103
Test Method: ASTM D3039
Specimen Preconditioning: as machined
Test Conditions: 180°F/Dry
Ply Orientation: $(warp)_{10}$
Testing Facility: Toray Composites (America)
Test Date: 3/14/2000

Test Operator: John Smith
Test Frame: Instron 4505
Test Speed: 0.05 in/min
Control Mode: Stroke
Strain Gage: One biaxial gage (CEA-06-125UT-120)
Fiber Volume(normalizing): 44.2%
CPT (average): 0.0104 in.
Fiber Volume(batch average): 44.9%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ultimate Tensile Load (lbs.)	Ultimate Tensile Strength Actual (ksi)	Ultimate Tensile Strength Norm. (ksi)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Tensile Modulus (0.1-0.3% strain) Actual (msi)	Tensile Modulus (0.1-0.3% strain) Norm. (msi)	Poisson's Ratio (0.1-0.3%) strain)	Failure Location & Comments
A1-911-082-1-7	0.1030	0.9931	6754	66.0	65.4	414.3	1103	3.36	3.33	0.120	Failure in gage area
A2-911-082-1-3	0.1032	0.9908	6736	65.9	65.4	390.8	1073	3.34	3.31	0.128	Failure in gage area
B1-911-082-1-3	0.1030	0.9901	6702	65.7	65.1	444.9	1128	3.35	3.32	0.128	Failure in gage area
B2-911-082-1-3	0.1036	0.9906	6733	65.6	65.4	393.5	1081	3.35	3.33	0.129	Failure in gage area
A2-911-082-1-2	0.1024	0.9932	6663	65.5	64.5	-	-	-	-	-	Failure in gage area
B2-911-082-1-2	0.1033	0.9934	6775	66.0	65.6	-	-	-	-	-	Failure in gage area
Average	0.1031	0.9919	6727	65.8	65.2			3.35	3.32	0.126	
Std. Dev.	0.0004	0.0015	40	0.21	0.38			0.01	0.01	0.004	
COV, %	0.37	0.16	0.59	0.33	0.58			0.33	0.37	3.19	

Material Type: FGF7781-07I
Batch Number: AF991104
Test Method: ASTM D3039
Specimen Preconditioning: as machined
Test Conditions: 180°F/Dry
Ply Orientation: $(warp)_{10}$
Testing Facility: Toray Composites (America)
Test Date: 3/14/2000

Test Operator: John Smith
Test Frame: Instron 4505
Test Speed: 0.05 in/min
Control Mode: Stroke
Strain Gage: One biaxial gage (CEA-06-125UT-120)
Fiber Volume(normalizing): 44.2%
CPT (average): 0.0104 in.
Fiber Volume(batch average): 45.3%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ultimate Tensile Load (lbs.)	Ultimate Tensile Strength Actual (ksi)	Ultimate Tensile Strength Norm. (ksi)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Tensile Modulus (0.1-0.3% strain) Actual (msi)	Tensile Modulus (0.1-0.3% strain) Norm. (msi)	Poisson's Ratio (0.1-0.3%) strain)	Failure Location & Comments
A1-911-083-1-3	0.1019	0.9913	6553	64.9	63.6	388.3	1070	3.37	3.31	0.127	Failure in gage area
A2-911-083-1-3	0.1033	0.9902	6711	65.6	65.2	420.9	1117	3.40	3.38	0.128	Failure in gage area
B1-911-083-1-3	0.1032	0.9912	6627	64.8	64.3	414.0	1089	3.30	3.27	0.129	Failure in gage area
B2-911-083-1-3	0.1040	0.9900	6621	64.3	64.3	395.0	1083	3.34	3.34	0.124	Failure in gage area
A2-911-083-1-2	0.1015	0.9933	6747	67.0	65.3	-	-	-	-	-	Failure in gage area
B2-911-083-1-2	0.1041	0.9931	6759	65.4	65.4	-	-	-	-	-	Failure in gage area
Average	0.1030	0.9915	6670	65.3	64.7			3.35	3.32	0.127	
Std. Dev.	0.0011	0.0014	82	0.92	0.74			0.05	0.05	0.002	
COV, %	1.05	0.14	1.23	1.41	1.15			1.35	1.37	1.59	

0° (Warp) Tension Properties, 180°F (Wet)

Material Type: FGF7781-07I
Batch Number: AF991102
Test Method: ASTM D3039
Specimen Preconditioning: per Section 3.2 of AGATE Methodology
Test Conditions: 180°F
Ply Orientation: $(warp)_{10}$
Testing Facility: Toray Composites (America)
Test Date: 5/2/00, 5/3/00

Test Operator: John Smith
Test Frame: Instron 4505
Test Speed: 0.05 in/min
Control Mode: Stroke
Strain Gage: One biaxial gage (CEA-06-125UT-120)
Fiber Volume(normalizing): 44.2%
CPT (average): 0.0104 in.
Fiber Volume(batch average): 44.4%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ultimate Tensile Load (lbs.)	Ultimate Tensile Strength Actual (ksi)	Ultimate Tensile Strength Norm. (ksi)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Tensile Modulus (0.1-0.3% strain) Actual (msi)	Tensile Modulus (0.1-0.3% strain) Norm. (msi)	Poisson's Ratio (0.1-0.3%) strain)	Failure Location & Comments
A1-911-081-1-7	0.1050	0.9910	5136	49.4	49.8	392.6	1035	3.09	3.12	0.115	Failure in gage area
A2-911-081-1-7	0.1061	0.9932	5283	50.1	51.1	408.8	1065	3.11	3.17	0.116	Failure in gage area
B1-911-081-1-7	0.1080	0.9909	5330	49.8	51.7	428.3	1083	3.06	3.18	0.114	Failure in gage area
B2-911-081-1-7	0.1062	0.9911	5097	48.4	49.5	425.4	1066	3.04	3.11	0.116	Failure in gage area
A1-911-081-1-8	0.1055	0.9932	5319	50.7	51.5	-	-	-	-	-	Failure in gage area
B1-911-081-1-8	0.1073	0.9936	5160	48.4	49.9	-	-	-	-	-	Failure in gage area
Average	0.1063	0.9922	5221	49.5	50.6			3.08	3.14	0.115	
Std. Dev.	0.0011	0.0013	102	0.94	0.97			0.03	0.04	0.001	
COV, %	1.06	0.13	1.95	1.90	1.92			1.04	1.16	0.79	

Material Type: FGF7781-07I
Batch Number: AF991103
Test Method: ASTM D3039
Specimen Preconditioning: per Section 3.2 of AGATE Methodology
Test Conditions: 180°F
Ply Orientation: $(warp)_{10}$
Testing Facility: Toray Composites (America)
Test Date: 5/2/00, 5/3/00

Test Operator: John Smith
Test Frame: Instron 4505
Test Speed: 0.05 in/min
Control Mode: Stroke
Strain Gage: One biaxial gage (CEA-06-125UT-120)
Fiber Volume(normalizing): 44.2%
CPT (average): 0.0104 in.
Fiber Volume(batch average): 44.9%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ultimate Tensile Load (lbs.)	Ultimate Tensile Strength Actual (ksi)	Ultimate Tensile Strength Norm. (ksi)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Tensile Modulus (0.1-0.3% strain) Actual (msi)	Tensile Modulus (0.1-0.3% strain) Norm. (msi)	Poisson's Ratio (0.1-0.3%) strain)	Failure Location & Comments
A1-911-082-1-4	0.1054	0.9931	4997	47.7	48.4	395.0	1054	3.15	3.19	0.117	Failure in gage area
A2-911-082-1-4	0.1035	0.9936	5009	48.7	48.5	377.2	1031	3.18	3.16	0.118	Failure in gage area
B1-911-082-1-4	0.1026	0.9903	5094	50.1	49.5	452.4	1098	3.18	3.14	0.112	Failure in gage area
B2-911-082-1-4	0.1039	0.9905	4974	48.4	48.3	405.0	1044	3.10	3.10	0.112	Failure in gage area
A1-911-082-1-5	0.1053	0.9935	4819	46.1	46.6	-	-	-	-	-	Failure in gage area
B1-911-082-1-5	0.1023	0.9934	4884	48.1	47.3	-	-	-	-	-	Failure in gage area
Average	0.1038	0.9924	4963	48.2	48.1			3.15	3.15	0.114	
Std. Dev.	0.0013	0.0016	97	1.33	0.99			0.04	0.04	0.003	
COV, %	1.27	0.16	1.96	2.76	2.06			1.12	1.21	2.91	

Material Type: FGF7781-07I
Batch Number: AF991104
Test Method: ASTM D3039
Specimen Preconditioning: per Section 3.2 of AGATE Methodology
Test Conditions: 180°F
Ply Orientation: $(warp)_{10}$
Testing Facility: Toray Composites (America)
Test Date: 5/2/00, 5/3/00

Test Operator: John Smith
Test Frame: Instron 4505
Test Speed: 0.05 in/min
Control Mode: Stroke
Strain Gage: One biaxial gage (CEA-06-125UT-120)
Fiber Volume(normalizing): 44.2%
CPT (average): 0.0104 in.
Fiber Volume(batch average): 45.3%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ultimate Tensile Load (lbs.)	Ultimate Tensile Strength Actual (ksi)	Ultimate Tensile Strength Norm. (ksi)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Tensile Modulus (0.1-0.3% strain) Actual (msi)	Tensile Modulus (0.1-0.3% strain) Norm. (msi)	Poisson's Ratio (0.1-0.3%) strain)	Failure Location & Comments
A1-911-083-1-4	0.1021	0.9933	5299	52.2	51.3	363.1	1008	3.18	3.12	0.118	Failure in gage area
A2-911-083-1-1	0.1049	0.9932	5062	48.6	49.0	411.5	1073	3.17	3.20	0.114	Failure in gage area
B1-911-083-1-4	0.1034	0.9930	4841	47.2	46.9	423.0	1071	3.16	3.14	0.116	Failure in gage area
B2-911-083-1-4	0.1034	0.9933	5233	51.0	50.7	426.2	1080	3.18	3.16	0.112	Failure in gage area
A1-911-083-1-5	0.1021	0.9934	5143	50.7	49.8	-	-	-	-	-	Failure in gage area
B1-911-083-1-5	0.1033	0.9934	4924	48.0	47.7	-	-	-	-	-	Failure in gage area
Average	0.1032	0.9933	5084	49.6	49.2			3.17	3.16	0.115	
Std. Dev.	0.0010	0.0002	177	1.99	1.71			0.01	0.03	0.003	
COV, %	1.01	0.02	3.49	4.01	3.48			0.40	1.10	2.20	

90° (Fill) Tension Properties, -65°F (Dry)

Material Type: FGF7781-07I
Batch Number: AF991102
Test Method: ASTM D3039
Specimen Preconditioning: as machined
Test Conditions: -65°F/Dry
Ply Orientation: $(fill)_{10}$
Testing Facility: Intec
Test Date: 2/23/2000

Test Operator: Bryan Mines, Emmanuel Domingo
Test Frame: I
Test Speed: 0.05 in/min
Control Mode: Stroke
Strain Gage: One axial gage (CEA-06-125UW-350)
Fiber Volume(normalizing): 44.2%
CPT (average): 0.0104 in.
Fiber Volume(batch average): 44.4%

Specimen Number	*Specimen Thickness*	*Specimen Width*	*Ultimate Tensile Load*	*Ultimate Tensile Strength*		*Load @ 0.1% Strain*	*Load @ 0.3% Strain*	*Tensile Modulus (0.1-0.3% strain)*		*Failure Location & Comments*
	(in.)	*(in.)*	*(lbs.)*	*Actual (ksi)*	*Norm. (ksi)*	*(lbs.)*	*(lbs.)*	*Actual (msi)*	*Norm. (msi)*	
A1-911-081-1-1	0.1052	0.9910	6640	63.7	64.4	366	1096	3.46	3.50	Failure in gage area
A2-911-081-1-1	0.1046	0.9910	6540	63.1	63.5	430	1159	3.50	3.52	Failure in gage area
B1-911-081-1-1	0.1036	0.9910	6090	59.3	59.1	483	1193	3.49	3.48	Failure in gage area
B2-911-081-1-1	0.1032	0.9910	6680	65.3	64.8	386	1119	3.60	3.57	Failure in gage area
A1-911-081-1-2	0.1053	0.9940	6030	57.6	58.3	-	-	-	-	Failure in gage area
B1-911-081-1-2	0.1036	0.9940	6880	66.8	66.6	-	-	-	-	Failure in gage area
Average	0.1043	0.9920	6477	62.6	62.8			3.51	3.52	
Std. Dev.	0.0009	0.0015	342	3.53	3.32			0.06	0.04	
COV, %	0.87	0.16	5.28	5.63	5.28			1.73	1.16	

90° (Fill) Tension Properties, 75°F (Dry)

Material Type: FGF7781-07I
Batch Number: AF991102
Test Method: ASTM D3039
Specimen Preconditioning: as machined
Test Conditions: RT/Dry
Ply Orientation: $(fill)_{10}$
Testing Facility: Toray Composites (America)
Test Date: 2/24/2000

Test Operator: John Smith
Test Frame: Instron 4505
Test Speed: 0.05 in/min
Control Mode: Stroke
Strain Gage: One axial gage (C-960401-A)
Fiber Volume(normalizing): 44.2%
CPT (average): 0.0104 in.
Fiber Volume(batch average): 44.4%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ultimate Tensile Load (lbs.)	Ultimate Tensile Strength Actual (ksi)	Ultimate Tensile Strength Norm. (ksi)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Tensile Modulus (0.1-0.3% strain) Actual (msi)	Tensile Modulus (0.1-0.3% strain) Norm. (msi)	Failure Location & Comments
A1-911-081-1-3	0.1054	0.9934	5501	52.5	53.2	388	1064	3.23	3.27	Failure in gage area
A2-911-081-1-3	0.1058	0.9937	5437	51.7	52.6	366	1046	3.24	3.29	Failure in gage area
B1-911-081-1-3	0.1037	0.9935	5105	49.6	49.4	414	1097	3.31	3.30	Failure in gage area
B2-911-081-1-3	0.1054	0.9933	5603	53.5	54.2	405	1087	3.26	3.30	Failure in gage area
A1-911-081-1-4	0.1054	0.9905	5105	48.9	49.6	-	-	-	-	Failure in gage area
B1-911-081-1-4	0.1037	0.9905	4747	46.2	46.1	-	-	-	-	Failure in gage area
Average	0.1049	0.9925	5250	50.4	50.9			3.26	3.29	
Std. Dev.	0.0009	0.0016	322	2.71	3.06			0.04	0.01	
COV, %	0.90	0.16	6.13	5.37	6.01			1.17	0.44	

Material Type: FGF7781-07I
Batch Number: AF991103
Test Method: ASTM D3039
Specimen Preconditioning: as machined
Test Conditions: RT/Dry
Ply Orientation: $(fill)_{10}$
Testing Facility: Toray Composites (America)
Test Date: 3/21/2000

Test Operator: John Smith
Test Frame: Instron 4505
Test Speed: 0.05 in/min
Control Mode: Stroke
Strain Gage: One axial gage (C-960401-A)
Fiber Volume(normalizing): 44.2%
CPT (average): 0.0104 in.
Fiber Volume(batch average): 44.9%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ultimate Tensile Load (lbs.)	Ultimate Tensile Strength Actual (ksi)	Ultimate Tensile Strength Norm. (ksi)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Tensile Modulus (0.1-0.3% strain) Actual (msi)	Tensile Modulus (0.1-0.3% strain) Norm. (msi)	Failure Location & Comments
A1-911-082-1-1	0.1015	0.9929	4893	48.6	47.4	389	1063	3.34	3.26	Failure in gage area
A2-911-082-1-1	0.1028	0.9908	5114	50.2	49.6	400	1080	3.34	3.30	Failure in gage area
B1-911-082-1-1	0.1016	0.9909	5072	50.4	49.2	371	1053	3.38	3.31	Failure in gage area
B2-911-082-1-1	0.1013	0.9906	5180	51.6	50.3	409	1096	3.43	3.34	Failure in gage area
A1-911-082-1-2	0.1020	0.9933	5583	55.1	54.0	-	-	-	-	Failure in gage area
B1-911-082-1-2	0.1026	0.9938	5438	53.3	52.6	-	-	-	-	Failure in gage area
Average	0.1020	0.9920	5213	51.5	50.5			3.37	3.30	
Std. Dev.	0.0006	0.0014	253	2.37	2.42			0.04	0.03	
COV, %	0.62	0.14	4.86	4.60	4.79			1.24	0.98	

Material Type: FGF7781-07I
Batch Number: AF991104
Test Method: ASTM D3039
Specimen Preconditioning: as machined
Test Conditions: RT/Dry
Ply Orientation: $(fill)_{10}$
Testing Facility: Toray Composites (America)
Test Date: 3/21/2000

Test Operator: John Smith
Test Frame: Instron 4505
Test Speed: 0.05 in/min
Control Mode: Stroke
Strain Gage: One axial gage (C-960401-A)
Fiber Volume(normalizing): 44.2%
CPT (average): 0.0104 in.
Fiber Volume(batch average): 45.3%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ultimate Tensile Load (lbs.)	Ultimate Tensile Strength Actual (ksi)	Ultimate Tensile Strength Norm. (ksi)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Tensile Modulus (0.1-0.3% strain) Actual (msi)	Tensile Modulus (0.1-0.3% strain) Norm. (msi)	Failure Location & Comments
A1-911-083-1-1	0.1020	0.9908	5053	50.0	49.0	401	1080	3.36	3.30	Failure in gage area
A2-911-083-1-1	0.1028	0.9906	5077	49.8	49.3	386	1066	3.34	3.30	Failure in gage area
B1-911-083-1-1	0.1027	0.9910	5122	50.3	49.7	434	1119	3.37	3.33	Failure in gage area
B2-911-083-1-1	0.1010	0.9907	5061	50.6	49.1	379	1056	3.38	3.29	Failure in gage area
A1-911-083-1-2	0.1027	0.9936	5268	51.6	51.0	-	-	-	-	Failure in gage area
B1-911-083-1-2	0.1031	0.9937	5219	50.9	50.5	-	-	-	-	Failure in gage area
Average	0.1024	0.9917	5133	50.6	49.8			3.36	3.30	
Std. Dev.	0.0008	0.0015	90	0.66	0.80			0.02	0.02	
COV, %	0.76	0.15	1.75	1.31	1.61			0.56	0.52	

90° (Fill) Tension Properties, 180°F (Dry)

Material Type: FGF7781-07I
Batch Number: AF991102
Test Method: ASTM D3039
Specimen Preconditioning: as machined
Test Conditions: 180°F/Dry
Ply Orientation: $(fill)_{10}$
Testing Facility: Toray Composites (America)
Test Date: 3/14/2000

Test Operator: John Smith
Test Frame: Instron 4505
Test Speed: 0.05 in/min
Control Mode: Stroke
Strain Gage: One axial gage (C-960401-A)
Fiber Volume(normalizing): 44.2%
CPT (average): 0.0104 in.
Fiber Volume(batch average): 44.4%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ultimate Tensile Load (lbs.)	Ultimate Tensile Strength Actual (ksi)	Ultimate Tensile Strength Norm. (ksi)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Tensile Modulus (0.1-0.3% strain) Actual (msi)	Tensile Modulus (0.1-0.3% strain) Norm. (msi)	Failure Location & Comments
A1-911-081-1-5	0.1053	0.9939	5690	54.4	55.1	387	1027	3.06	3.10	Failure in gage area
A2-911-081-1-5	0.1058	0.9938	5672	54.0	54.9	349	999	3.09	3.15	Failure in gage area
B1-911-081-1-5	0.1040	0.9937	5575	53.9	53.9	387	1037	3.14	3.14	Failure in gage area
B2-911-081-1-5	0.1058	0.9939	5683	54.1	55.0	381	1031	3.09	3.14	Failure in gage area
A2-911-081-1-4	0.1061	0.9909	5690	54.1	55.2	-	-	-	-	Failure in gage area
B2-911-081-1-4	0.1056	0.9907	5786	55.3	56.2	-	-	-	-	Failure in gage area
Average	0.1054	0.9928	5683	54.3	55.0			3.10	3.13	
Std. Dev.	0.0007	0.0016	67	0.52	0.71			0.03	0.02	
COV, %	0.70	0.16	1.18	0.96	1.29			1.13	0.73	

Material Type: FGF7781-07I
Batch Number: AF991103
Test Method: ASTM D3039
Specimen Preconditioning: as machined
Test Conditions: 180°F/Dry
Ply Orientation: $(fill)_{10}$
Testing Facility: Toray Composites (America)
Test Date: 3/14/2000

Test Operator: John Smith
Test Frame: Instron 4505
Test Speed: 0.05 in/min
Control Mode: Stroke
Strain Gage: One axial gage (C-960401-A)
Fiber Volume(normalizing): 44.2%
CPT (average): 0.0104 in.
Fiber Volume(batch average): 44.9%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ultimate Tensile Load (lbs.)	Ultimate Tensile Strength Actual (ksi)	Ultimate Tensile Strength Norm. (ksi)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Tensile Modulus (0.1-0.3% strain) Actual (msi)	Tensile Modulus (0.1-0.3% strain) Norm. (msi)	Failure Location & Comments
A1-911-082-1-3	0.1025	0.9901	5618	55.4	54.6	342	983	3.16	3.12	Failure in gage area
A2-911-082-1-3	0.1042	0.9934	5589	54.0	54.1	398	1044	3.12	3.13	Failure in gage area
B1-911-082-1-3	0.1041	0.9938	5623	54.3	54.4	408	1063	3.16	3.17	Failure in gage area
B2-911-082-1-3	0.1026	0.9929	5654	55.5	54.8	396	1046	3.19	3.15	Failure in gage area
A2-911-082-1-2	0.1033	0.9936	5518	53.7	53.4	-	-	-	-	Failure in gage area
B2-911-082-1-2	0.1022	0.9931	5733	56.5	55.5	-	-	-	-	Failure in gage area
Average	0.1032	0.9928	5622	54.9	54.5			3.16	3.14	
Std. Dev.	0.0009	0.0014	71	1.06	0.70			0.03	0.02	
COV, %	0.85	0.14	1.26	1.93	1.29			0.96	0.74	

Material Type: FGF7781-07I
Batch Number: AF991104
Test Method: ASTM D3039
Specimen Preconditioning: as machined
Test Conditions: 180°F/Dry
Ply Orientation: $(fill)_{10}$
Testing Facility: Toray Composites (America)
Test Date: 3/14/2000

Test Operator: John Smith
Test Frame: Instron 4505
Test Speed: 0.05 in/min
Control Mode: Stroke
Strain Gage: One axial gage (C-960401-A)
Fiber Volume(normalizing): 44.2%
CPT (average): 0.0104 in.
Fiber Volume(batch average): 45.3%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ultimate Tensile Load (lbs.)	Ultimate Tensile Strength Actual (ksi)	Ultimate Tensile Strength Norm. (ksi)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Tensile Modulus (0.1-0.3% strain) Actual (msi)	Tensile Modulus (0.1-0.3% strain) Norm. (msi)	Failure Location & Comments
A1-911-083-1-3	0.1034	0.9934	5686	55.4	55.0	411	1084	3.28	3.26	Failure in gage area
A2-911-083-1-3	0.1034	0.9934	5536	53.9	53.6	369	1018	3.16	3.14	Failure in gage area
B1-911-083-1-3	0.1035	0.9936	5700	55.4	55.2	388	1041	3.17	3.16	Failure in gage area
B2-911-083-1-3	0.1026	0.9935	5399	53.0	52.3	430	1071	3.14	3.10	Failure in gage area
A2-911-083-1-2	0.1030	0.9939	5602	54.7	54.2	-	-	-	-	Failure in gage area
B2-911-083-1-2	0.1018	0.9941	5614	55.5	54.3	-	-	-	-	Failure in gage area

90° (Fill) Tension Properties, 180°F (Wet)

Material Type: FGF7781-07I
Batch Number: AF991102
Test Method: ASTM D3039
Specimen Preconditioning: per Section 3.2 of AGATE Methodology
Test Conditions: 180°F
Ply Orientation: $(fill)_{10}$
Testing Facility: Toray Composites (America)
Test Date: 5/2/00, 5/3/00

Test Operator: John Smith
Test Frame: Instron 4505
Test Speed: 0.05 in/min
Control Mode: Stroke
Strain Gage: One axial gage (C-960401-A)
Fiber Volume(normalizing): 44.2%
CPT (average): 0.0104 in.
Fiber Volume(batch average): 44.4%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ultimate Tensile Load (lbs.)	Ultimate Tensile Strength Actual (ksi)	Ultimate Tensile Strength Norm. (ksi)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Tensile Modulus (0.1-0.3% strain) Actual (msi)	Tensile Modulus (0.1-0.3% strain) Norm. (msi)	Failure Location & Comments
A1-911-081-1-8	0.1039	0.9934	4517	43.8	43.7	350	946	2.89	2.88	Failure in gage area
A2-911-081-1-8	0.1049	0.9930	4575	43.9	44.3	427	1032	2.90	2.93	Failure in gage area
B1-911-081-1-8	0.1029	0.9937	4436	43.4	42.9	381	992	2.99	2.95	Failure in gage area
B2-911-081-1-8	0.1063	0.9935	4351	41.2	42.1	376	986	2.89	2.95	Failure in gage area
A1-911-081-1-9	0.1035	0.9928	4488	43.7	43.5	-	-	-	-	Failure in gage area
B1-911-081-1-9	0.1024	0.9934	4448	43.7	43.1	-	-	-	-	Failure in gage area
Average	0.1040	0.9933	4469	43.3	43.3			2.92	2.93	
Std. Dev.	0.0014	0.0003	77	1.03	0.75			0.05	0.03	
COV, %	1.38	0.03	1.71	2.38	1.73			1.62	1.11	

Material Type: FGF7781-07I
Batch Number: AF991103
Test Method: ASTM D3039
Specimen Preconditioning: per Section 3.2 of AGATE Methodology
Test Conditions: 180°F
Ply Orientation: $(fill)_{10}$
Testing Facility: Toray Composites (America)
Test Date: 5/2/00, 5/3/00

Test Operator: John Smith
Test Frame: Instron 4505
Test Speed: 0.05 in/min
Control Mode: Stroke
Strain Gage: One axial gage (C-960401-A)
Fiber Volume(normalizing): 44.2%
CPT (average): 0.0104 in.
Fiber Volume(batch average): 44.9%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ultimate Tensile Load (lbs.)	Ultimate Tensile Strength Actual (ksi)	Ultimate Tensile Strength Norm. (ksi)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Tensile Modulus (0.1-0.3% strain) Actual (msi)	Tensile Modulus (0.1-0.3% strain) Norm. (msi)	Failure Location & Comments
A1-911-082-1-4	0.1027	0.9933	4115	40.4	39.8	371	974	2.95	2.91	Failure in gage area
A2-911-082-1-4	0.1057	0.9906	4195	40.1	40.7	389	991	2.87	2.92	Failure in gage area
B1-911-082-1-4	0.1057	0.9910	4192	40.0	40.7	383	991	2.90	2.95	Failure in gage area
B2-911-082-1-4	0.1026	0.9901	4383	43.2	42.6	365	973	2.99	2.95	Failure in gage area
A1-911-082-1-5	0.1028	0.9935	4408	43.2	42.7	-	-	-	-	Failure in gage area
B1-911-082-1-5	0.1056	0.9937	4282	40.8	41.4	-	-	-	-	Failure in gage area
Average	0.1042	0.9920	4263	41.3	41.3			2.93	2.93	
Std. Dev.	0.0016	0.0016	116	1.50	1.13			0.05	0.02	
COV, %	1.58	0.17	2.72	3.63	2.73			1.80	0.60	

Material Type: FGF7781-07I
Batch Number: AF991104
Test Method: ASTM D3039
Specimen Preconditioning: per Section 3.2 of AGATE Methodology
Test Conditions: 180°F
Ply Orientation: $(fill)_{10}$
Testing Facility: Toray Composites (America)
Test Date: 5/2/00, 5/3/00

Test Operator: John Smith
Test Frame: Instron 4505
Test Speed: 0.05 in/min
Control Mode: Stroke
Strain Gage: One axial gage (C-960401-A)
Fiber Volume(normalizing): 44.2%
CPT (average): 0.0104 in.
Fiber Volume(batch average): 45.3%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ultimate Tensile Load (lbs.)	Ultimate Tensile Strength Actual (ksi)	Ultimate Tensile Strength Norm. (ksi)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Tensile Modulus (0.1-0.3% strain) Actual (msi)	Tensile Modulus (0.1-0.3% strain) Norm. (msi)	Failure Location & Comments
A1-911-083-1-4	0.1043	0.9906	4463	43.2	43.3	343	942	2.90	2.91	Failure in gage area
A2-911-083-1-4	0.1033	0.9902	4435	43.4	43.1	364	967	2.95	2.93	Failure in gage area
B1-911-083-1-4	0.1036	0.9905	4385	42.7	42.6	371	980	2.97	2.96	Failure in gage area
B2-911-083-1-4	0.1032	0.9900	4404	43.1	42.8	411	1002	2.90	2.87	Failure in gage area
A1-911-083-1-5	0.1044	0.9935	4372	42.2	42.3	-	-	-	-	Failure in gage area
B1-911-083-1-5	0.1040	0.9937	4229	40.9	40.9	-	-	-	-	Failure in gage area
Average	0.1038	0.9914	4381	42.6	42.5			2.93	2.92	
Std. Dev.	0.0005	0.0017	82	0.92	0.85			0.03	0.03	
COV, %	0.49	0.17	1.86	2.16	2.00			1.19	1.18	

0° (Warp) Compression Properties, -65°F (Dry)

Material Type:	FGF7781-07I	*Test Operator:*	John Smith
Batch Number:	AF991103	*Test Frame:*	Instron 4510
Test Method:	SACMA SRM 1-94	*Test Speed:*	0.05 in/min
Preconditioning:	as machined	*Control Mode:*	Stroke
Test Conditions:	-65°F/Dry	*Strain Gage:*	N/A
Ply Orientation:	$(warp)_{12}$	*FV(normalizing):*	44.2%
Testing Facility:	TCA	*CPT (average):*	0.0104 in.
Test Date:	2/26/2000	*FV(batch average):*	44.9%

Specimen Number	*Specimen Thickness (in.)*	*Specimen Width (in.)*	*Ult. Comp. Load (kips)*	*Ult. Comp. Strength Actual (ksi)*	*Ult. Comp. Strength Norm. (ksi)*	*Failure Location & Comments*
A1-911-082-1-5	0.1247	0.5013	5.41	86.6	86.5	Failure in gage
A1-911-082-1-6	0.1247	0.5013	5.68	90.9	90.9	Failure in gage
A1-911-082-1-7	0.1247	0.4992	6.12	98.3	98.2	Failure in gage
B1-911-082-1-8	0.1190	0.5006	5.33	89.5	85.3	Failure in gage
B1-911-082-1-9	0.1190	0.5006	5.34	89.7	85.5	Failure in gage
B1-911-082-1-10	0.1190	0.5004	5.23	87.8	83.8	Failure in gage
Average	0.1219	0.5005	5.52	90.5	88.4	
Std. Dev.	0.0031	0.0008	0.33	4.12	5.39	
COV, %	2.56	0.15	6.00	4.56	6.10	

Material Type:	FGF7781-07I	*Test Operator:*	Bryan Mines
Batch Number:	AF991102	*Test Frame:*	H
Test Method:	SACMA SRM 1-94	*Test Speed:*	0.05 in/min
Preconditioning:	as machined	*Control Mode:*	Stroke
Test Conditions:	-65°F/Dry	*Strain Gage:*	One axial gage (CEA-06-125UW-350)
Ply Orientation:	$(warp)_{12}$	*FV(normalizing):*	44.2%
Testing Facility:	Intec	*CPT (average):*	0.0104 in.
Test Date:	2/23/2000	*FV(batch average):*	44.4%

Specimen Number	*Specimen Thickness (in.)*	*Specimen Width (in.)*	*Load @ 0.1% Strain (lbs.)*	*Load @ 0.3% Strain (lbs.)*	*Comp. Mod. (0.1-0.3% strain) Actual (msi)*	*Comp. Mod. (0.1-0.3% strain) Norm. (msi)*
A2-911-081-1-1	0.1342	0.4990	417.8	905.2	3.64	3.91
B2-911-081-1-1	0.1220	0.4990	495.8	971.4	3.91	3.82
Average	0.1281	0.4990			3.77	3.87
Std. Dev.	0.0086	0.0000			0.19	0.07
COV, %	6.73	0.00			5.00	1.73

0° (Warp) Compression Properties, 75°F (Dry)

Material Type: FGF7781-07I
Batch Number: AF991102
Test Method: SACMA SRM 1-94
Preconditioning: as machined
Test Conditions: RT/Dry
Ply Orientation: $(warp)_{12}$
Testing Facility: TCA
Test Date: 2/24/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: N/A
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 44.4%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ult. Comp. Load (kips)	Ult. Comp. Strength Actual (ksi)	Ult. Comp. Strength Norm. (ksi)	Failure Location & Comments
A1-911-081-1-9	0.1307	0.5008	4.75	72.6	76.0	Failure in gage
A1-911-081-1-10	0.1307	0.5008	4.53	69.2	72.5	Failure in gage
A2-911-081-1-17	0.1307	0.5006	4.20	64.2	67.2	Failure in gage
B1-911-081-1-9	0.1229	0.5009	4.72	76.7	75.5	Failure in gage
B2-911-081-1-17	0.1229	0.4980	4.91	80.3	79.1	Failure in gage
B2-911-081-1-18	0.1229	0.5005	5.18	84.3	83.0	Failure in gage
Average	0.1268	0.5003	4.72	74.6	75.5	
Std. Dev.	0.0043	0.0011	0.33	7.36	5.39	
COV, %	3.39	0.22	7.07	9.88	7.14	

Material Type: FGF7781-07I
Batch Number: AF991102
Test Method: SACMA SRM 1-94
Preconditioning: as machined
Test Conditions: RT/Dry
Ply Orientation: $(warp)_{12}$
Testing Facility: TCA
Test Date: 3/20/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: One axial gage (FAE-12S-AS-S6EL-2)
FV(normalizing): 44.2% in.
CPT (average): 0.0104
FV(batch average): 44.4%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Comp. Mod. (0.1-0.3% strain) Actual (msi)	Comp. Mod. (0.1-0.3% strain) Norm. (msi)
A2-911-081-1-	0.1325	0.5009	273.7	741.6	3.53	3.74
B2-911-081-1-	0.1227	0.4992	279.6	742.0	3.77	3.71
Average	0.1276	0.5001			3.65	3.73
Std. Dev.	0.0069	0.0012			0.18	0.02
COV, %	5.40	0.24			4.81	0.59

Material Type: FGF7781-07I
Batch Number: AF991103
Test Method: SACMA SRM 1-94
Preconditioning: as machined
Test Conditions: RT/Dry
Ply Orientation: $(warp)_{12}$
Testing Facility: TCA
Test Date: 3/13/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: N/A
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 44.9%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ult. Comp. Load (kips)	Ult. Comp. Strength Actual (ksi)	Ult. Comp. Strength Norm. (ksi)	Failure Location & Comments
A1-911-082-1-9	0.1204	0.5010	4.62	76.6	73.9	Failure in gage
A1-911-082-1-10	0.1204	0.5006	4.56	75.6	73.0	Failure in gage
A2-911-082-1-17	0.1204	0.5010	4.42	73.3	70.7	Failure in gage
B1-911-082-1-9	0.1224	0.5007	4.75	77.5	76.0	Failure in gage
B2-911-082-1-17	0.1224	0.4980	4.76	78.1	76.6	Failure in gage
B2-911-082-1-18	0.1224	0.5005	4.97	81.1	79.5	Failure in gage
Average	0.1214	0.5003	4.68	77.0	75.0	
Std. Dev.	0.0011	0.0011	0.19	2.60	3.07	
COV, %	0.88	0.23	4.02	3.37	4.10	

Material Type: FGF7781-07I
Batch Number: AF991103
Test Method: SACMA SRM 1-94
Preconditioning: as machined
Test Conditions: RT/Dry
Ply Orientation: $(warp)_{12}$
Testing Facility: TCA
Test Date: 3/20/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: One axial gage (FAE-12S-AS-S6EL-2)
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 44.9%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Comp. Mod. (0.1-0.3% strain) Actual (msi)	Comp. Mod. (0.1-0.3% strain) Norm. (msi)
A2-911-082-1-	0.1200	0.4987	284.0	767.0	4.04	3.88
B2-911-082-1-	0.1239	0.4992	292.4	778.5	3.93	3.90
Average	0.1219	0.4990			3.98	3.89
Std. Dev.	0.0028	0.0003			0.07	0.02
COV, %	2.27	0.07			1.87	0.39

Material Type: FGF7781-07I
Batch Number: AF991104
Test Method: SACMA SRM 1-94
Preconditioning: as machined
Test Conditions: RT/Dry
Ply Orientation: $(warp)_{12}$
Testing Facility: TCA
Test Date: 3/13/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: N/A
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 45.3%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ult. Comp. Load (kips)	Ult. Comp. Strength Actual (ksi)	Ult. Comp. Strength Norm. (ksi)	Failure Location & Comments
A1-911-083-1-9	0.1269	0.5010	5.04	79.3	80.6	Failure in gage
A1-911-083-1-10	0.1269	0.4989	4.83	76.4	77.6	Failure in gage
A2-911-083-1-17	0.1269	0.5004	5.21	82.0	83.3	Failure in gage
B1-911-083-1-9	0.1236	0.4988	4.90	79.5	78.8	Failure in gage
B2-911-083-1-17	0.1236	0.5008	4.62	74.6	73.9	Failure in gage
B2-911-083-1-18	0.1236	0.5007	4.67	75.5	74.8	Failure in gage
Average	0.1252	0.5001	4.88	77.9	78.2	
Std. Dev.	0.0018	0.0010	0.22	2.83	3.54	
COV, %	1.43	0.20	4.53	3.63	4.53	

Material Type: FGF7781-07I
Batch Number: AF991104
Test Method: SACMA SRM 1-94
Preconditioning: as machined
Test Conditions: RT/Dry
Ply Orientation: $(warp)_{12}$
Testing Facility: TCA
Test Date: 3/20/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: One axial gage (FAE-12S-AS-S6EL-2)
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 45.3%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Comp. Mod. (0.1-0.3% strain) Actual (msi)	Comp. Mod. (0.1-0.3% strain) Norm. (msi)
A2-911-083-1-	0.1266	0.4985	279.7	762.4	3.83	3.88
B2-911-083-1-	0.1205	0.4987	273.0	748.6	3.96	3.82
Average	0.1235	0.4986			3.89	3.85
Std. Dev.	0.0043	0.0002			0.09	0.04
COV, %	3.47	0.03			2.40	1.08

0° (Warp) Compression Properties, 180°F (Dry)

Material Type: FGF7781-07I
Batch Number: AF991102
Test Method: SACMA SRM 1-94
Preconditioning: as machined
Test Conditions: 180°F/Dry
Ply Orientation: $(warp)_{12}$
Testing Facility: TCA
Test Date: 2/24/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: N/A
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 44.4%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ult. Comp. Load (kips)	Ult. Comp. Strength Actual (ksi)	Ult. Comp. Strength Norm. (ksi)	Failure Location & Comments
A1-911-081-1-11	0.1307	0.5008	3.97	60.6	63.5	Failure in gage
A2-911-081-1-18	0.1307	0.5004	3.92	59.9	62.7	Failure in gage
A2-911-081-1-19	0.1307	0.5010	3.78	57.7	60.4	Failure in gage
B1-911-081-1-10	0.1229	0.5009	4.02	65.3	64.3	Failure in gage
B1-911-081-1-11	0.1229	0.5007	4.19	68.1	67.1	Failure in gage
B2-911-081-1-19	0.1229	0.4979	4.11	67.2	66.1	Failure in gage
Average	0.1268	0.5003	4.00	63.1	64.0	
Std. Dev.	0.0043	0.0012	0.15	4.30	2.40	
COV, %	3.39	0.24	3.64	6.81	3.74	

Material Type: FGF7781-07I
Batch Number: AF991102
Test Method: SACMA SRM 1-94
Preconditioning: as machined
Test Conditions: 180°F/Dry
Ply Orientation: $(warp)_{12}$
Testing Facility: TCA
Test Date: 3/20/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: One axial gage (FAE-12S-AS-S6EL-2)
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 44.4%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Comp. Mod. (0.1-0.3% strain) Actual (msi)	Comp. Mod. (0.1-0.3% strain) Norm. (msi)
A2-911-081-1-4	0.1319	0.4995	297.1	759.7	3.51	3.71
B2-911-081-1-4	0.1229	0.5009	293.8	760.6	3.79	3.73
Average	0.1274	0.5002			3.65	3.72
Std. Dev.	0.0063	0.0010			0.20	0.02
COV, %	4.97	0.20			5.40	0.44

Material Type: FGF7781-07I
Batch Number: AF991103
Test Method: SACMA SRM 1-94
Preconditioning: as machined
Test Conditions: 180°F/Dry
Ply Orientation: $(warp)_{12}$
Testing Facility: TCA
Test Date: 3/21/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: N/A
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 44.9%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ult. Comp. Load (kips)	Ult. Comp. Strength Actual (ksi)	Ult. Comp. Strength Norm. (ksi)	Failure Location & Comments
A1-911-082-1-11	0.1204	0.5000	3.58	59.4	57.3	Failure in gage
A2-911-082-1-18	0.1204	0.5008	4.00	66.4	64.0	Failure in gage
A2-911-082-1-19	0.1204	0.5007	3.96	65.7	63.4	Failure in gage
B1-911-082-1-10	0.1224	0.5009	3.92	63.9	62.7	Failure in gage
B1-911-082-1-11	0.1224	0.5009	3.94	64.3	63.0	Failure in gage
B2-911-082-1-19	0.1224	0.4977	3.94	64.6	63.4	Failure in gage
Average	0.1214	0.5002	3.89	64.1	62.3	
Std. Dev.	0.0011	0.0012	0.16	2.45	2.48	
COV, %	0.88	0.25	3.99	3.82	3.98	

Material Type: FGF7781-07I
Batch Number: AF991103
Test Method: SACMA SRM 1-94
Preconditioning: as machined
Test Conditions: 180°F/Dry
Ply Orientation: $(warp)_{12}$
Testing Facility: TCA
Test Date: 3/20/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: One axial gage (FAE-12S-AS-S6EL-2)
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 44.9%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Comp. Mod. (0.1-0.3% strain) Actual (msi)	Comp. Mod. (0.1-0.3% strain) Norm. (msi)
A2-911-082-1-2	0.1210	0.5007	293.7	771.1	3.94	3.82
B2-911-082-1-2	0.1237	0.5005	314.3	806.4	3.97	3.94
Average	0.1224	0.5006			3.96	3.88
Std. Dev.	0.0019	0.0001			0.02	0.08
COV, %	1.56	0.02			0.60	2.16

Material Type: FGF7781-07I
Batch Number: AF991104
Test Method: SACMA SRM 1-94
Preconditioning: as machined
Test Conditions: 180°F/Dry
Ply Orientation: $(warp)_{12}$
Testing Facility: TCA
Test Date: 3/21/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: N/A
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 45.3%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ult. Comp. Load (kips)	Ult. Comp. Strength Actual (ksi)	Ult. Comp. Strength Norm. (ksi)	Failure Location & Comments
A1-911-083-1-11	0.1269	0.5013	3.83	60.2	61.2	Failure in gage
A2-911-083-1-18	0.1269	0.5011	4.08	64.2	65.3	Failure in gage
A2-911-083-1-19	0.1269	0.5006	3.81	60.0	61.0	Failure in gage
B1-911-083-1-10	0.1263	0.5012	4.00	63.2	64.0	Failure in gage
B1-911-083-1-11	0.1263	0.4989	3.93	62.3	63.1	Failure in gage
B2-911-083-1-19	0.1263	0.5007	3.90	61.6	62.3	Failure in gage
Average	0.1266	0.5006	3.92	61.9	62.8	
Std. Dev.	0.0003	0.0009	0.10	1.68	1.66	
COV, %	0.24	0.18	2.66	2.71	2.65	

Material Type: FGF7781-07I
Batch Number: AF991104
Test Method: SACMA SRM 1-94
Preconditioning: as machined
Test Conditions: 180°F/Dry
Ply Orientation: $(warp)_{12}$
Testing Facility: TCA
Test Date: 3/20/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: One axial gage (FAE-12S-AS-S6EL-2)
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 45.3%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Comp. Mod. (0.1-0.3% strain) Actual (msi)	Comp. Mod. (0.1-0.3% strain) Norm. (msi)
A2-911-083-1-2	0.1268	0.5006	288.0	740.7	3.57	3.62
B2-911-083-1-2	0.1214	0.5039	289.5	803.6	4.20	4.09
Average	0.1241	0.5022			3.89	3.86
Std. Dev.	0.0038	0.0023			0.45	0.33
COV, %	3.06	0.46			11.58	8.53

0° (Warp) Compression Properties, 180°F (Wet)

Material Type: FGF7781-07I
Batch Number: AF991102
Test Method: SACMA SRM 1-94
Preconditioning: Section 3.2 of AGATE
Test Conditions: 180°F
Ply Orientation: $(warp)_{12}$
Testing Facility: TCA
Test Date: 7/7/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: N/A
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 44.4%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ult. Comp. Load (kips)	Ult. Comp. Strength Actual (ksi)	Ult. Comp. Strength Norm. (ksi)	Failure Location & Comments
A1-911-081-1-1	0.1285	0.5002	3.50	54.5	56.1	Failure in gage
A1-911-081-1-2	0.1285	0.5012	3.47	53.9	55.5	Failure in gage
A1-911-081-1-3	0.1285	0.5013	3.43	53.3	54.9	Failure in gage
B1-911-081-1-1	0.1285	0.5000	3.22	50.1	51.5	Failure in gage
B1-911-081-1-2	0.1285	0.4999	3.31	51.6	53.1	Failure in gage
B1-911-081-1-3	0.1285	0.4994	3.18	49.5	51.0	Failure in gage
Average	0.1285	0.5003	3.35	52.1	53.7	
Std. Dev.	0.0000	0.0007	0.14	2.07	2.14	
COV, %	0.00	0.15	4.09	3.98	3.98	

Material Type: FGF7781-07I
Batch Number: AF991102
Test Method: SACMA SRM 1-94
Preconditioning: Section 3.2 of AGATE
Test Conditions: 180°F
Ply Orientation: $(warp)_{12}$
Testing Facility: TCA
Test Date: 6/8/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: One axial gage (FAE-12S-AS-S6EL-2)
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 44.4%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Comp. Mod. (0.1-0.3% strain) Actual (msi)	Comp. Mod. (0.1-0.3% strain) Norm. (msi)
A2-911-081-1-5	0.1315	0.5007	264.3	708.2	3.37	3.55
B2-911-081-1-5	0.1229	0.5034	313.1	757.8	3.59	3.54
Average	0.1272	0.5020			3.48	3.55
Std. Dev.	0.0060	0.0020			0.16	0.01
COV, %	4.75	0.39			4.48	0.26

Material Type: FGF7781-07I
Batch Number: AF991103
Test Method: SACMA SRM 1-94
Preconditioning: Section 3.2 of AGATE
Test Conditions: 180°F
Ply Orientation: $(warp)_{12}$
Testing Facility: TCA
Test Date: 7/7/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: N/A
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 44.9%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ult. Comp. Load (kips)	Ult. Comp. Strength Actual (ksi)	Ult. Comp. Strength Norm. (ksi)	Failure Location & Comments
A1-911-082-1-1	0.1250	0.5009	2.98	47.5	47.6	Failure in gage
A1-911-082-1-2	0.1250	0.5003	3.06	49.0	49.0	Failure in gage
A1-911-082-1-3	0.1250	0.5004	3.18	50.8	50.9	Failure in gage
B1-911-082-1-1	0.1220	0.5001	2.81	46.0	45.0	Failure in gage
B1-911-082-1-2	0.1220	0.5002	2.84	46.5	45.5	Failure in gage
B1-911-082-1-3	0.1220	0.5002	2.85	46.7	45.6	Failure in gage
Average	0.1235	0.5004	2.95	47.8	47.3	
Std. Dev.	0.0016	0.0003	0.15	1.83	2.35	
COV, %	1.33	0.06	5.00	3.83	4.98	

Material Type: FGF7781-07I
Batch Number: AF991103
Test Method: SACMA SRM 1-94
Preconditioning: Section 3.2 of AGATE
Test Conditions: 180°F
Ply Orientation: $(warp)_{12}$
Testing Facility: TCA
Test Date: 6/8/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: One axial gage (FAE-12S-AS-S6EL-2)
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 44.9%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Comp. Mod. (0.1-0.3% strain) Actual (msi)	Comp. Mod. (0.1-0.3% strain) Norm. (msi)
A2-911-082-1-3	0.1215	0.4989	286.0	727.8	3.64	3.55
B2-911-082-1-3	0.1232	0.4993	263.3	695.2	3.51	3.47
Average	0.1224	0.4991			3.58	3.51
Std. Dev.	0.0012	0.0003			0.09	0.06
COV, %	0.97	0.06			2.62	1.65

Material Type: FGF7781-07I
Batch Number: AF991104
Test Method: SACMA SRM 1-94
Preconditioning: Section 3.2 of AGATE
Test Conditions: 180°F
Ply Orientation: $(warp)_{12}$
Testing Facility: TCA
Test Date: 7/7/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: N/A
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 45.3%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ult. Comp. Load (kips)	Ult. Comp. Strength Actual (ksi)	Ult. Comp. Strength Norm. (ksi)	Failure Location & Comments
A1-911-083-1-1	0.1267	0.5006	3.17	50.0	50.8	Failure in gage
A1-911-083-1-2	0.1267	0.5009	3.13	49.3	50.0	Failure in gage
A1-911-083-1-3	0.1267	0.5008	3.10	48.8	49.5	Failure in gage
B1-911-083-1-1	0.1238	0.5006	3.41	54.9	54.5	Failure in gage
B1-911-083-1-2	0.1238	0.5005	3.42	55.2	54.8	Failure in gage
B1-911-083-1-3	0.1238	0.5006	3.20	51.6	51.2	Failure in gage
Average	0.1253	0.5007	3.24	51.6	51.8	
Std. Dev.	0.0016	0.0002	0.14	2.83	2.28	
COV, %	1.24	0.03	4.38	5.47	4.40	

Material Type: FGF7781-07I
Batch Number: AF991104
Test Method: SACMA SRM 1-94
Preconditioning: Section 3.2 of AGATE
Test Conditions: 180°F
Ply Orientation: $(warp)_{12}$
Testing Facility: TCA
Test Date: 6/8/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: One axial gage (FAE-12S-AS-S6EL-2)
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 45.3%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Comp. Mod. (0.1-0.3% strain) Actual (msi)	Comp. Mod. (0.1-0.3% strain) Norm. (msi)
A2-911-083-1-3	0.1269	0.4990	271.2	713.9	3.49	3.55
B2-911-083-1-3	0.1224	0.5009	273.3	706.2	3.53	3.46
Average	0.1246	0.5000			3.51	3.51
Std. Dev.	0.0032	0.0014			0.03	0.06
COV, %	2.60	0.28			0.75	1.85

90° (Fill) Compression Properties, -65°F (Dry)

Material Type: FGF7781-07I
Batch Number: AF991103
Test Method: SACMA SRM 1-94
Preconditioning: as machined
Test Conditions: -65°F/Dry
Ply Orientation: $(fill)_{12}$
Testing Facility: TCA
Test Date: 2/25/2000

Test Operator: John Smith
Test Frame: Instron 4510
Test Speed: 0.05 in/min
Control Mode: Stroke
Strain Gage: N/A
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 44.9%

Specimen Number	*Specimen Thickness (in.)*	*Specimen Width (in.)*	*Ult. Comp. Load (kips)*	*Ult. Comp. Strength Actual (ksi)*	*Ult. Comp. Strength Norm. (ksi)*	*Failure Location & Comments*
A-911-082-1-1	0.1237	0.5000	4.81	77.7	77.0	Failure in gage
A-911-082-1-2	0.1237	0.4999	4.96	80.2	79.4	Failure in gage
A-911-082-1-3	0.1237	0.4998	4.90	79.2	78.5	Failure in gage
B1-911-082-1-7	0.1253	0.5004	4.93	78.7	79.0	Failure in gage
B1-911-082-1-8	0.1253	0.5003	5.00	79.8	80.1	Failure in gage
B1-911-082-1-11	0.1253	0.4999	4.91	78.3	78.6	Failure in gage
Average	0.1245	0.5000	4.92	79.0	78.8	
Std. Dev.	0.0009	0.0003	0.07	0.92	1.05	
COV, %	0.70	0.05	1.35	1.17	1.33	

Material Type: FGF7781-07I
Batch Number: AF991102
Test Method: SACMA SRM 1-94
Preconditioning: as machined
Test Conditions: -65°F/Dry
Ply Orientation: $(fill)_{12}$
Testing Facility: Intec
Test Date: 2/23/2000

Test Operator: Bryan Mines
Test Frame: Instron 4505
Test Speed: 0.05 in/min
Control Mode: Stroke
Strain Gage: One axial gage (CEA-06-125UW-350)
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 44.4%

Specimen Number	*Specimen Thickness (in.)*	*Specimen Width (in.)*	*Load @ 0.1% Strain (lbs.)*	*Load @ 0.3% Strain (lbs.)*	*Comp. Mod. (0.1-0.3% strain) Actual (msi)*	*Comp. Mod. (0.1-0.3% strain) Norm. (msi)*
A2-911-081-1-1	0.1261	0.4990	433.8	898.6	3.69	3.73
B2-911-081-1-1	0.1245	0.4990	428.3	882.3	3.65	3.65
Average	0.1253	0.4990			3.67	3.69
Std. Dev.	0.0011	0.0000			0.03	0.06
COV, %	0.90	0.00			0.76	1.66

90° (Fill) Compression Properties, 75°F (Dry)

Material Type: FGF7781-07I
Batch Number: AF991102
Test Method: SACMA SRM 1-94
Preconditioning: as machined
Test Conditions: RT/Dry
Ply Orientation: $(fill)_{12}$
Testing Facility: TCA
Test Date: 2/24/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: N/A
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 44.4%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ult. Comp. Load (kips)	Ult. Comp. Strength Actual (ksi)	Ult. Comp. Strength Norm. (ksi)	Failure Location & Comments
A1-911-081-1-9	0.1264	0.5005	4.24	67.1	67.9	Failure in gage
A1-911-081-1-10	0.1264	0.5002	4.22	66.8	67.7	Failure in gage
A2-911-081-1-17	0.1264	0.5004	3.86	61.0	61.8	Failure in gage
B1-911-081-1-9	0.1247	0.5009	4.20	67.3	67.2	Failure in gage
B2-911-081-1-17	0.1247	0.5002	4.30	69.0	68.9	Failure in gage
B2-911-081-1-18	0.1247	0.5006	4.16	66.6	66.5	Failure in gage
Average	0.1255	0.5005	4.16	66.3	66.7	
Std. Dev.	0.0009	0.0003	0.16	2.71	2.51	
COV, %	0.75	0.05	3.75	4.09	3.76	

Material Type: FGF7781-07I
Batch Number: AF991102
Test Method: SACMA SRM 1-94
Preconditioning: as machined
Test Conditions: RT/Dry
Ply Orientation: $(fill)_{12}$
Testing Facility: TCA
Test Date: 3/20/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: One axial gage (FAE-12S-AS-S6EL-2)
FV(normalizing): 44.2% in.
CPT (average): 0.0104
FV(batch average): 44.4%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Comp. Mod. (0.1-0.3% strain) Actual (msi)	Comp. Mod. (0.1-0.3% strain) Norm. (msi)
A2-911-081-1-3	0.1264	0.5013	290.8	766.8	3.76	3.80
B2-911-081-1-3	0.1248	0.4990	270.1	713.6	3.56	3.56
Average	0.1256	0.5001			3.66	3.68
Std. Dev.	0.0011	0.0016			0.14	0.17
COV, %	0.86	0.31			3.83	4.69

Material Type: FGF7781-07I
Batch Number: AF991103
Test Method: SACMA SRM 1-94
Preconditioning: as machined
Test Conditions: RT/Dry
Ply Orientation: $(fill)_{12}$
Testing Facility: TCA
Test Date: 3/13/2000, 7/28/00

Test Operator: John Smith, Jeremy Bucholtz
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: N/A
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 44.9%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ult. Comp. Load (kips)	Ult. Comp. Strength Actual (ksi)	Ult. Comp. Strength Norm. (ksi)	Failure Location & Comments
A2-911-082-1-17	0.1223	0.5009	4.25	69.4	68.0	Failure in gage
B1-911-082-1-9	0.1263	0.5008	3.99	63.0	63.8	Failure in gage
B2-911-082-1-17	0.1263	0.5007	3.91	61.9	62.6	Failure in gage
B2-911-082-1-18	0.1263	0.5000	3.97	62.8	63.6	Failure in gage
A2-911-082-1-20	0.1223	0.5009	3.99	65.1	63.8	Failure in gage
A2-911-082-1-21	0.1223	0.5002	4.12	67.4	66.0	Failure in gage
Average	0.1243	0.5006	4.04	64.9	64.6	
Std. Dev.	0.0022	0.0004	0.13	2.96	2.00	
COV, %	1.79	0.08	3.10	4.56	3.09	

Material Type: FGF7781-07I
Batch Number: AF991103
Test Method: SACMA SRM 1-94
Preconditioning: as machined
Test Conditions: RT/Dry
Ply Orientation: $(fill)_{12}$
Testing Facility: TCA
Test Date: 3/20/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: One axial gage (FAE-12S-AS-S6EL-2)
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 44.9%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Comp. Mod. (0.1-0.3% strain) Actual (msi)	Comp. Mod. (0.1-0.3% strain) Norm. (msi)
A2-911-082-1-1	0.1210	0.4994	282.3	739.3	3.78	3.67
B2-911-082-1-1	0.1258	0.4987	228.1	664.9	3.48	3.51
Average	0.1234	0.4991			3.63	3.59
Std. Dev.	0.0034	0.0005			0.21	0.11
COV, %	2.76	0.09			5.87	3.11

Material Type: FGF7781-07I
Batch Number: AF991104
Test Method: SACMA SRM 1-94
Preconditioning: as machined
Test Conditions: RT/Dry
Ply Orientation: $(fill)_{12}$
Testing Facility: TCA
Test Date: 3/13/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: N/A
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 45.3%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ult. Comp. Load (kips)	Ult. Comp. Strength Actual (ksi)	Ult. Comp. Strength Norm. (ksi)	Failure Location & Comments
A1-911-083-1-9	0.1249	0.5008	4.28	68.5	68.5	Failure in gage
A1-911-083-1-10	0.1249	0.5007	4.09	65.4	65.5	Failure in gage
A2-911-083-1-17	0.1249	0.5005	3.66	58.5	58.6	Failure in gage
B1-911-083-1-9	0.1244	0.5012	4.12	66.1	65.9	Failure in gage
B2-911-083-1-17	0.1244	0.5005	4.29	68.8	68.6	Failure in gage
B2-911-083-1-18	0.1244	0.5007	3.94	63.2	63.0	Failure in gage
Average	0.1247	0.5007	4.06	65.1	65.0	
Std. Dev.	0.0003	0.0003	0.24	3.83	3.79	
COV, %	0.20	0.05	5.85	5.88	5.83	

Material Type: FGF7781-07I
Batch Number: AF991104
Test Method: SACMA SRM 1-94
Preconditioning: as machined
Test Conditions: RT/Dry
Ply Orientation: $(fill)_{12}$
Testing Facility: TCA
Test Date: 3/20/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: One axial gage (FAE-12S-AS-S6EL-2)
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 45.3%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Comp. Mod. (0.1-0.3% strain) Actual (msi)	Comp. Mod. (0.1-0.3% strain) Norm. (msi)
A2-911-083-1-1	0.1259	0.4987	277.6	726.3	3.57	3.60
B2-911-083-1-1	0.1232	0.4993	270.0	710.0	3.58	3.53
Average	0.1245	0.4990			3.58	3.57
Std. Dev.	0.0020	0.0004			0.00	0.05
COV, %	1.58	0.09			0.11	1.47

90° (Fill) Compression Properties, 180°F (Dry)

Material Type: FGF7781-07I
Batch Number: AF991102
Test Method: SACMA SRM 1-94
Preconditioning: as machined
Test Conditions: 180°F/Dry
Ply Orientation: $(fill)_{12}$
Testing Facility: TCA
Test Date: 3/20/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: N/A
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 44.4%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ult. Comp. Load (kips)	Ult. Comp. Strength Actual (ksi)	Ult. Comp. Strength Norm. (ksi)	Failure Location & Comments
A1-911-081-1-11	0.1264	0.5003	3.33	52.6	53.3	Failure in gage
A2-911-081-1-18	0.1264	0.5002	3.13	49.5	50.2	Failure in gage
A2-911-081-1-19	0.1264	0.5004	3.35	52.9	53.6	Failure in gage
B1-911-081-1-10	0.1247	0.5003	3.40	54.5	54.4	Failure in gage
B1-911-081-1-11	0.1247	0.5009	3.54	56.7	56.6	Failure in gage
B2-911-081-1-19	0.1247	0.5007	3.50	56.1	56.0	Failure in gage
Average	0.1255	0.5004	3.37	53.7	54.0	
Std. Dev.	0.0009	0.0003	0.15	2.6	2.3	
COV, %	0.75	0.05	4.30	4.87	4.25	

Material Type: FGF7781-07I
Batch Number: AF991102
Test Method: SACMA SRM 1-94
Preconditioning: as machined
Test Conditions: 180°F/Dry
Ply Orientation: $(fill)_{12}$
Testing Facility: TCA
Test Date: 3/20/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: One axial gage (FAE-12S-AS-S6EL-2)
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 44.4%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Comp. Mod. (0.1-0.3% strain) Actual (msi)	Comp. Mod. (0.1-0.3% strain) Norm. (msi)
A2-911-081-1-4	0.1264	0.4989	261.6	693.3	3.42	3.47
B2-911-081-1-4	0.1250	0.5010	269.8	717.2	3.57	3.58
Average	0.1257	0.5000			3.50	3.52
Std. Dev.	0.0010	0.0015			0.10	0.08
COV, %	0.77	0.30			2.99	2.22

Material Type: FGF7781-07I
Batch Number: AF991103
Test Method: SACMA SRM 1-94
Preconditioning: as machined
Test Conditions: 180°F/Dry
Ply Orientation: $(fill)_{12}$
Testing Facility: TCA
Test Date: 3/21/2000, 7/28/00

Test Operator: John Smith, Jeremy Bucholtz
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: N/A
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 44.9%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ult. Comp. Load (kips)	Ult. Comp. Strength Actual (ksi)	Ult. Comp. Strength Norm. (ksi)	Failure Location & Comments
A2-911-082-1-18	0.1223	0.5006	3.58	58.4	57.2	Failure in gage
A2-911-082-1-19	0.1223	0.5006	3.49	57.0	55.8	Failure in gage
B1-911-082-1-10	0.1263	0.5005	3.36	53.1	53.8	Failure in gage
B1-911-082-1-11	0.1263	0.5008	3.42	54.0	54.7	Failure in gage
B2-911-082-1-19	0.1263	0.5008	3.33	52.7	53.3	Failure in gage
A2-911-082-1-23	0.1223	0.5008	3.38	55.1	54.0	Failure in gage
Average	0.1243	0.5007	3.42	55.1	54.8	
Std. Dev.	0.0022	0.0001	0.09	2.26	1.47	
COV, %	1.79	0.03	2.67	4.10	2.68	

Material Type: FGF7781-07I
Batch Number: AF991103
Test Method: SACMA SRM 1-94
Preconditioning: as machined
Test Conditions: 180°F/Dry
Ply Orientation: $(fill)_{12}$
Testing Facility: TCA
Test Date: 3/20/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: One axial gage (FAE-12S-AS-S6EL-2)
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 44.9%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Comp. Mod. (0.1-0.3% strain) Actual (msi)	Comp. Mod. (0.1-0.3% strain) Norm. (msi)
A2-911-082-1-2	0.1214	0.5010	284.9	725.9	3.63	3.53
B2-911-082-1-2	0.1261	0.5038	291.3	749.8	3.61	3.65
Average	0.1237	0.5024			3.62	3.59
Std. Dev.	0.0033	0.0020			0.01	0.08
COV, %	2.69	0.40			0.35	2.34

Material Type: FGF7781-07I
Batch Number: AF991104
Test Method: SACMA SRM 1-94
Preconditioning: as machined
Test Conditions: 180°F/Dry
Ply Orientation: $(fill)_{12}$
Testing Facility: TCA
Test Date: 3/21/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: N/A
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 45.3%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ult. Comp. Load (kips)	Ult. Comp. Strength Actual (ksi)	Ult. Comp. Strength Norm. (ksi)	Failure Location & Comments
A1-911-083-1-11	0.1249	0.5006	3.42	54.7	54.8	Failure in gage
A2-911-083-1-18	0.1249	0.5005	3.04	48.6	48.6	Failure in gage
A2-911-083-1-19	0.1249	0.5010	3.13	50.0	50.0	Failure in gage
B1-911-083-1-10	0.1244	0.5008	3.37	54.1	53.9	Failure in gage
B1-911-083-1-11	0.1244	0.5008	3.11	49.8	49.7	Failure in gage
B2-911-083-1-19	0.1244	0.5009	3.41	54.8	54.6	Failure in gage
Average	0.1247	0.5008	3.25	52.0	51.9	
Std. Dev.	0.0003	0.0002	0.17	2.82	2.78	
COV, %	0.20	0.03	5.36	5.42	5.36	

Material Type: FGF7781-07I
Batch Number: AF991104
Test Method: SACMA SRM 1-94
Preconditioning: as machined
Test Conditions: 180°F/Dry
Ply Orientation: $(fill)_{12}$
Testing Facility: TCA
Test Date: 3/20/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: One axial gage (FAE-12S-AS-S6EL-2)
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 45.3%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Comp. Mod. (0.1-0.3% strain) Actual (msi)	Comp. Mod. (0.1-0.3% strain) Norm. (msi)
A2-911-083-1-2	0.1255	0.5039	255.0	681.3	3.37	3.39
B2-911-083-1-2	0.1236	0.5031	313.8	792.2	3.85	3.81
Average	0.1245	0.5035			3.61	3.60
Std. Dev.	0.0013	0.0005			0.34	0.30
COV, %	1.07	0.11			9.31	8.24

90° (Fill) Compression Properties, 180°F (Wet)

Material Type: FGF7781-07I
Batch Number: AF991102
Test Method: SACMA SRM 1-94
Preconditioning: Section 3.2 of AGATE
Test Conditions: 180°F
Ply Orientation: $(fill)_{12}$
Testing Facility: TCA
Test Date: 7/7/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: N/A
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 44.4%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ult. Comp. Load (kips)	Ult. Comp. Strength Actual (ksi)	Ult. Comp. Strength Norm. (ksi)	Failure Location & Comments
A1-911-081-1-1	0.1271	0.5003	2.77	43.6	44.4	Failure in gage
A1-911-081-1-2	0.1271	0.5005	2.86	44.9	45.7	Failure in gage
A1-911-081-1-3	0.1271	0.5006	2.83	44.5	45.3	Failure in gage
B1-911-081-1-1	0.1271	0.5008	2.75	43.2	44.0	Failure in gage
B1-911-081-1-2	0.1271	0.5006	2.89	45.4	46.3	Failure in gage
B1-911-081-1-3	0.1271	0.5007	2.75	43.2	44.0	Failure in gage
Average	0.1271	0.5006	2.81	44.1	44.9	
Std. Dev.	0.0000	0.0002	0.06	0.95	0.96	
COV, %	0.00	0.03	2.14	2.15	2.15	

Material Type: FGF7781-07I
Batch Number: AF991102
Test Method: SACMA SRM 1-94
Preconditioning: Section 3.2 of AGATE
Test Conditions: 180°F
Ply Orientation: $(fill)_{12}$
Testing Facility: TCA
Test Date: 6/8/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: One axial gage (FAE-12S-AS-S6EL-2)
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 44.4%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Comp. Mod. (0.1-0.3% strain) Actual (msi)	Comp. Mod. (0.1-0.3% strain) Norm. (msi)
A2-911-081-1-5	0.1265	0.5009	262.2	676.7	3.27	3.32
B2-911-081-1-5	0.1250	0.5039	260.4	676.8	3.31	3.31
Average	0.1257	0.5024			3.29	3.31
Std. Dev.	0.0011	0.0021			0.03	0.00
COV, %	0.88	0.42			0.79	0.10

Material Type: FGF7781-07I
Batch Number: AF991103
Test Method: SACMA SRM 1-94
Preconditioning: Section 3.2 of AGATE
Test Conditions: 180°F
Ply Orientation: $(fill)_{12}$
Testing Facility: TCA
Test Date: 7/7/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: N/A
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 44.9%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ult. Comp. Load (kips)	Ult. Comp. Strength Actual (ksi)	Ult. Comp. Strength Norm. (ksi)	Failure Location & Comments
B1-911-082-1-1	0.1290	0.5004	2.63	40.8	42.1	Failure in gage
B1-911-082-1-2	0.1290	0.5001	2.56	39.7	41.0	Failure in gage
B1-911-082-1-3	0.1290	0.5002	2.40	37.1	38.4	Failure in gage
Average	0.1290	0.5002	2.53	39.2	40.5	
Std. Dev.	0.0000	0.0002	0.12	1.86	1.92	
COV, %	0.00	0.03	4.76	4.75	4.75	

Material Type: FGF7781-07I
Batch Number: AF991103
Test Method: SACMA SRM 1-94
Preconditioning: Section 3.2 of AGATE
Test Conditions: 180°F
Ply Orientation: $(fill)_{12}$
Testing Facility: TCA
Test Date: 6/8/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: One axial gage (FAE-12S-AS-S6EL-2)
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 44.9%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Comp. Mod. (0.1-0.3% strain) Actual (msi)	Comp. Mod. (0.1-0.3% strain) Norm. (msi)
A2-911-082-1-3	0.1220	0.4990	235.1	650.9	3.42	3.34
B2-911-082-1-3	0.1265	0.5006	263.1	694.2	3.40	3.45
Average	0.1242	0.4998			3.41	3.39
Std. Dev.	0.0032	0.0011			0.01	0.08
COV, %	2.56	0.22			0.25	2.31

Material Type: FGF7781-07I
Batch Number: AF991104
Test Method: SACMA SRM 1-94
Preconditioning: Section 3.2 of AGATE
Test Conditions: 180°F
Ply Orientation: $(fill)_{12}$
Testing Facility: TCA
Test Date: 7/7/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: N/A
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 45.3%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Ult. Comp. Load (kips)	Ult. Comp. Strength Actual (ksi)	Ult. Comp. Strength Norm. (ksi)	Failure Location & Comments
A1-911-083-1-1	0.1253	0.5001	2.88	45.9	46.1	Failure in gage
A1-911-083-1-2	0.1253	0.5006	2.70	43.1	43.2	Failure in gage
A1-911-083-1-3	0.1253	0.5007	2.73	43.5	43.7	Failure in gage
B1-911-083-1-1	0.1268	0.4999	2.80	44.2	44.9	Failure in gage
B1-911-083-1-2	0.1268	0.5002	2.74	43.3	44.0	Failure in gage
B1-911-083-1-3	0.1268	0.5002	2.70	42.5	43.2	Failure in gage
Average	0.1261	0.5003	2.76	43.7	44.2	
Std. Dev.	0.0008	0.0003	0.07	1.19	1.12	
COV, %	0.65	0.06	2.50	2.72	2.54	

Material Type: FGF7781-07I
Batch Number: AF991104
Test Method: SACMA SRM 1-94
Preconditioning: per Section 3.2 of AGATE Me
Test Conditions: 180°F
Ply Orientation: $(fill)_{12}$
Testing Facility: TCA
Test Date: 6/8/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: One axial gage (FAE-12S-AS-S6EL-2)
FV(normalizing): 44.2%
CPT (average): 0.0104 in.
FV(batch average): 45.3%

Specimen Number	Specimen Thickness (in.)	Specimen Width (in.)	Load @ 0.1% Strain (lbs.)	Load @ 0.3% Strain (lbs.)	Comp. Mod. (0.1-0.3% strain) Actual (msi)	Comp. Mod. (0.1-0.3% strain) Norm. (msi)
A2-911-083-1-3	0.1250	0.5012	265.1	696.8	3.45	3.45
B2-911-083-1-3	0.1239	0.5012	252.1	672.1	3.38	3.36
Average	0.1244	0.5012			3.41	3.40
Std. Dev.	0.0007	0.0000			0.05	0.07
COV, %	0.60	0.01			1.35	1.94

90° Compression - Ultimate Strength
(180°F/Wet)

Toray Composites (America), Inc.

FAA Project No: TC 1616SE-15
TCA Internal Specification: TCSPF-T-FG03
Material Type: FGF7781-07I
Batch Number: AF991103
Test Method: SACMA SRM 1-94
Specimen Preconditioning: per Section 3.2 of AGATE Methodology
Test Conditions: 180°F
Ply Orientation: $(fill)_{12}$
Panel Fabrication: TCA - vacuum bagged at 270°F
Testing Facility: Toray Composites (America)

Test Plan Document: AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems
Test Date: 7/7/2000, 12/15/2000
Test Operator: John Smith, Jeremy Buckholtz
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: N/A
Fiber Volume(normalizing): 44.2%
CPT (average): 0.0104 in.
Fiber Volume(batch average): 44.9%

Specimen Number	*Specimen Thickness (in.)*	*Specimen Width (in.)*	*Ultimate Compression Load (kips)*	*Ult. Compression Strength*		*Test Date*	*Failure Location & Comments*
				Actual (ksi)	*Norm. (ksi)*		
A1-911-082-1-4	0.1230	0.50010	2.702	43.9	43.3	12/15/2000	Failure in gage area
A1-911-082-1-5	0.1255	0.49998	2.524	40.2	40.5	12/15/2000	Failure in gage area
A1-911-082-1-6	0.1240	0.50033	2.688	43.3	43.0	12/15/2000	Failure in gage area
A2-911-082-1-2	0.1245	0.50062	2.429	39.0	38.9	12/15/2000	Failure in gage area
A2-911-082-1-3	0.1245	0.50100	2.595	41.6	41.5	12/15/2000	Failure in gage area
A2-911-082-1-4	0.1240	0.50100	2.559	41.2	40.9	12/15/2000	Failure in gage area
B1-911-082-1-1	0.1290	0.50036	2.631	40.8	42.1	7/7/2000	Failure in gage area
B1-911-082-1-2	0.1290	0.50005	2.559	39.7	41.0	7/7/2000	Failure in gage area
B1-911-082-1-3	0.1290	0.50017	2.396	37.1	38.4	7/7/2000	Failure in gage area
Average	0.1258	0.50040	2.565	40.8	41.1		
Std. Dev.	0.0025	0.00039	0.105	2.10	1.68		
COV, %	1.96	0.08	4.09	5.16	4.09		

In-plane (Iosipescu) Shear Properties, -65°F (Dry)

Material Type: FGF7781-07I
Batch Number: AF991102
Test Method: ASTM D5379
Specimen Preconditioning: as machined
Test Conditions: -65°F/Dry
Ply Orientation: $(0/90)_{3S}$
Testing Facility: Intec
Test Date: 2/23/2000

Test Operator: Bryan Mines
Test Frame: H
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: One biaxial gage (EA-06-062TW-350)

CPT (average): 0.0104 in.
Fiber Volume(batch average): 44.4%

Specimen Number	*Specimen Thickness (in.)*	*Notch Width (in.)*	*Ultimate Load (lbs.)*	*In-plane Shear Strength Actual (ksi)*	*IPS Modulus(1) (0.25-0.65%)(2) (msi)*	*Failure Location & Comments*
A1-911-081-1-1	0.1226	0.4590	1340	23.8	0.786	Shear failure in gage
A1-911-081-2-1	0.1232	0.4590	1310	23.2	0.706	Shear failure in gage
B1-911-081-1-1	0.1218	0.4570	1280	23.0	0.707	Shear failure in gage
B1-911-081-2-1	0.1241	0.4510	1270	22.7	0.680	Shear failure in gage
A1-911-081-3-1	0.1228	0.4590	1400	24.8	-	Shear failure in gage
B1-911-081-3-1	0.1221	0.4520	1370	24.8	-	Shear failure in gage
Average	0.1228	0.4562	1328	23.7	0.720	
Std. Dev.	0.0008	0.0037	51	0.93	0.046	
COV, %	0.67	0.81	3.85	3.94	6.38	

(1) Modulus is determined to be the slope of the Stress-Shear Strain curve.

(2) 0.25 ~ 0.65% strain range per ASTM D5379-98, Section 12.3.1

In-plane Shear (Iosipescu) Properties, 75°F (Dry)

Material Type: FGF7781-07I
Batch Number: AF991102
Test Method: ASTM D5379
Specimen Preconditioning: as machined
Test Conditions: RT/Dry
Ply Orientation: $(0/90)_{3S}$
Testing Facility: TCA
Test Date: 3/23/00, 3/24/00

Test Operator: John Smith
Test Frame: Instron 4505
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: One biaxial gage (EA-06-125-TW-120)
CPT (average): 0.0104 in.
Fiber Volume(batch average): 44.4%

Specimen Number	*Specimen Thickness (in.)*	*Notch Width (in.)*	*Ultimate Load (lbs.)*	*In-plane Shear Strength Actual (ksi)*	*IPS Modulus [1] (0.25-0.65%) [2] (msi)*	*Failure Location & Comments*
A1-911-081-1-11	0.1249	0.4576	1063	18.6	0.583	Shear failure in gage
A1-911-081-2-2	0.1232	0.4583	1055	18.7	0.597	Shear failure in gage
B1-911-081-1-2	0.1228	0.4574	1052	18.7	0.614	Shear failure in gage
B1-911-081-2-2	0.1253	0.4498	1035	18.4	0.604	Shear failure in gage
A1-911-081-3-2	0.1232	0.4575	1026	18.2	-	Shear failure in gage
B1-911-081-3-2	0.1233	0.4512	1007	18.1	-	Shear failure in gage
Average	0.1238	0.4553	1040	18.4	0.600	
Std. Dev.	0.0010	0.0038	21	0.26	0.013	
COV, %	0.85	0.82	2.02	1.42	2.17	

Material Type: FGF7781-07I
Batch Number: AF991103
Test Method: ASTM D5379
Specimen Preconditioning: as machined
Test Conditions: RT/Dry
Ply Orientation: $(0/90)_{3S}$
Testing Facility: TCA
Test Date: 2/23/00, 2/24/00

Test Operator: John Smith
Test Frame: Instron 4505
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: One biaxial gage (EA-06-125-TW-120)
CPT (average): 0.0104 in.
Fiber Volume(batch average): 44.9%

Specimen Number	*Specimen Thickness (in.)*	*Notch Width (in.)*	*Ultimate Load (lbs.)*	*In-plane Shear Strength Actual (ksi)*	*IPS Modulus [1] (0.25-0.65%) [2] (msi)*	*Failure Location & Comments*
A1-911-082-1-1	0.1216	0.4497	988	18.1	0.621	Shear failure in gage
A1-911-082-2-1	0.1228	0.4498	994	18.0	0.638	Shear failure in gage
B1-911-082-1-1	0.1220	0.4520	1002	18.2	0.632	Shear failure in gage
B1-911-082-2-1	0.1221	0.4518	1015	18.4	0.612	Shear failure in gage
A1-911-082-3-1	0.1223	0.4499	1058	19.2	-	Shear failure in gage
B1-911-082-3-1	0.1219	0.4502	1041	19.0	-	Shear failure in gage
Average	0.1221	0.4505	1016	18.5	0.626	
Std. Dev.	0.0004	0.0010	28	0.51	0.012	
COV, %	0.33	0.23	2.73	2.77	1.85	

Material Type: FGF7781-07I
Batch Number: AF991104
Test Method: ASTM D5379
Specimen Preconditioning: as machined
Test Conditions: RT/Dry
Ply Orientation: $(0/90)_{3S}$
Testing Facility: TCA
Test Date: 3/23/00, 3/24/00

Test Operator: John Smith
Test Frame: Instron 4505
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: One biaxial gage (EA-06-125-TW-120)
CPT (average): 0.0104 in.
Fiber Volume(batch average): 45.3%

Specimen Number	*Specimen Thickness (in.)*	*Notch Width (in.)*	*Ultimate Load (lbs.)*	*In-plane Shear Strength Actual (ksi)*	*IPS Modulus [1] (0.25-0.65%) [2] (msi)*	*Failure Location & Comments*
A1-911-083-1-1	0.1198	0.4455	999	18.7	0.747	Shear failure in gage
A1-911-083-2-1	0.1201	0.4507	1013	18.7	0.622	Shear failure in gage
B1-911-083-1-1	0.1179	0.4466	952	18.1	0.693	Shear failure in gage
B1-911-083-2-1	0.1184	0.4433	961	18.3	0.639	Shear failure in gage
A1-911-083-3-1	0.1194	0.4443	1000	18.8	-	Shear failure in gage
B1-911-083-3-1	0.1191	0.4457	946	17.8	-	Shear failure in gage
Average	0.1191	0.4460	978	18.4	0.675	
Std. Dev.	0.0009	0.0026	29	0.41	0.057	
COV, %	0.72	0.58	2.95	2.24	8.38	

[1] Modulus is determined to be the slope of the Stress-Shear Strain curve.
[2] 0.25 ~ 0.65% strain range per ASTM D5379-98, Section 12.3.1

In-plane Shear (Iosipescu) Properties, 180°F (Dry)

Material Type: FGF7781-07I
Batch Number: AF991102
Test Method: ASTM D5379
Specimen Preconditioning: as machined
Test Conditions: 180°F/Dry
Ply Orientation: $(0/90)_{3S}$
Testing Facility: TCA
Test Date: 3/16/2000

Test Operator: John Smith
Test Frame: Instron 4505
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: One biaxial gage (EA-06-125-TW-120)
CPT (average): 0.0104 in.
Fiber Volume(batch average): 44.4%

Specimen Number	*Specimen Thickness (in.)*	*Notch Width (in.)*	*Ultimate Load (lbs.)*	*In-plane Shear Strength Actual (ksi)*	*IPS Modulus [1] (0.25-0.65%) [2] (msi)*	*Failure Location & Comments*
A1-911-081-1-3	0.1232	0.4572	879	15.6	0.561	Shear failure in gage
A1-911-081-2-3	0.1238	0.4557	881	15.6	0.515	Shear failure in gage
B1-911-081-1-3	0.1243	0.4574	862	15.2	0.504	Shear failure in gage
B1-911-081-2-3	0.1270	0.4499	844	14.8	0.513	Shear failure in gage
B1-911-081-3-3	0.1250	0.4503	855	15.2	-	Shear failure in gage
A1-911-081-3-3	0.1240	0.4572	856	15.1	-	Shear failure in gage
Average	0.1245	0.4546	863	15.2	0.523	
Std. Dev.	0.0013	0.0036	14	0.32	0.026	
COV, %	1.08	0.78	1.68	2.12	4.90	

Material Type: FGF7781-07I
Batch Number: AF991103
Test Method: ASTM D5379
Specimen Preconditioning: as machined
Test Conditions: 180°F/Dry
Ply Orientation: $(0/90)_{3S}$
Testing Facility: TCA
Test Date: 3/16/2000

Test Operator: John Smith
Test Frame: Instron 4505
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: One biaxial gage (EA-06-125-TW-120)
CPT (average): 0.0104 in.
Fiber Volume(batch average): 44.9%

Specimen Number	*Specimen Thickness (in.)*	*Notch Width (in.)*	*Ultimate Load (lbs.)*	*In-plane Shear Strength Actual (ksi)*	*IPS Modulus [1] (0.25-0.65%) [2] (msi)*	*Failure Location & Comments*
A1-911-082-1-2	0.1224	0.4499	863	15.7	0.519	Shear failure in gage
A1-911-082-2-2	0.1235	0.4501	835	15.0	0.556	Shear failure in gage
B1-911-082-1-2	0.1226	0.4508	869	15.7	0.570	Shear failure in gage
B1-911-082-2-2	0.1228	0.4508	857	15.5	0.574	Shear failure in gage
A1-911-082-3-2	0.1230	0.4508	872	15.7	-	Shear failure in gage
B1-911-082-3-2	0.1230	0.4499	862	15.6	-	Shear failure in gage
Average	0.1229	0.4504	860	15.5	0.555	
Std. Dev.	0.0004	0.0005	13	0.27	0.025	
COV, %	0.33	0.10	1.55	1.75	4.52	

Material Type: FGF7781-07I
Batch Number: AF991104
Test Method: ASTM D5379
Specimen Preconditioning: as machined
Test Conditions: 180°F/Dry
Ply Orientation: $(0/90)_{3S}$
Testing Facility: TCA
Test Date: 3/16/2000

Test Operator: John Smith
Test Frame: Instron 4505
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: One biaxial gage (EA-06-125-TW-120)
CPT (average): 0.0104 in.
Fiber Volume(batch average): 45.3%

Specimen Number	*Specimen Thickness (in.)*	*Notch Width (in.)*	*Ultimate Load (lbs.)*	*In-plane Shear Strength Actual (ksi)*	*IPS Modulus [1] (0.25-0.65%) [2] (msi)*	*Failure Location & Comments*
A1-911-083-1-2	0.1206	0.4455	846	15.7	0.540	Shear failure in gage
A1-911-083-2-2	0.1215	0.4434	820	15.2	0.506	Shear failure in gage
B1-911-083-1-2	0.1180	0.4463	780	14.8	0.561	Shear failure in gage
B1-911-083-2-2	0.1181	0.4438	801	15.3	0.535	Shear failure in gage
A1-911-083-3-2	0.1210	0.4433	834	15.5	-	Shear failure in gage
B1-911-083-3-2	0.1190	0.4445	792	15.0	-	Shear failure in gage
Average	0.1197	0.4445	812	15.3	0.536	
Std. Dev.	0.0015	0.0012	25	0.35	0.023	
COV, %	1.29	0.27	3.13	2.26	4.23	

[1] Modulus is determined to be the slope of the Stress-Shear Strain curve.
[2] 0.25 ~ 0.65% strain range per ASTM D5379-98, Section 12.3.1

In-plane Shear (Iosipescu) Properties, 180°F (Wet)

Material Type: FGF7781-07I
Batch Number: AF991102
Test Method: ASTM D5379
Specimen Preconditioning: per Section 3.2 of AGATE Methodology
Test Conditions: 180°F
Ply Orientation: $(0/90)_{3S}$
Testing Facility: TCA
Test Date: 6/6/00, 6/7/00

Test Operator: John Smith
Test Frame: Instron 4505
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: One biaxial gage (EA-06-125-TW-120)
CPT (average): 0.0104 in.
Fiber Volume(batch average): 44.4%

Specimen Number	*Specimen Thickness (in.)*	*Notch Width (in.)*	*Ultimate Load (lbs.)*	*In-plane Shear Strength Actual (ksi)*	*IPS Modulus [1] (0.25-0.65%) [2] (msi)*	*Failure Location & Comments*
A1-911-081-1-4	0.1239	0.4574	666	11.8	0.434	Shear failure in gage
A1-911-081-1-5	0.1244	0.4588	656	11.5	0.589	Shear failure in gage
B1-911-081-1-4	0.1258	0.4580	666	11.6	0.441	Shear failure in gage
B1-911-081-1-5	0.1262	0.4587	666	11.5	0.476	Shear failure in gage
A1-911-081-1-6	0.1246	0.4578	676	11.9	-	Shear failure in gage
B1-911-081-1-6	0.1262	0.4577	668	11.6	-	Shear failure in gage
Average	0.1252	0.4580	667	11.6	0.485	
Std. Dev.	0.0010	0.0006	6	0.14	0.072	
COV, %	0.81	0.12	0.95	1.23	14.79	

Material Type: FGF7781-07I
Batch Number: AF991103
Test Method: ASTM D5379
Specimen Preconditioning: per Section 3.2 of AGATE Methodology
Test Conditions: 180°F
Ply Orientation: $(0/90)_{3S}$
Testing Facility: TCA
Test Date: 6/6/00, 6/7/00

Test Operator: John Smith
Test Frame: Instron 4505
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: One biaxial gage (EA-06-125-TW-120)
CPT (average): 0.0104 in.
Fiber Volume(batch average): 44.9%

Specimen Number	*Specimen Thickness (in.)*	*Notch Width (in.)*	*Ultimate Load (lbs.)*	*In-plane Shear Strength Actual (ksi)*	*IPS Modulus [1] (0.25-0.65%) [2] (msi)*	*Failure Location & Comments*
A1-911-082-1-3	0.1233	0.4501	653	11.8	0.450	Shear failure in gage
A1-911-082-1-4	0.1240	0.4502	650	11.6	0.434	Shear failure in gage
B1-911-082-1-3	0.1235	0.4512	645	11.6	0.435	Shear failure in gage
B1-911-082-1-4	0.1243	0.4510	644	11.5	0.447	Shear failure in gage
A1-911-082-1-5	0.1248	0.4499	665	11.8	-	Shear failure in gage
B1-911-082-1-5	0.1246	0.4522	662	11.8	-	Shear failure in gage
Average	0.1241	0.4507	653	11.7	0.442	
Std. Dev.	0.0006	0.0009	9	0.13	0.008	
COV, %	0.50	0.19	1.35	1.14	1.85	

Material Type: FGF7781-07I
Batch Number: AF991104
Test Method: ASTM D5379
Specimen Preconditioning: per Section 3.2 of AGATE Methodology
Test Conditions: 180°F
Ply Orientation: $(0/90)_{3S}$
Testing Facility: TCA
Test Date: 6/6/00, 6/7/00

Test Operator: John Smith
Test Frame: Instron 4505
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: One biaxial gage (EA-06-125-TW-120)
CPT (average): 0.0104 in.
Fiber Volume(batch average): 45.3%

Specimen Number	*Specimen Thickness (in.)*	*Notch Width (in.)*	*Ultimate Load (lbs.)*	*In-plane Shear Strength Actual (ksi)*	*IPS Modulus [1] (0.25-0.65%) [2] (msi)*	*Failure Location & Comments*
A1-911-083-1-3	0.1219	0.4447	631	11.6	0.439	Shear failure in gage
A1-911-083-1-4	0.1226	0.4452	631	11.6	0.420	Shear failure in gage
B1-911-083-1-3	0.1191	0.4437	611	11.6	0.452	Shear failure in gage
B1-911-083-1-4	0.1204	0.4438	629	11.8	0.463	Shear failure in gage
A1-911-083-1-5	0.1226	0.4471	638	11.6	-	Shear failure in gage
B1-911-083-1-5	0.1217	0.4459	633	11.7	-	Shear failure in gage
Average	0.1214	0.4450	629	11.6	0.444	
Std. Dev.	0.0014	0.0013	9	0.08	0.018	
COV, %	1.13	0.29	1.47	0.66	4.17	

[1] Modulus is determined to be the slope of the Stress-Shear Strain curve.
[2] 0.25 ~ 0.65% strain range per ASTM D5379-98, Section 12.3.1

In-plane Shear (Iosipescu) Strength, Fluid Sensitivity

Fluid: Jet Fuel

Material Type: FGF7781-07I
Batch Number: AF991102
Test Method: ASTM D5379
Specimen Preconditioning: at RT for 500 hrs
Test Temperature: 180°F
Ply Orientation: $(0/90)_{3S}$
Testing Facility: TCA
Test Date: 3/9/2000

Test Operator: John Smith
Test Frame: Instron 4505
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: N/A
CPT (average): 0.0104 in.
Fiber Volume(batch average): 44.4%

Specimen Number	*Specimen Thickness (in.)*	*Notch Width (in.)*	*Ultimate Load (lbs.)*	*In-plane Shear Strength Actual (ksi)*	*Failure Location & Comments*
A1-911-081-1-9	0.1260	0.4580	886	15.4	Shear failure in gage
A1-911-081-2-9	0.1260	0.4580	819	14.2	Shear failure in gage
A1-911-081-3-9	0.1250	0.4586	837	14.6	Shear failure in gage
B1-911-081-1-9	0.1250	0.4574	839	14.7	Shear failure in gage
B1-911-081-2-9	0.1270	0.4521	862	15.0	Shear failure in gage
Average	0.1258	0.4568	849	14.8	
Std. Dev.	0.0008	0.0027	26	0.44	
COV, %	0.67	0.59	3.05	2.98	

Fluid: Hydraulic Fluid

Material Type: FGF7781-07I
Batch Number: AF991102
Test Method: ASTM D5379
Specimen Preconditioning: at RT for 60 - 90 minutes
Test Temperature: 180°F
Ply Orientation: $(0/90)_{3S}$
Testing Facility: TCA
Test Date: 3/9/2000

Test Operator: John Smith
Test Frame: Instron 4505
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: N/A
CPT (average): 0.0104 in.
Fiber Volume(batch average): 44.4%

Specimen Number	*Specimen Thickness (in.)*	*Notch Width (in.)*	*Ultimate Load (lbs.)*	*In-plane Shear Strength Actual (ksi)*	*Failure Location & Comments*
A1-911-081-1-8	0.1250	0.4582	871	15.2	Shear failure in gage
A1-911-081-2-8	0.1250	0.4575	843	14.7	Shear failure in gage
A1-911-081-3-8	0.1250	0.4579	836	14.6	Shear failure in gage
B1-911-081-1-8	0.1260	0.4579	841	14.6	Shear failure in gage
B1-911-081-2-8	0.1280	0.4509	825	14.3	Shear failure in gage
Average	0.1258	0.4564	843	14.7	
Std. Dev.	0.0013	0.0031	17	0.33	
COV, %	1.04	0.68	1.98	2.24	

Fluid: MEK Solvent

Material Type: FGF7781-07I
Batch Number: AF991102
Test Method: ASTM D5379
Specimen Preconditioning: at RT for 60 - 90 minutes
Test Temperature: RT
Ply Orientation: $(0/90)_{3S}$
Testing Facility: TCA
Test Date: 3/23/2000

Test Operator: John Smith
Test Frame: Instron 4505
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: N/A
CPT (average): 0.0104 in.
Fiber Volume(batch average): 44.4%

Specimen Number	*Specimen Thickness (in.)*	*Notch Width (in.)*	*Ultimate Load (lbs.)*	*In-plane Shear Strength Actual (ksi)*	*Failure Location & Comments*
A1-911-081-1-7	0.1248	0.4578	1048	18.3	Shear failure in gage
A1-911-081-2-7	0.1254	0.4577	1061	18.5	Shear failure in gage
A1-911-081-3-7	0.1255	0.4571	1002	17.5	Shear failure in gage
B1-911-081-1-7	0.1264	0.4571	1045	18.1	Shear failure in gage
B1-911-081-2-7	0.1290	0.4509	1038	17.8	Shear failure in gage
Average	0.1262	0.4561	1039	18.0	
Std. Dev.	0.0017	0.0029	22	0.40	
COV, %	1.32	0.64	2.14	2.24	

Apparent Interlaminar Shear Strength, 75°F (Dry)

Material Type: FGF7781-07I
Batch Number: AF991102
Test Method: ASTM D2344
Specimen Preconditioning: as machined
Test Conditions: RT/Dry
Ply Orientation: $(warp)_{10}$
Testing Facility: TCA
Test Date: 3/10/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: N/A
CPT (average): 0.0104 in.
Fiber Volume(batch average): 44.4%

Specimen Number	Specimen Depth (in.)	Specimen Width (in.)	Span: Thickness Ratio	Ultimate Load (kips)	Short Beam Shear Strength (ksi)	Failure Location & Comments
A1-911-081-1-4	0.1084	0.2518	5:1	274	7.54	Shear Failure
A1-911-081-1-5	0.1084	0.2519	5:1	288	7.90	Shear Failure
A1-911-081-1-6	0.1080	0.2518	5:1	291	8.01	Shear Failure
B1-911-081-1-1	0.1041	0.2517	5:1	329	9.41	Shear Failure
B1-911-081-1-2	0.1037	0.2520	5:1	330	9.46	Shear Failure
B1-911-081-1-3	0.1039	0.2519	5:1	319	9.15	Shear Failure
Average	0.1061	0.2518		305	8.58	
Std. Dev.	0.0024	0.0001		24	0.855	
COV, %	2.24	0.03		7.80	9.96	

Material Type: FGF7781-07I
Batch Number: AF991103
Test Method: ASTM D2344
Specimen Preconditioning: as machined
Test Conditions: RT/Dry
Ply Orientation: $(warp)_{10}$
Testing Facility: TCA
Test Date: 3/22/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: N/A
CPT (average): 0.0104 in.
Fiber Volume(batch average): 44.9%

Specimen Number	Specimen Depth (in.)	Specimen Width (in.)	Span: Thickness Ratio	Ultimate Load (kips)	Short Beam Shear Strength (ksi)	Failure Location & Comments
A1-911-082-1-1	0.1042	0.2508	5:1	281	8.06	Shear Failure
A1-911-082-1-2	0.1038	0.2509	5:1	320	9.22	Shear Failure
A1-911-082-1-3	0.1042	0.2508	5:1	294	8.45	Shear Failure
B1-911-082-1-1	0.1044	0.2515	5:1	312	8.92	Shear Failure
B1-911-082-1-2	0.1041	0.2514	5:1	318	9.11	Shear Failure
B1-911-082-1-3	0.1047	0.2514	5:1	313	8.91	Shear Failure
Average	0.1042	0.2511		306	8.78	
Std. Dev.	0.0003	0.0003		15	0.439	
COV, %	0.30	0.13		5.04	5.01	

Material Type: FGF7781-07I
Batch Number: AF991104
Test Method: ASTM D2344
Specimen Preconditioning: as machined
Test Conditions: RT/Dry
Ply Orientation: $(warp)_{10}$
Testing Facility: TCA
Test Date: 3/22/2000

Test Operator: John Smith
Test Frame: Instron 4510
Loading Rate: 0.05 in/min
Control Mode: Stroke
Strain Gage: N/A
CPT (average): 0.0104 in.
Fiber Volume(batch average): 45.3%

Specimen Number	Specimen Depth (in.)	Specimen Width (in.)	Span: Thickness Ratio	Ultimate Load (kips)	Short Beam Shear Strength (ksi)	Failure Location & Comments
A1-911-083-1-1	0.0988	0.2522	5:1	286	8.60	Shear Failure
A1-911-083-1-2	0.0987	0.2522	5:1	274	8.25	Shear Failure
A1-911-083-1-3	0.0977	0.2521	5:1	312	9.51	Shear Failure
B1-911-083-1-1	0.1065	0.2517	5:1	310	8.68	Shear Failure
B1-911-083-1-2	0.1052	0.2517	5:1	314	8.91	Shear Failure
B1-911-083-1-3	0.1060	0.2518	5:1	311	8.73	Shear Failure
Average	0.1021	0.2519		301	8.78	
Std. Dev.	0.0041	0.0002		17	0.419	
COV, %	4.05	0.10		5.68	4.77	

APPENDIX G. DATES OF PANEL MANUFACTURE AND COPY OF FAA FORM 8130-3

FAA Form 8130-3
Airworthiness Approval Tag
for

FGF7781-07I
Style 7781/#2510
Fiberglass 8-Harness Woven Fabric

Panels

P-3

1. UNITED STATES

2.

FAA FORM 8130-3

AIRWORTHINESS APPROVAL TAG

U.S. Department of Transportation
Federal Aviation Administration

3. System Tracking Ref. N...

4. Organization TOLMY
19002 50TH AVE NE
TACOMA, WA. 98446

5. Work Order, Contract, or Invoice Number:
FAA PROJECT NO.
TC16165E-15

6. Item	7. Description	8. Part Number	9. Eligibility *	10. Quantity	11. Serial/Batch Number	12. Status/Work
1.	TEST PANEL FIBERGLASS FABRIC PREPREG	AF991102 AF991103 AF991104	—	22 22 22	—	PROTOTYPE

13. Remarks CONFORMS TO: MQMEB PCMS. DTD. 2-99

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
Newly Overhauled ☐

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special reqirements of the importing country have been met.

19.
Return to Service in Accordance with FAR 43.9

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chiu	DAR.F351003N		
17. Name *(Typed or Printed)*:	**18. Date:**	**22. Name** *(Typed or Printed)*	**23. Date:**
WING C. CHIU	12-21-99		

FAA Form 8130-3 (...)

* (Optional) Installer must cross check eligibility with applicable technical data

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. No P-5
4. Organization TORAY COMPOSITES 121000 50TH AVE. E TACOMA, WA 98446		5. Work Order, Contract, or Invoice Number: FAA PROJ NO. TC 1616 SE-15

6. Item	7. Description	8. Part Number	9. Eligibility *	10. Quantity	11. Serial/Batch Number	12. Status/Work
1.	0° comp. 12 Ply	AF991102		4	—	PROTO TYPE
	90° comp. 12 Ply	AF991102		4		

13. Remarks

CONFORMS TO: MGMTEB PCMS, DTD. 2-1999.

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14. New [X]
Newly Overhauled [ ]

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special reqirements of the importing country have been met.

19. **Return to Service in Accordance with FAR 43.9**

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	PARF351003NM		
17. Name *(Typed or Printed)*:	**18. Date:**	**22. Name *(Typed or Printed)***	**23. Date:**
WING C. CHIN	4-12-00		

FAA Form 8130-3 (11-90)

* (Optional) Installer must cross check eligibility with applicable technical data

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. No. P-6

4. Organization: TCRAY
19002 50TH AVE E.
TACOMA WA 98446

5. Work Order, Contract, or Invoice Number:
FAA PROGNO
TC1616SE-A 10-26-99

6. Item	7. Description	8. Part Number	9. Eligibility *	10. Quantity	11. Serial/Batch Number	12. Status/Work
1.	TEST PANELS	B-3-910-041 A-3-910-041 A-3-910-042 B-3-910-042 A3-910-043		1 1 1 1 1	—	PROTO TYPE
13. Remarks		B-910-043 A-3911-082		1 1		

CONFORMS TO DOC. TCSPF-T-FG03 REV.—, 9-20-99
TCSPF-T-UD06 REV.—, 9-20-99

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14. New [X]
Newly Overhauled [ ]

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special reqirements of the importing country have been met.

19. **Return to Service in Accordance with FAR 43.9**

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	DARF351003NM		
17. Name *(Typed or Printed)*:	**18. Date:**	**22. Name *(Typed or Printed)***	**23. Date:**
WING C. CHIN			

FAA Form 8130-3 (11-93)

* (Optional) Installer must cross check eligibility with applicable technical data.

FAA Form 8130-3
Airworthiness Approval Tag
for

FGF7781-07I
Style 7781/#2510
Fiberglass 8-Harness Woven Fabric Prepreg

Specimens

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. No. # 1 FAA Project No. TC1616SE-15 Dated: 10/1/99

4. Organization
Toray Composites (America), Inc.
19002 50th Ave. N.E.
Tacoma, WA 98446

5. Work Order, Contract, or Invoice Number:

6. Item	7. Description	8. Part Number	9. Eligibilty*	10. Quantity	11. Serial/Batch Number	12. Status/Work
1	0° (Warp) Tension, Oven A	AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composites Material Systems, Section 4.5.1 and Section 4.5.3, Table 4.3 and Table 4.6, respectively	Model LC40-550FG	20	AF991102 A-1-911-081-1-1 to 1-10 & A-2-911-081-1-1 to 1-10	Test Specimens
2	0° (Warp) Tension, Oven B			20	AF991102 B-1-911-081-1-1 to 1-10 & B-2-911-081-1-1 to 1-10	Test Specimens

13. Remarks Conformity Inspection in support of FAA Project No. TC1616SE-15, dated 10/1/99

Item	Batch	Specimen Type	-65°F (Dry)	RT (Dry)	180°F (Dry)	180°F (Wet)	Fluid Sensitivity	Spare	Total	
1	AF991102	0° (Warp) Tension, Oven A								Ref. Doc.: AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems, Section 4.5.1, Table 4.3
		Ult. Strength & Modulus	2	2	2	2	-	8	20	
		Ult. Strength only	1	1	1	1	-			
2	AF991102	0° (Warp) Tension, Oven B								
		Ult. Strength & Modulus	2	2	2	2	-	8	20	
		Ult. Strength only	1	1	1	1	-			

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
New Overhauled ☐

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special requirements of the importing country have been met.

19.
Return to Service in Accordance with FAR 43.9

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	DAREF351003NM		
17. Name (*Typed or Printed*): Wing C. Chin	18. Date 2-8-00	22. Name (*Typed or Printed*):	23. Date

FAA Form 8130-3 (11-93)

* (Optional) Installer must cross check eligibility with applicable technical data.

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. No. # 2 FAA Project No. TC1616SE-15 Dated: 10/1/99

4. Organization
Toray Composites (America), Inc.
19002 50th Ave. N.E.
Tacoma, WA 98446

5. Work Order, Contract, or Invoice Number:

6. Item	7. Description	8. Part Number	9. Eligibilty*	10. Quantity	11. Serial/Batch Number	12. Status/Work
1	90° (Fill) Tension, Oven A	AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composites Material Systems, Section 4.5.1 and Section 4.5.3, Table 4.3 and Table 4.6, respectively	Model LC40-550FG	20	AF991102 A-1-911-081-1-1 to 1-10 & A-2-911-081-1-1 to 1-10	Test Specimens
2	90° (Fill) Tension, Oven B			20	AF991102 B-1-911-081-1-1 to 1-10 & B-2-911-081-1-1 to 1-10	Test Specimens

13. Remarks Conformity Inspection in support of FAA Project No. TC1616SE-15, dated 10/1/99

Item	Batch	Specimen Type	-65°F (Dry)	RT (Dry)	180°F (Dry)	180°F (Wet)	Fluid Sensitivity	Spare	Total	
1	AF991102	90° (Fill) Tension, Oven A								Ref. Doc.: AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems, Section 4.5.1, Table 4.3
		Ult. Strength & Modulus	2	2	2	2	-	8	20	
		Ult. Strength only	1	1	1	1	-			
2	AF991102	90° (Fill) Tension, Oven B								
		Ult. Strength & Modulus	2	2	2	2	-	8	20	
		Ult. Strength only	1	1	1	1	-			

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
New Overhauled ☐

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special requirements of the importing country have been met.

19.
Return to Service in Accordance with FAR 43.9

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	DARF3S100ZNM		
17. Name (*Typed or Printed*):	18. Date	22. Name (*Typed or Printed*):	23. Date
Wing C. Chin	2-8-00		

FAA Form 8130-3 (11-93)

* (Optional) Installer must cross check eligibility with applicable technical data.

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. No. # 3 FAA Project No. TC1616SE-15 Dated: 10/1/99

4. Organization
Toray Composites (America), Inc.
19002 50th Ave. N.E.
Tacoma, WA 98446

5. Work Order, Contract, or Invoice Number:

6. Item	7. Description	8. Part Number	9. Eligibilty*	10. Quantity	11. Serial/Batch Number	12. Status/Work
1	0°(Warp)Comp. Strength, Oven A	AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composites Material Systems, Section 4.5.1 and Section 4.5.3, Table 4.3 and Table 4.6, respectively	Model LC40-550FG	16	AF991102 A-1-911-081-1-9 to 1-16 & A-2-911-081-1-17 to 1-24	Test Specimens
2	0°(Warp)Comp. Strength, Oven B			16	AF991102 B-1-911-081-1-9 to 1-16 & B-2-911-081-1-17 to 1-24	Test Specimens

13. Remarks Conformity Inspection in support of FAA Project No. TC1616SE-15, dated 10/1/99

Item	Batch	Specimen Type	-65°F (Dry)	RT (Dry)	180°F (Dry)	180°F (Wet)	Fluid Sensitivity	Spare	Total	
1	AF991102	0° (Warp) Comp. Strength, Oven A	3	3	3	-	-	7	16	Ref. Doc.: AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems, Section 4.5.1, Table 4.3
2	AF991102	0° (Warp) Comp. Strength, Oven B	3	3	3	-	-	7	16	

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
New Overhauled ☐

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special requirements of the importing country have been met.

19.
Return to Service in Accordance with FAR 43.9

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	DARF351003104		
17. Name *(Typed or Printed)*: Wing C. Chin	18. Date 2-23-2000	22. Name *(Typed or Printed)*:	23. Date

FAA Form 8130-3 (11-93)

* (Optional) Installer must cross check eligibility with applicable technical data.

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. No. # 3A FAA Project No. TC1616SE-15 Dated: 10/1/99

4. Organization
Toray Composites (America), Inc.
19002 50th Ave. N.E.
Tacoma, WA 98446

5. Work Order, Contract, or Invoice Number:

6. Item	7. Description	8. Part Number	9. Eligibilty*	10. Quantity	11. Serial/Batch Number	12. Status/Work
1	0°(Warp)Comp. Strength, Oven A	AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composites Material Systems, Section 4.5.1 and Section 4.5.3, Table 4.3 and Table 4.6, respectively	Model LC40-550FG	8	AF991102 A-1-911-081-1-1 to 1-8	Test Specimens
2	0°(Warp)Comp. Strength, Oven B			9	AF991102 B-1-911-081-1-1 to 1-9	Test Specimens

13. Remarks Conformity Inspection in support of FAA Project No. TC1616SE-15, dated 10/1/99

Item	Batch	Specimen Type	-65°F (Dry)	RT (Dry)	180°F (Dry)	180°F (Wet)	Fluid Sensitivity	Spare	Total	
1	AF991102	0° (Warp) Comp. Strength, Oven A				3		5	8	Ref. Doc.: AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems, Section 4.5.1, Table 4.3
2	AF991102	0° (Warp) Comp. Strength, Oven B				3		6	9	

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
New Overhauled ☐

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special requirements of the importing country have been met.

19.
Return to Service in Accordance with FAR 43.9

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	DAREF351003NM		
17. Name *(Typed or Printed)*:	18. Date	22. Name *(Typed or Printed)*:	23. Date
Wing C. Chin	4-14-2000		

FAA Form 8130-3 (11-93)

* (Optional) Installer must cross check eligibility with applicable technical data.

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. No # 3B FAA Project No. TC1616SE-15 Dated: 10/1/99

4. Organization
Toray Composites (America), Inc.
19002 50th Ave. N.E.
Tacoma, WA 98446

5. Work Order, Contract, or Invoice Number:

6. Item	7. Description	8. Part Number	9. Eligibilty*	10. Quantity	11. Serial/Batch Number	12. Status/Work
1	0°(Warp)Comp. Strength, Oven A	AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composites Material Systems, Section 4.5.1 and Section 4.5.3, Table 4.3 and Table 4.6, respectively	Model LC40-550FG	8 (AF163) 8 (EA9696)	AF991102 A-1-911-081-1-1 to 1-8 A-1-911-081-1-1 to 1-8	Test Specimens Test Specimens
2	0°(Warp)Comp. Strength, Oven B			8 (AF163) 8 (EA9696)	AF991102 B-1-911-081-1-1 to 1-8 B-1-911-081-1-1 to 1-8	Test Specimens Test Specimens

13. Remarks Conformity Inspection in support of FAA Project No. TC1616SE-15, dated 10/1/99

Item	Batch	Specimen Type	-65°F (Dry)	RT (Dry)	180°F (Dry)	180°F (Wet)	Fluid Sensitivity	Spare	Total	
1	AF991102	0° (Warp) Comp. Strength, Oven A	5	-	-	-	-	3	8	Ref. Doc.: AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems, Section 4.5.1, Table 4.3
2	AF991102	0° (Warp) Comp. Strength, Oven A		-	-	-	-	8	8	
3	AF991102	0° (Warp) Comp. Strength, Oven B	5	-	-	-	-	3	8	
4	AF991102	0° (Warp) Comp. Strength, Oven B		-	-	-	-	8	8	

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
New Overhauled ☐

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special requirements of the importing country have been met.

19.
Return to Service in Accordance with FAR 43.9

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	DARF351003NM		
17. Name *(Typed or Printed)*: Wing C. Chin	18. Date 4-21-2000	22. Name *(Typed or Printed)*:	23. Date

FAA Form 8130-3 (11-93)

* (Optional) Installer must cross check eligibility with applicable technical data.

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. No. # 4 FAA Project No. TC1616SE-15 Dated: 10/1/99

4. Organization	5. Work Order, Contract, or Invoice Number:
Toray Composites (America), Inc. 19002 50th Ave. N.E. Tacoma, WA 98446	

6. Item	7. Description	8. Part Number	9. Eligibilty*	10. Quantity	11. Serial/Batch Number	12. Status/Work
1	90°(Fill)Comp. Strength, Oven A	AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composites Material Systems, Section 4.5.1 and Section 4.5.3, Table 4.3 and Table 4.6, respectively	Model LC40-550FG	16	AF991102 A-1-911-081-1-9 to 1-16 & A-2-911-081-1-17 to 1-24	Test Specimens
2	90°(Fill)Comp. Strength, Oven B			16	AF991102 B-1-911-081-1-9 to 1-16 & B-2-911-081-1-17 to 1-24	Test Specimens

13. Remarks Conformity Inspection in support of FAA Project No. TC1616SE-15, dated 10/1/99

Item	Batch	Specimen Type	-65°F (Dry)	RT (Dry)	180°F (Dry)	180°F (Wet)	Fluid Sensitivity	Spare	Total	
1	AF991102	90° (Fill) Comp. Strength, Oven A	3	3	3	-	-	7	16	Ref. Doc.: AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems, Section 4.5.1, Table 4.3
2	AF991102	90° (Fill) Comp. Strength, Oven B	3	3	3	-	-	7	16	

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
New Overhauled ☐

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special requirements of the importing country have been met.

19.
Return to Service in Accordance with FAR 43.9

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	DAREF351003NM		
17. Name (*Typed or Printed*):	**18. Date**	**22. Name (*Typed or Printed*):**	**23. Date**
Wing C. Chin	2-8-00		

FAA Form 8130-3 (11-93)

* (Optional) Installer must cross check eligibility with applicable technical data.

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. No. # 4A FAA Project No. TC1616SE-15 Dated: 10/1/99

4. Organization
Toray Composites (America), Inc.
19002 50th Ave. N.E.
Tacoma, WA 98446

5. Work Order, Contract, or Invoice Number:

6. Item	7. Description	8. Part Number	9. Eligibilty*	10. Quantity	11. Serial/Batch Number	12. Status/Work
1	90°(Fill)Comp. Strength, Oven A	AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composites Material Systems, Section 4.5.1 and Section 4.5.3, Table 4.3 and Table 4.6, respectively	Model LC40-550FG	9	AF991102 A-1-911-081-1-1 to 1-9	Test Specimens
2	90°(Fill)Comp. Strength, Oven B			8	AF991102 B-1-911-081-1-1 to 1-9	Test Specimens

13. Remarks Conformity Inspection in support of FAA Project No. TC1616SE-15, dated 10/1/99

Item	Batch	Specimen Type	-65°F (Dry)	RT (Dry)	180°F (Dry)	180°F (Wet)	Fluid Sensitivity	Spare	Total	
1	AF991102	90° (Fill) Comp. Strength, Oven A				3		6	9	Ref. Doc.: AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems, Section 4.5.1, Table 4.3
2	AF991102	90° (Fill) Comp. Strength, Oven B				3		5	8	

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
New Overhauled ☐

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special requirements of the importing country have been met.

19.
Return to Service in Accordance with FAR 43.9

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	DARF351003NM		
17. Name (*Typed or Printed*): Wing C. Chin	18. Date 4-14-2000	22. Name (*Typed or Printed*):	23. Date

FAA Form 8130-3 (11-93)

* (Optional) Installer must cross check eligibility with applicable technical data.

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. No. # 4B FAA Project No. TC1616SE-15 Dated: 10/1/99

4. Organization
Toray Composites (America), Inc.
19002 50th Ave. N.E.
Tacoma, WA 98446

5. Work Order, Contract, or Invoice Number:

6. Item	7. Description	8. Part Number	9. Eligibilty*	10. Quantity	11. Serial/Batch Number	12. Status/Work
1	90°(Fill)Comp. Strength, Oven A	AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composites Material Systems, Section 4.5.1 and Section 4.5.3, Table 4.3 and Table 4.6, respectively	Model LC40-550FG	8 (AF163)	AF991102 A-1-911-081-1-1 to 1-8	Test Specimens
2	90°(Fill)Comp. Strength, Oven A			8 (EA9696)	A-1-911-081-1-1 to 1-8	Test Specimens
3	90°(Fill)Comp. Strength, Oven B			8 (AF163)	AF991102 B-1-911-081-1-1 to 1-8	Test Specimens
4	90°(Fill)Comp. Strength, Oven B			8 (EA9696)	B-2-911-081-1-1 to 1-8	Test Specimens

13. Remarks Conformity Inspection in support of FAA Project No. TC1616SE-15, dated 10/1/99

Item	Batch	Specimen Type	-65°F (Dry)	RT (Dry)	180°F (Dry)	180°F (Wet)	Fluid Sensitivity	Spare	Total	
1	AF991102	90° (Fill) Comp. Strength, Oven A	5	-	-	-	-	3	8	Ref. Doc.: AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems, Section 4.5.1, Table 4.3
2	AF991102	90° (Fill) Comp. Strength, Oven A		-	-	-	-	5	8	
3	AF991102	90° (Fill) Comp. Strength, Oven B	5	-	-	-	-	3	8	
4	AF991102	90° (Fill) Comp. Strength, Oven B		-	-	-	-	5	8	

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
New Overhauled ☐

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special requirements of the importing country have been met.

19.
Return to Service in Accordance with FAR 43.9

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	DNF351003WR		
17. Name (*Typed or Printed*):	**18. Date**	**22. Name (*Typed or Printed*):**	**23. Date**
Wing C. Chin	4-21-2000		

FAA Form 8130-3 (11-93)

* (Optional) Installer must cross check eligibility with applicable technical data.

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. No. # 5 FAA Project No. TC1616SE-15 Dated: 10/1/99

4. Organization
Toray Composites (America), Inc.
19002 50th Ave. N.E.
Tacoma, WA 98446

5. Work Order, Contract, or Invoice Number:

6. Item	7. Description	8. Part Number	9. Eligibilty*	10. Quantity	11. Serial/Batch Number	12. Status/Work
1	0°(Warp)Comp. Modulus, Oven A	AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composites Material Systems, Section 4.5.1 and Section 4.5.3, Table 4.3 and Table 4.6, respectively	Model LC40-550FG	12	AF991102 A-2-911-081-1-1 to 1-12	Test Specimens
2	0°(Warp)Comp. Modulus, Oven B			12	AF991102 B-2-911-081-1-1 to 1-12	Test Specimens
3	90°(Fill)Comp. Modulus, Oven A			12	AF991102 A-2-911-081-1-1 to 1-12	Test Specimens
4	90°(Fill)Comp. Modulus, Oven B			12	AF991102 B-2-911-081-1-1 to 1-12	Test Specimens

13. Remarks Conformity Inspection in support of FAA Project No. TC1616SE-15, dated 10/1/99

Item	Batch	Specimen Type	-65°F (Dry)	RT (Dry)	180°F (Dry)	180°F (Wet)	Fluid Sensitivity	Spare	Total	
1	AF991102	0° (Warp)Comp. Modulus, Oven A	1	1	1	1	-	8	12	Ref. Doc.: AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems, Section 4.5.1, Table 4.3
2	AF991102	0° (Warp) Comp. Modulus, Oven B	1	1	1	1	-	8	12	
3	AF991102	90° (Fill) Comp. Modulus, Oven A	1	1	1	1	-	8	12	
4	AF991102	90° (Fill) Comp. Modulus, Oven B	1	1	1	1	-	8	12	

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
New Overhauled ☐

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special requirements of the importing country have been met.

19.
Return to Service in Accordance with FAR 43.9

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	DAREF351003NM		
17. Name (*Typed or Printed*): Wing C. Chin	18. Date 2-8-00	22. Name (*Typed or Printed*):	23. Date

FAA Form 8130-3 (11-93)

* (Optional) Installer must cross check eligibility with applicable technical data.

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. No. # 6 FAA Project No. TC1616SE-15 Dated: 10/1/99

4. Organization
Toray Composites (America), Inc.
19002 50th Ave. N.E.
Tacoma, WA 98446

5. Work Order, Contract, or Invoice Number:

6. Item	7. Description	8. Part Number	9. Eligibilty*	10. Quantity	11. Serial/Batch Number	12. Status/Work
1	In-plane Shear (Iosipescu), Oven A	AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composites Material Systems, Section 4.5.1 and Section 4.5.3, Table 4.3 and Table 4.6, respectively	Model LC40-550FG	33	AF991102 A-1-911-081-1-1 to 3-11	Test Specimens
2	In-plane Shear (Iosipescu), Oven B			33	AF991102 B-1-911-081-1-1 to 3-11	Test Specimens

13. Remarks: Conformity Inspection in support of FAA Project No. TC1616SE-15, dated 10/1/99

Item	Batch	Specimen Type	-65°F (Dry)	RT (Dry)	180°F (Dry)	180°F (Wet)	Fluid Sensitivity	Spare	Total	
1	AF991102	In-plane Shear (Iosipescu), Oven A								Ref. Doc.: AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems, Section 4.5.1, Table 4.3
		Ult. Strength & Modulus	2	2	2	2	-	13	33	
		Ult. Strength only	1	1	1	1	8			
2	AF991102	In-plane Shear (Iosipescu), Oven B								
		Ult. Strength & Modulus	2	2	2	2	-	13	33	
		Ult. Strength only	1	1	1	1	8			

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
New Overhauled ☐

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special requirements of the importing country have been met.

19.
Return to Service in Accordance with FAR 43.9

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	DARF351003N15		
17. Name *(Typed or Printed)*: Wing C. Chin	18. Date 2-8-00	22. Name *(Typed or Printed)*:	23. Date

FAA Form 8130-3 (11-93)

* (Optional) Installer must cross check eligibility with applicable technical data.

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. No. # 7 FAA Project No. TC1616SE-15 Dated: 10/1/99

4. Organization
Toray Composites (America), Inc.
19002 50th Ave. N.E.
Tacoma, WA 98446

5. Work Order, Contract, or Invoice Number:

6. Item	7. Description	8. Part Number	9. Eligibilty*	10. Quantity	11. Serial/Batch Number	12. Status/Work
1	0° (Warp) ILSS, Oven A	AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composites Material Systems, Section 4.5.1 and Section 4.5.3, Table 4.3 and Table 4.6, respectively	Model LC40-550FG	6	AF991102 A-1-911-081-1-1 to 1-6	Test Specimens
2	0° (Warp) ILSS, Oven B			6	AF991102 B-1-911-081-1-1 to 1-6	Test Specimens

13. Remarks Conformity Inspection in support of FAA Project No. TC1616SE-15, dated 10/1/99

Item	Batch	Specimen Type	-65°F (Dry)	RT (Dry)	180°F (Dry)	180°F (Wet)	Fluid Sensitivity	Spare	Total	
1	AF991102	0° (Warp) ILSS, Oven A	-	3	-	-	-	3	6	Ref. Doc.: AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems, Section 4.5.1, Table 4.3
2	AF991102	0° (Warp) ILSS, Oven B	-	3	-	-	-	3	6	

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
New Overhauled ☐

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special requirements of the importing country have been met.

19.
Return to Service in Accordance with FAR 43.9

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15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	DAE351003NM		
17. Name *(Typed or Printed)*: Wing C. Chin	18. Date 2-8-00	22. Name *(Typed or Printed)*:	23. Date

FAA Form 8130-3 (11-93)

* (Optional) Installer must cross check eligibility with applicable technical data.

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. No. # 8 FAA Project No. TC1616SE-15 Dated: 10/1/99

4. Organization
Toray Composites (America), Inc.
19002 50th Ave. N.E.
Tacoma, WA 98446

5. Work Order, Contract, or Invoice Number:

6. Item	7. Description	8. Part Number	9. Eligibilty*	10. Quantity	11. Serial/Batch Number	12. Status/Work
1	0° (Warp) Tension, Oven A	AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composites Material Systems, Section 4.5.1 and Section 4.5.3, Table 4.3 and Table 4.6, respectively	Model LC40-550FG	20	AF991103 A-1-911-082-1-1 to 1-10 & A-2-911-082-1-1 to 1-10	Test Specimens
2	0° (Warp) Tension, Oven B			20	AF991103 B-1-911-082-1-1 to 1-10 & B-2-911-082-1-1 to 1-10	Test Specimens

13. Remarks Conformity Inspection in support of FAA Project No. TC1616SE-15, dated 10/1/99

Item	Batch	Specimen Type	-65°F (Dry)	RT (Dry)	180°F (Dry)	180°F (Wet)	Fluid Sensitivity	Spare	Total	
1	AF991103	0° (Warp) Tension, Oven A								Ref. Doc.: AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems, Section 4.5.1, Table 4.3
		Ult. Strength & Modulus	-	2	2	2	-	11	20	
		Ult. Strength only	-	1	1	1	-			
2	AF991103	0° (Warp) Tension, Oven B								
		Ult. Strength & Modulus	-	2	2	2	-	11	20	
		Ult. Strength only	-	1	1	1	-			

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
New Overhauled ☐

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

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Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	DARF351003NM		
17. Name (*Typed or Printed*): Wing C. Chin	18. Date 2-8-00	22. Name (*Typed or Printed*):	23. Date

FAA Form 8130-3 (11-93)

* (Optional) Installer must cross check eligibility with applicable technical data.

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. No. # 9 FAA Project No. TC1616SE-15 Dated: 10/1/99

4. Organization
Toray Composites (America), Inc.
19002 50th Ave. N.E.
Tacoma, WA 98446

5. Work Order, Contract, or Invoice Number:

6. Item	7. Description	8. Part Number	9. Eligibilty*	10. Quantity	11. Serial/Batch Number	12. Status/Work
1	90° (Fill) Tension, Oven A	AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composites Material Systems, Section 4.5.1 and Section 4.5.3, Table 4.3 and Table 4.6, respectively	Model LC40-550FG	20	AF991103 A-1-911-082-1-1 to 1-10 & A-2-911-082-1-1 to 1-10	Test Specimens
2	90° (Fill) Tension, Oven B			20	AF991103 B-1-911-082-1-1 to 1-10 & B-2-911-081-1-1 to 1-10	Test Specimens

13. Remarks Conformity Inspection in support of FAA Project No. TC1616SE-15, dated 10/1/99

Item	Batch	Specimen Type	-65°F (Dry)	RT (Dry)	180°F (Dry)	180°F (Wet)	Fluid Sensitivity	Spare	Total	
1	AF991103	90° (Fill) Tension, Oven A								Ref. Doc.: AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems, Section 4.5.1, Table 4.3
		Ult. Strength & Modulus	-	2	2	2	-	11	20	
		Ult. Strength only	-	1	1	1	-			
2	AF991103	90° (Fill) Tension, Oven B								
		Ult. Strength & Modulus	-	2	2	2	-	11	20	
		Ult. Strength only	-	1	1	1	-			

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
New Overhauled ☐

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special requirements of the importing country have been met.

19.
Return to Service in Accordance with FAR 43.9

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	DAR F351003N M		
17. Name (*Typed or Printed*): Wing C. Chin	18. Date 2-8-00	22. Name (*Typed or Printed*):	23. Date

FAA Form 8130-3 (11-93)

* (Optional) Installer must cross check eligibility with applicable technical data.

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. No. #10 FAA Project No. TC1616SE-15 Dated: 10/1/99

4. Organization
Toray Composites (America), Inc.
19002 50th Ave. N.E.
Tacoma, WA 98446

5. Work Order, Contract, or Invoice Number:

6. Item	7. Description	8. Part Number	9. Eligibilty*	10. Quantity	11. Serial/Batch Number	12. Status/Work
1	0°(Warp)Comp. Strength, Oven A	AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composites Material Systems, Section 4.5.1 and Section 4.5.3, Table 4.3 and Table 4.6, respectively	Model LC40-550FG	16	AF991103 A-1-911-082-1-9 to 1-16 & A-2-911-082-1-17 to 1-24	Test Specimens
2	0°(Warp)Comp. Strength, Oven B			16	AF991103 B-1-911-082-1-9 to 1-16 & B-2-911-082-1-17 to 1-24	Test Specimens

13. Remarks Conformity Inspection in support of FAA Project No. TC1616SE-15, dated 10/1/99

Item	Batch	Specimen Type	-65°F (Dry)	RT (Dry)	180°F (Dry)	180°F (Wet)	Fluid Sensitivity	Spare	Total	
1	AF991103	0° (Warp) Comp. Strength, Oven A	-	3	3	-	-	10	16	Ref. Doc.: AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems, Section 4.5.1, Table 4.3
2	AF991103	0° (Warp) Comp. Strength, Oven B	-	3	3	-	-	10	16	

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
New Overhauled ☐

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Return to Service in Accordance with FAR 43.9

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	DAKF351003NM		
17. Name *(Typed or Printed)*: Wing C. Chin	18. Date 2-23-2000	22. Name *(Typed or Printed)*:	23. Date

FAA Form 8130-3 (11-93)

* (Optional) Installer must cross check eligibility with applicable technical data.

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. No. # 10A FAA Project No. TC1616SE-15 Dated: 10/1/99

4. Organization	5. Work Order, Contract, or Invoice Number:
Toray Composites (America), Inc. 19002 50th Ave. N.E. Tacoma, WA 98446	

6. Item	7. Description	8. Part Number	9. Eligibilty*	10. Quantity	11. Serial/Batch Number	12. Status/Work
1	0°(Warp)Comp. Strength, Oven A	AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composites Material Systems, Section 4.5.1 and Section 4.5.3, Table 4.3 and Table 4.6, respectively	Model LC40-550FG	9	AF991103 A-1-911-082-1-1 to 1-9	Test Specimens
2	0°(Warp)Comp. Strength, Oven B			9	AF991103 B-1-911-082-1-1 to 1-9	Test Specimens

13. Remarks Conformity Inspection in support of FAA Project No. TC1616SE-15, dated 10/1/99

Item	Batch	Specimen Type	-65°F (Dry)	RT (Dry)	180°F (Dry)	180°F (Wet)	Fluid Sensitivity	Spare	Total	
1	AF991103	0° (Warp) Comp. Strength, Oven A				3		6	9	Ref. Doc.: AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems, Section 4.5.1, Table 4.3
2	AF991103	0° (Warp) Comp. Strength, Oven B				3		6	9	

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
New Overhauled ☐

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special requirements of the importing country have been met.

19.
Return to Service in Accordance with FAR 43.9

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	DARF351003NM		
17. Name *(Typed or Printed)*: Wing C. Chin	18. Date 4-14-2000	22. Name *(Typed or Printed)*:	23. Date

FAA Form 8130-3 (11-93)

* (Optional) Installer must cross check eligibility with applicable technical data.

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. No. # 10B FAA Project No. TC1616SE-15 Dated: 10/1/99

4. Organization
Toray Composites (America), Inc.
19002 50th Ave. N.E.
Tacoma, WA 98446

5. Work Order, Contract, or Invoice Number:

6. Item	7. Description	8. Part Number	9. Eligibilty*	10. Quantity	11. Serial/Batch Number	12. Status/Work
1	90° Comp. Str, A1	AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composites Material Systems, Section 4.5.1 and Section 4.5.3, Table 4.3 and Table 4.6, respectively	Model LC40-550FG	15	AF991103 A-1-911-082-1-1 to 1-15	Test Specimens
2	90° Comp. Str, A2			14	AF991103 A-2-911-082-1-1 to 1-14	Test Specimens

13. Remarks Conformity Inspection in support of FAA Project No. TC1416RC-R, dated 7/18/97

Item	Batch	Specimen Type	-65°F (Dry)	RT (Dry)	180°F (Dry)	180°F (Wet)	Spare	Total	
1	AF991103	90° Comp. Str, A1	3	-	-	3	9	15	Ref. Doc.: AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems, Section 4.5.1, Table 4.3
2	AF991103	90° Comp. Str, A2	-	-	-	-	14	14	

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
New Overhauled ☐

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special requirements of the importing country have been met.

19.
Return to Service in Accordance with FAR 43.9

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	DAREZS105310W		
17. Name (*Typed or Printed*): Wing C. Chin	18. Date 8-24-2000	22. Name (*Typed or Printed*):	23. Date

FAA Form 8130-3 (11-93)

* (Optional) Installer must cross check eligibility with applicable technical data.

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. No. # 11 FAA Project No. TC1616SE-15 Dated: 10/1/99

4. Organization	5. Work Order, Contract, or Invoice Number:
Toray Composites (America), Inc. 19002 50th Ave. N.E. Tacoma, WA 98446	

6. Item	7. Description	8. Part Number	9. Eligibilty*	10. Quantity	11. Serial/Batch Number	12. Status/Work
1	90°(Fill)Comp. Strength, Oven A	AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composites Material Systems, Section 4.5.1 and Section 4.5.3, Table 4.3 and Table 4.6, respectively	Model LC40-550FG	16	AF991103 A-1-911-082-1-9 to 1-16 & A-2-911-082-1-17 to 1-24	Test Specimens
2	90°(Fill)Comp. Strength, Oven B			16	AF991103 B-1-911-082-1-9 to 1-16 & B-1-911-082-1-17 to 1-24	Test Specimens

13. Remarks Conformity Inspection in support of FAA Project No. TC1616SE-15, dated 10/1/99

Item	Batch	Specimen Type	-65°F (Dry)	RT (Dry)	180°F (Dry)	180°F (Wet)	Fluid Sensitivity	Spare	Total	
1	AF991103	90° (Fill) Comp. Strength, Oven A	-	3	3	-	-	10	16	Ref. Doc.: AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems, Section 4.5.1, Table 4.3
2	AF991103	90° (Fill) Comp. Strength, Oven B	-	3	3	-	-	10	16	

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
New Overhauled ☐

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special requirements of the importing country have been met.

19.
Return to Service in Accordance with FAR 43.9

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	DAREB51003NM		
17. Name *(Typed or Printed)*: Wing C. Chin	18. Date 2-8-00	22. Name *(Typed or Printed)*:	23. Date

FAA Form 8130-3 (11-93)

* (Optional) Installer must cross check eligibility with applicable technical data.

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. No. # 11A FAA Project No. TC1616SE-15 Dated: 10/1/99

4. Organization	5. Work Order, Contract, or Invoice Number:
Toray Composites (America), Inc. 19002 50th Ave. N.E. Tacoma, WA 98446	

6. Item	7. Description	8. Part Number	9. Eligibilty*	10. Quantity	11. Serial/Batch Number	12. Status/Work
1	90°(Fill)Comp. Strength, Oven A	AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composites Material Systems, Section 4.5.1 and Section 4.5.3, Table 4.3 and Table 4.6, respectively	Model LC40-550FG	9	AF991103 A-1-911-082-1-1 to 1-9	Test Specimens
2	90°(Fill)Comp. Strength, Oven B			9	AF991103 B-1-911-082-1-1 to 1-9	Test Specimens

13. Remarks Conformity Inspection in support of FAA Project No. TC1616SE-15, dated 10/1/99

Item	Batch	Specimen Type	-65°F (Dry)	RT (Dry)	180°F (Dry)	180°F (Wet)	Fluid Sensitivity	Spare	Total	
1	AF991103	90° (Fill) Comp. Strength, Oven A				3		6	9	Ref. Doc.: AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems, Section 4.5.1, Table 4.3
2	AF991103	90° (Fill) Comp. Strength, Oven B				3		6	9	

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
New Overhauled ☐

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special requirements of the importing country have been met.

19.
Return to Service in Accordance with FAR 43.9

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	DARF351003NM		
17. Name (*Typed or Printed*):	18. Date	22. Name (*Typed or Printed*):	23. Date
Wing C. Chin	4-14-2000		

FAA Form 8130-3 (11-93)

* (Optional) Installer must cross check eligibility with applicable technical data.

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. No. # 12 FAA Project No. TC1616SE-15 Dated: 10/1/99

4. Organization
Toray Composites (America), Inc.
19002 50th Ave. N.E.
Tacoma, WA 98446

5. Work Order, Contract, or Invoice Number:

6. Item	7. Description	8. Part Number	9. Eligibilty*	10. Quantity	11. Serial/Batch Number	12. Status/Work
1	0°(Warp)Comp. Modulus, Oven A	AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composites Material Systems, Section 4.5.1 and Section 4.5.3, Table 4.3 and Table 4.6, respectively	Model LC40-550FG	12	AF991103 A-2-911-082-1-1 to 1-12	Test Specimens
2	0°(Warp)Comp. Modulus, Oven B			12	AF991103 B-2-911-082-1-1 to 1-12	Test Specimens
3	90°(Fill)Comp. Modulus, Oven A			12	AF991103 A-2-911-082-1-1 to 1-12	Test Specimens
4	90°(Fill)Comp. Modulus, Oven B			12	AF991103 B-2-911-082-1-1 to 1-12	Test Specimens

13. Remarks Conformity Inspection in support of FAA Project No. TC1616SE-15, dated 10/1/99

Item	Batch	Specimen Type	-65°F (Dry)	RT (Dry)	180°F (Dry)	180°F (Wet)	Fluid Sensitivity	Spare	Total	
1	AF991103	0° (Warp)Comp. Modulus, Oven A	-	1	1	1	-	9	12	Ref. Doc.: AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems, Section 4.5.1, Table 4.3
2	AF991103	0° (Warp) Comp. Modulus, Oven B	-	1	1	1	-	9	12	
3	AF991103	90° (Fill) Comp. Modulus, Oven A	-	1	1	1	-	9	12	
4	AF991103	90° (Fill) Comp. Modulus, Oven B	-	1	1	1	-	9	12	

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
New Overhauled ☐

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special requirements of the importing country have been met.

19.
Return to Service in Accordance with FAR 43.9

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	DAEF351003NM		
17. Name (*Typed or Printed*): Wing C. Chin	18. Date 2-8-00	22. Name (*Typed or Printed*):	23. Date

FAA Form 8130-3 (11-93)

* (Optional) Installer must cross check eligibility with applicable technical data.

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. No. # 13 FAA Project No. TC1616SE-15 Dated: 10/1/99

4. Organization
Toray Composites (America), Inc.
19002 50th Ave. N.E.
Tacoma, WA 98446

5. Work Order, Contract, or Invoice Number:

6. Item	7. Description	8. Part Number	9. Eligibilty*	10. Quantity	11. Serial/Batch Number	12. Status/Work
1	In-plane Shear (Iosipescu), Oven A	AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composites Material Systems, Section 4.5.1 and Section 4.5.3, Table 4.3 and Table 4.6, respectively	Model LC40-550FG	33	AF991103 A-1-911-082-1-1 to 3-11	Test Specimens
2	In-plane Shear (Iosipescu), Oven B			33	AF991103 B-1-911-082-1-1 to 3-11	Test Specimens

13. Remarks Conformity Inspection in support of FAA Project No. TC1616SE-15, dated 10/1/99

Item	Batch	Specimen Type	-65°F (Dry)	RT (Dry)	180°F (Dry)	180°F (Wet)	Fluid Sensitivity	Spare	Total	
1	AF991103	In-plane Shear (Iosipescu), Oven A								Ref. Doc.: AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems, Section 4.5.1, Table 4.3
		Ult. Strength & Modulus	-	2	2	2	-	24	33	
		Ult. Strength only	-	1	1	1	-			
2	AF991103	In-plane Shear (Iosipescu), Oven B								
		Ult. Strength & Modulus	-	2	2	2	-	24	33	
		Ult. Strength only	-	1	1	1	-			

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
New Overhauled ☐

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special requirements of the importing country have been met.

19.
Return to Service in Accordance with FAR 43.9

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	DXRE351003NM		
17. Name *(Typed or Printed)*: Wing C. Chin	18. Date 2-8-00	22. Name *(Typed or Printed)*:	23. Date

FAA Form 8130-3 (11-93)

* (Optional) Installer must cross check eligibility with applicable technical data.

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. No. # 14 FAA Project No. TC1616SE-15 Dated: 10/1/99

4. Organization
Toray Composites (America), Inc.
19002 50th Ave. N.E.
Tacoma, WA 98446

5. Work Order, Contract, or Invoice Number:

6. Item	7. Description	8. Part Number	9. Eligibilty*	10. Quantity	11. Serial/Batch Number	12. Status/Work
1	0° (Warp) ILSS, Oven A	AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composites Material Systems, Section 4.5.1 and Section 4.5.3, Table 4.3 and Table 4.6, respectively	Model LC40-550FG	6	AF991103 A-1-911-082-1-1 to 1-6	Test Specimens
2	0° (Warp) ILSS, Oven B			6	AF991103 B-1-911-082-1-1 to 1-6	Test Specimens

13. Remarks: Conformity Inspection in support of FAA Project No. TC1616SE-15, dated 10/1/99

Item	Batch	Specimen Type	-65°F (Dry)	RT (Dry)	180°F (Dry)	180°F (Wet)	Fluid Sensitivity	Spare	Total
1	AF991103	0° (Warp) ILSS, Oven A	-	3	-	-	-	3	6
2	AF991103	0° (Warp) ILSS, Oven B	-	3	-	-	-	3	6

Ref. Doc.: AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems, Section 4.5.1, Table 4.3

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
New Overhauled ☐

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special requirements of the importing country have been met.

19.
Return to Service in Accordance with FAR 43.9

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	DARF351003N M		
17. Name (*Typed or Printed*): Wing C. Chin	18. Date 2-8-00	22. Name (*Typed or Printed*):	23. Date

FAA Form 8130-3 (11-93)

* (Optional) Installer must cross check eligibility with applicable technical data.

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. No. # 15 FAA Project No. TC1616SE-15 Dated: 10/1/99

4. Organization
Toray Composites (America), Inc.
19002 50th Ave. N.E.
Tacoma, WA 98446

5. Work Order, Contract, or Invoice Number:

6. Item	7. Description	8. Part Number	9. Eligibilty*	10. Quantity	11. Serial/Batch Number	12. Status/Work
1	0° (Warp) Tension, Oven A	AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composites Material Systems, Section 4.5.1 and Section 4.5.3, Table 4.3 and Table 4.6, respectively	Model LC40-550FG	20	AF991104 A-1-911-083-1-1 to 1-10 & A-2-911-083-1-1 to 1-10	Test Specimens
2	0° (Warp) Tension, Oven B			20	AF991104 B-1-911-083-1-1 to 1-10 & B-2-911-083-1-1 to 1-10	Test Specimens

13. Remarks Conformity Inspection in support of FAA Project No. TC1616SE-15, dated 10/1/99

Item	Batch	Specimen Type	-65°F (Dry)	RT (Dry)	180°F (Dry)	180°F (Wet)	Fluid Sensitivity	Spare	Total	
1	AF991104	0° (Warp) Tension, Oven A								Ref. Doc.: AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems, Section 4.5.1, Table 4.3
		Ult. Strength & Modulus	-	2	2	2	-	11	20	
		Ult. Strength only	-	1	1	1	-			
2	AF991104	0° (Warp) Tension, Oven B								
		Ult. Strength & Modulus	-	2	2	2	-	11	20	
		Ult. Strength only	-	1	1	1	-			

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
New Overhauled ☐

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special requirements of the importing country have been met.

19.
Return to Service in Accordance with FAR 43.9

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	DAQF351003N		
17. Name (*Typed or Printed*): Wing C. Chin	18. Date 2-8-00	22. Name (*Typed or Printed*):	23. Date

FAA Form 8130-3 (11-93)

* (Optional) Installer must cross check eligibility with applicable technical data.

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. No. # 16 FAA Project No. TC1616SE-15 Dated: 10/1/99

4. Organization
Toray Composites (America), Inc.
19002 50th Ave. N.E.
Tacoma, WA 98446

5. Work Order, Contract, or Invoice Number:

6. Item	7. Description	8. Part Number	9. Eligibilty*	10. Quantity	11. Serial/Batch Number	12. Status/Work
1	90° (Fill) Tension, Oven A	AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composites Material Systems, Section 4.5.1 and Section 4.5.3, Table 4.3 and Table 4.6, respectively	Model LC40-550FG	20	AF991104 A-1-911-083-1-1 to 1-10 & A-2-911-083-1-1 to 1-10	Test Specimens
2	90° (Fill) Tension, Oven B			20	AF991104 B-1-911-083-1-1 to 1-10 & B-2-911-083-1-1 to 1-10	Test Specimens

13. Remarks Conformity Inspection in support of FAA Project No. TC1616SE-15, dated 10/1/99

Item	Batch	Specimen Type	-65°F (Dry)	RT (Dry)	180°F (Dry)	180°F (Wet)	Fluid Sensitivity	Spare	Total	
1	AF991104	90° (Fill) Tension, Oven A								Ref. Doc.: AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems, Section 4.5.1, Table 4.3
		Ult. Strength & Modulus	-	2	2	2	-	11	20	
		Ult. Strength only	-	1	1	1	-			
2	AF991104	90° (Fill) Tension, Oven B								
		Ult. Strength & Modulus	-	2	2	2	-	11	20	
		Ult. Strength only	-	1	1	1	-			

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
New Overhauled ☐

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special requirements of the importing country have been met.

19.
Return to Service in Accordance with FAR 43.9

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	RAF351003NM		
17. Name (*Typed or Printed*): Wing C. Chin	18. Date 2-8-00	22. Name (*Typed or Printed*):	23. Date

FAA Form 8130-3 (11-93)

* (Optional) Installer must cross check eligibility with applicable technical data.

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. No. #17 FAA Project No. TC1616SE-15 Dated: 10/1/99

4. Organization
Toray Composites (America), Inc.
19002 50th Ave. N.E.
Tacoma, WA 98446

5. Work Order, Contract, or Invoice Number:

6. Item	7. Description	8. Part Number	9. Eligibilty*	10. Quantity	11. Serial/Batch Number	12. Status/Work
1	0°(Warp)Comp. Strength, Oven A	AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composites Material Systems, Section 4.5.1 and Section 4.5.3, Table 4.3 and Table 4.6, respectively	Model LC40-550FG	16	AF991104 A-1-911-083-1-9 to 1-16 & A-2-911-083-1-17 to 1-24	Test Specimens
2	0°(Warp)Comp. Strength, Oven B			16	AF991104 B-1-911-083-1-9 to 1-16 & B-2-911-083-1-17 to 1-24	Test Specimens

13. Remarks Conformity Inspection in support of FAA Project No. TC1616SE-15, dated 10/1/99

Item	Batch	Specimen Type	-65°F (Dry)	RT (Dry)	180°F (Dry)	180°F (Wet)	Fluid Sensitivity	Spare	Total	
1	AF991104	0° (Warp) Comp. Strength, Oven A	-	3	3	-	-	10	16	Ref. Doc.: AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems, Section 4.5.1, Table 4.3
2	AF991104	0° (Warp) Comp. Strength, Oven B	-	3	3	-	-	10	16	

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
New Overhauled ☐

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special requirements of the importing country have been met.

19.
Return to Service in Accordance with FAR 43.9

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	DARF-5100-2		
17. Name *(Typed or Printed)*:	18. Date	22. Name *(Typed or Printed)*:	23. Date
Wing C. Chin	2-23-2000		

FAA Form 8130-3 (11-93)

* (Optional) Installer must cross check eligibility with applicable technical data.

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. No. # 17A FAA Project No. TC1616SE-15 Dated: 10/1/99

4. Organization
Toray Composites (America), Inc.
19002 50th Ave. N.E.
Tacoma, WA 98446

5. Work Order, Contract, or Invoice Number:

6. Item	7. Description	8. Part Number	9. Eligibilty*	10. Quantity	11. Serial/Batch Number	12. Status/Work
1	0°(Warp)Comp. Strength, Oven A	AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composites Material Systems, Section 4.5.1 and Section 4.5.3, Table 4.3 and Table 4.6, respectively	Model LC40-550FG	6	AF991104 A-1-911-083-1-9 to 1-6	Test Specimens
2	0°(Warp)Comp. Strength, Oven B			9 ~~10~~	AF991104 B-1-911-083-1-9 to 1- 10	Test Specimens

13. Remarks Conformity Inspection in support of FAA Project No. TC1616SE-15, dated 10/1/99

Item	Batch	Specimen Type	-65°F (Dry)	RT (Dry)	180°F (Dry)	180°F (Wet)	Fluid Sensitivity	Spare	Total	
1	AF991104	0° (Warp) Comp. Strength, Oven A				3		3	6	Ref. Doc.: AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems, Section 4.5.1, Table 4.3
2	AF991104	0° (Warp) Comp. Strength, Oven B				3		7	10	

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
New Overhauled ☐

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special requirements of the importing country have been met.

19.
Return to Service in Accordance with FAR 43.9

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	DAREF351003NM		
17. Name (*Typed or Printed*): Wing C. Chin	18. Date 4-14-2000	22. Name (*Typed or Printed*):	23. Date

FAA Form 8130-3 (11-93)

* (Optional) Installer must cross check eligibility with applicable technical data.

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. No. # 18 FAA Project No. TC1616SE-15 Dated: 10/1/99

4. Organization
Toray Composites (America), Inc.
19002 50th Ave. N.E.
Tacoma, WA 98446

5. Work Order, Contract, or Invoice Number:

6. Item	7. Description	8. Part Number	9. Eligibilty*	10. Quantity	11. Serial/Batch Number	12. Status/Work
1	90°(Fill)Comp. Strength, Oven A	AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composites Material Systems, Section 4.5.1 and Section 4.5.3, Table 4.3 and Table 4.6, respectively	Model LC40-550FG	16	AF991104 A-1-911-083-1-9 to 1-16 & A-2-911-083-1-17 to 1-24	Test Specimens
2	90°(Fill)Comp. Strength, Oven B			16	AF991104 B-1-911-083-1-9 to 1-16 & B-2-911-083-1-17 to 1-24	Test Specimens

13. Remarks Conformity Inspection in support of FAA Project No. TC1616SE-15, dated 10/1/99

Item	Batch	Specimen Type	-65°F (Dry)	RT (Dry)	180°F (Dry)	180°F (Wet)	Fluid Sensitivity	Spare	Total	
1	AF991104	90° (Fill) Comp. Strength, Oven A	-	3	3	-	-	10	16	Ref. Doc.: AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems, Section 4.5.1, Table 4.3
2	AF991104	90° (Fill) Comp. Strength, Oven B	-	3	3	-	-	10	16	

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
New Overhauled ☐

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special requirements of the importing country have been met.

19.
Return to Service in Accordance with FAR 43.9

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	DAXF356003NWO		
17. Name (*Typed or Printed*): Wing C. Chin	18. Date 2-8-00	22. Name (*Typed or Printed*):	23. Date

FAA Form 8130-3 (11-93)

* (Optional) Installer must cross check eligibility with applicable technical data.

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. No. # 18A FAA Project No. TC1616SE-15 Dated: 10/1/99

4. Organization
Toray Composites (America), Inc.
19002 50th Ave. N.E.
Tacoma, WA 98446

5. Work Order, Contract, or Invoice Number:

6. Item	7. Description	8. Part Number	9. Eligibilty*	10. Quantity	11. Serial/Batch Number	12. Status/Work
1	90°(Fill)Comp. Strength, Oven A	AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composites Material Systems, Section 4.5.1 and Section 4.5.3, Table 4.3 and Table 4.6, respectively	Model LC40-550FG	9 ~~10~~	AF991104 A-1-911-083-1-9 to 1-10	Test Specimens
2	90°(Fill)Comp. Strength, Oven B			9 ~~10~~	AF991104 B-1-911-083-1-9 to 1- 11	Test Specimens

13. Remarks Conformity Inspection in support of FAA Project No. TC1616SE-15, dated 10/1/99

Item	Batch	Specimen Type	-65°F (Dry)	RT (Dry)	180°F (Dry)	180°F (Wet)	Fluid Sensitivity	Spare	Total	
1	AF991104	90° (Fill) Comp. Strength, Oven A				3		7	10	Ref. Doc.: AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems, Section 4.5.1, Table 4.3
2	AF991104	90° (Fill) Comp. Strength, Oven B				3		8	11	

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
New Overhauled ☐

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special requirements of the importing country have been met.

19.
Return to Service in Accordance with FAR 43.9

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	DAQF351003NM		
17. Name *(Typed or Printed)*: Wing C. Chin	**18. Date** 4-14-2000	**22. Name** *(Typed or Printed)*:	**23. Date**

FAA Form 8130-3 (11-93)

* (Optional) Installer must cross check eligibility with applicable technical data.

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. No. # 19 FAA Project No. TC1616SE-15 Dated: 10/1/99

4. Organization
Toray Composites (America), Inc.
19002 50th Ave. N.E.
Tacoma, WA 98446

5. Work Order, Contract, or Invoice Number:

6. Item	7. Description	8. Part Number	9. Eligibilty*	10. Quantity	11. Serial/Batch Number	12. Status/Work
1	0°(Warp)Comp. Modulus, Oven A	AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composites Material Systems, Section 4.5.1 and Section 4.5.3, Table 4.3 and Table 4.6, respectively	Model LC40-550FG	12	AF991104 A-2-911-083-1-1 to 1-12	Test Specimens
2	0°(Warp)Comp. Modulus, Oven B			12	AF991104 B-2-911-083-1-1 to 1-12	Test Specimens
3	90°(Fill)Comp. Modulus, Oven A			12	AF991104 A-2-911-083-1-1 to 1-12	Test Specimens
4	90°(Fill)Comp. Modulus, Oven B			12	AF991104 B-2-911-083-1-1 to 1-12	Test Specimens

13. Remarks Conformity Inspection in support of FAA Project No. TC1616SE-15, dated 10/1/99

Item	Batch	Specimen Type	-65°F (Dry)	RT (Dry)	180°F (Dry)	180°F (Wet)	Fluid Sensitivity	Spare	Total	
1	AF991104	0° (Warp)Comp. Modulus, Oven A	-	1	1	1	-	9	12	Ref. Doc.: AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems, Section 4.5.1, Table 4.3
2	AF991104	0° (Warp) Comp. Modulus, Oven B	-	1	1	1	-	9	12	
3	AF991104	90° (Fill) Comp. Modulus, Oven A	-	1	1	1	-	9	12	
4	AF991104	90° (Fill) Comp. Modulus, Oven B	-	1	1	1	-	9	12	

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
New Overhauled ☐

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special requirements of the importing country have been met.

19.
Return to Service in Accordance with FAR 43.9

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	DKRF351003N		
17. Name (*Typed or Printed*):	18. Date	22. Name (*Typed or Printed*):	23. Date
Wing C. Chin	2-8-00		

FAA Form 8130-3 (11-93)

* (Optional) Installer must cross check eligibility with applicable technical data.

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. N. # 20 FAA Project No. TC1616SE-15 Dated: 10/1/99

4. Organization
Toray Composites (America), Inc.
19002 50th Ave. N.E.
Tacoma, WA 98446

5. Work Order, Contract, or Invoice Number:

6. Item	7. Description	8. Part Number	9. Eligibilty*	10. Quantity	11. Serial/Batch Number	12. Status/Work
1	In-plane Shear (Iosipescu), Oven A	AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composites Material Systems, Section 4.5.1 and Section 4.5.3, Table 4.3 and Table 4.6, respectively	Model LC40-550FG	33	AF991104 A-1-911-083-1-1 to 3-11	Test Specimens
2	In-plane Shear (Iosipescu), Oven B			33	AF991104 B-1-911-083-1-1 to 3-11	Test Specimens

13. Remarks Conformity Inspection in support of FAA Project No. TC1616SE-15, dated 10/1/99

Item	Batch	Specimen Type	-65°F (Dry)	RT (Dry)	180°F (Dry)	180°F (Wet)	Fluid Sensitivity	Spare	Total
1	AF991104	In-plane Shear (Iosipescu), Oven A							
		Ult. Strength & Modulus	-	2	2	2	-	24	33
		Ult. Strength only	-	1	1	1	-		
2	AF991104	In-plane Shear (Iosipescu), Oven B							
		Ult. Strength & Modulus	-	2	2	2	-	24	33
		Ult. Strength only	-	1	1	1	-		

Ref. Doc.: AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems, Section 4.5.1, Table 4.3

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
New Overhauled ☐

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special requirements of the importing country have been met.

19.
Return to Service in Accordance with FAR 43.9

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	DAREF351003NM		
17. Name *(Typed or Printed)*: Wing C. Chin	18. Date 2-8-00	22. Name *(Typed or Printed)*:	23. Date

FAA Form 8130-3 (11-93)

* (Optional) Installer must cross check eligibility with applicable technical data.

1. UNITED STATES	2. **FAA FORM 8130-3** **AIRWORTHINESS APPROVAL TAG** U.S. Department of Transportation **Federal Aviation Administration**	3. System Tracking Ref. N # 21 FAA Project No. TC1616SE-15 Dated: 10/1/99

4. Organization
Toray Composites (America), Inc.
19002 50th Ave. N.E.
Tacoma, WA 98446

5. Work Order, Contract, or Invoice Number:

6. Item	7. Description	8. Part Number	9. Eligibilty*	10. Quantity	11. Serial/Batch Number	12. Status/Work
1	0° (Warp) ILSS, Oven A	AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composites Material Systems, Section 4.5.1 and Section 4.5.3, Table 4.3 and Table 4.6, respectively	Model LC40-550FG	6	AF991104 A-1-911-083-1-1 to 1-6	Test Specimens
2	0° (Warp) ILSS, Oven B			6	AF991104 B-1-911-083-2B-1 to 2B-6	Test Specimens

13. Remarks Conformity Inspection in support of FAA Project No. TC1616SE-15, dated 10/1/99

Item	Batch	Specimen Type	-65°F (Dry)	RT (Dry)	180°F (Dry)	180°F (Wet)	Fluid Sensitivity	Spare	Total	
1	AF991104	0° (Warp) ILSS, Oven A	-	3	-	-	-	3	6	Ref. Doc.: AGATE Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems, Section 4.5.1, Table 4.3
2	AF991104	0° (Warp) ILSS, Oven B	-	3	-	-	-	3	6	

Limited life parts must be accompanied by maintenance history including total time/total cycles/time since new.

14.
New ☒
New Overhauled ☐

Certifies that the new or newly overhauled part(s) identified above, except as otherwise specified in block 13 was (were) manufactured in accordance with FAA approved design data and airworthiness.

NOTE: In case of parts to be exported, the special requirements of the importing country have been met.

19.
Return to Service in Accordance with FAR 43.9

Certifies that the work specified in block 13 (or attached) above was carried out in accordance with FAA airworthiness regulations and in respect to the work performed the part(s) is (are) approved for return to service.

15. Signature	16. FAA Authorization No.:	20. Authorized Signature:	21. Certificate Number:
Wing C. Chin	DAREF3S100-3WM		
17. Name *(Typed or Printed)*: Wing C. Chin	18. Date 2-8-00	22. Name *(Typed or Printed)*:	23. Date

FAA Form 8130-3 (11-93)

* (Optional) Installer must cross check eligibility with applicable technical data.

FAA Form 8110-3
Statement of Compliance with
Federal Aviation Regulations

FAA Form 8100-1
Conformity Inspection Record

FAA Form 8120-10
Request for Conformity

FAA Form 8130-9
Statement of Conformity

for

FGF7781-07I
Style 7781/#2510
Fiberglass 8-Harness Woven Fabric Prepreg

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

STATEMENT OF COMPLIANCE WITH THE FEDERAL AVIATION REGULATIONS

DATE: AUG 31, 2000

AIRCRAFT OR AIRCRAFT COMPONENT IDENTIFICATION

MAKE	MODEL NO.	TYPE (*Airplane, Radio, Helicopter, etc.*)	NAME OF APPLICANT
LANCAIR	LC40	AIRPLANE	LANCAIR COMPANY

LIST OF DATA

IDENTIFICATION	TITLE
TCQAL-T-1014 New Release	AGATE MATERIAL QUALIFICATION OF FGF7781 / #2510 295g/m2, Fiberglass Woven Fabric Test Conducted Under FAA Project Number: TC1616SE-A This approval is for the Test Results obtained in accordance with AGATE Test Plan, "Material Qualification Methodology for Epoxy-Based Prepreg Composite Material System", dated February 1999 Toray Composite (America), Inc. Material Process Specification TCSPF-T-FG03, Rev. 1 was used to fabricate specimens.

PURPOSE OF DATA

In support of LC40 Certification Effort

APPLICABLE REQUIREMENTS (*List specific sections*)

FAR 23.603, FAR 23.605, FAR.23.613

CERTIFICATION - Under authority vested by direction of the Administrator and in accordance with conditions and limitations of appointment under Part 183 of the Federal Aviation Regulations, data listed above and on attached sheets numbered _____ _____ have been examined in accordance with established procedures and found to comply with applicable requirements of the Federal Aviation Regulations.

I (We) Therefore
- [ ] Recommend approval of these data
- [X] Approve these data

SIGNATURE(S) OF DESIGNATED ENGINEERING REPRESENTATIVE(S)	DESIGNATION NUMBER(S)	CLASSIFICATION(S)
M. Ashizawa	NM-2249	Structures

FAA Form 8110-3 (11-70) SUPERSEDES PREVIOUS EDITION

GPO 901-613

Conformity Inspection Record	1. Project Number, TIA/Request Date: TC16169SE-A 10-26-99	2. SHEET 1 of Sheets 1
3. Applicant/Manufacturer: PACIFIC AVIATIONS	4. Beginning Date: 8-1-2000	5. Ending Date: 8-30-2000
6. Model: LANCAIR PART CONFORMITY	7. Inspected By: Wing C. Kim DAEF351003 NM	

8. Item No.	9. Nomenclature of Item Inspected	10. Drawing, Document, Specification, etc.	11. Revision and Date	12. No. of Items Determined SAT.	12. No. of Items Determined UNSAT.	13. Comments
1.	DOC. MQFEBPCMS	N/A	Rev.— 2-99	1		REPEAT TEST SEE FAA FORM 8130-3 FOR QTY. & BATCH NO'S. APPLICANT ADVISED FAA PROJECT ENGR OF THE RETESTING.
2.	DOC. TC AMS.	TCSPF-T-UD06	Rev.— 9-20-99	1		
3.	DOC. TCADMS	TCSPF-T-FG03	Rev.— 9-20-99	1		

FAA Form 8100-1 ... Supersedes Previous Edition

MAR-27-2000 09:01 SEATTLE MIDO 425 227 1159 P.01/01

FILE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

REQUEST FOR CONFORMITY

To: Manufacturing Inspection District Office
1601 Lind Ave. SW
Renton, WA 88055-4055

Attention: Jim Doyle

Request for Conformity Inspection

- [ ] Part Conformity
- [ ] Installation
- [x] Other Test Specimen

Project No.: TC1818SE-A
Date: October 26, 1999

A conformity inspection pertaining to the subject is requested for the following:

Applicant Name: Pacific Aviation Composites USA, LLC

Company Name: same

Street: 22550 Nelson Road

City: Bend State: OR Zip: 97701

Time/Date Available: [x] Applicant will Contact FAA

Type Installation: Composite material test panels and specimens

Make/Model: Lancair LC40-550FG Quantity: See Test Plan

Requesting Document (P.O.) and Date:

Design Data: (with Revision/Date): Panels and specimens defined in Appendix B of "Material Qualification Methodology for Epoxy-Based Prepreg Composite Material Systems" dated February, 1999; manufactured in accordance with Documents Numbered 2-5 under PAC USA cover letter CA012382 dated October 1, 1999.

Special Instructions: Conformity must take place twice: once on panels and once on specimens.

Contact: Terry Merxbauer At: 541-318-1144 (Phone Number)

FAA Project Manager: Jeff Morfitt, ANM-190S Phone: (425) 227-2595

Remarks: The applicant requests that the conformity inspection be delegated to DAR Wing Chin, DAR No. F351003NM. Conformity of both the panels and specimens will take place at Toray Composites America in Tacoma, WA.

- [ ] T.I.A. Issued
- [x] FAA Form 8100-1 Required
- [ ] T.I.R. Required
- [x] FAA Form 8130-9 Required
- [x] 8130-3 Tags (As Required)

Note: Please return this request for conformity with the FAA conformity document to Modification Branch (ANM-190S -Jeff Morfitt) via the Seattle MIDO (ANM-108S)

FAA Form 8120-10

OMB: 2120-0018

STATEMENT OF CONFORMITY

Section I — Aircraft

1. Make	2. Model
3. Serial No.	4. Registration No.

Section II — Engine

1. Make	2. Model
3. Serial No.	

Section III — Propeller

1. Make	2. Hub Model
3. Blade Model	4. Hub Serial No.
5. Blade Serial Nos.	

Section IV — Certification

I hereby certify that:

- [X] A. I have complied with Section 21.33(a.).
- [ ] B. The aircraft described above, produced under type certificate only (FAR 21 Subpart F), conforms to its type certificate, is in a condition for safe operation, and was flight checked on _____ *(Date)*
- [ ] C. The engine or propeller described above, presented herewith for type certification, conforms to the type design therefor.
- [ ] D. The engine or propeller described above produced under type certificate only (FAR 21 Subpart F), conforms to its type certificate and is in a condition for safe operation. The engine or, if applicable, the variable pitch propeller was subjected by the manufacturer to a final operation check on _____ *(Date)*

Deviations: NONE

FAA PROJ NO. TC16160SE-A, DTD 10-26-00

Signature of Certifier	Title
Lana A. Jouni	TECHNICAL ENGINEER
Organization: TORAY COMPOSITES (AMERICA)	Date: 8/1/00

FAA Form 8130-9 (11-88) Use Previous Edition

*U.S.GPO:1994-568-012/56

OMB: 2120-0018

STATEMENT OF CONFORMITY

Section I — Aircraft

1. Make	2. Model
3. Serial No.	4. Registration No.

Section II — Engine

1. Make	2. Model
3. Serial No.	

Section III — Propeller

1. Make	2. Hub Model
3. Blade Model	4. Hub Serial No.
5. Blade Serial Nos.	

Section IV — Certification

I hereby certify that:

☐ A. I have complied with Section 21.33(a.).

☐ B. The aircraft described above, produced under type certificate only (FAR 21 Subpart F), conforms to its type certificate, is in a condition for safe operation, and was flight checked on _____ *(Date)*

☐ C. The engine or propeller described above, presented herewith for type certification, conforms to the type design therefor.

☐ D. The engine or propeller described above produced under type certificate only (FAR 21 Subpart F), conforms to its type certificate and is in a condition for safe operation. The engine or, if applicable, the variable pitch propeller was subjected by the manufacturer to a final operation check on _____ *(Date)*

Deviations:

Signature of Certifier: Laura A. Fanucci	Title: TECHNICAL ENGINEER
Organization: TORAY COMPOSITES (AMERICA)	Date: 8-24-00

FAA Form 8130-9 (11-88) Use Previous Edition

*U.S.GPO:1994-568-012/56

Not Subject to OMB Clearance

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

STATEMENT OF CONFORMITY

SECTION I – AIRCRAFT

1. MAKE	2. MODEL
	N/A
3. SERIAL NO.	4. REGISTRATION NO.

SECTION II – ENGINE

1. MAKE	2. MODEL
3. SERIAL NO.	

SECTION III – PROPELLER

1. MAKE	2. HUB MODEL
3. BLADE MODEL	4. HUB SERIAL NO.
5. BLADE SERIAL NOS.	

SECTION IV – CERTIFICATION

I hereby certify that:

☑ A. I have complied with Section 21.33(a). CONFORMS TO TCSPF-T-UD06 Rev. 2, DTD 8-9-00

☐ B. The aircraft described above, produced under type certificate only (FAR 21 Subpart F), conforms to its type certificate, is in a condition for safe operation, and was flight checked on _____ (Date).

☐ C. The engine or propeller described above, presented herewith for type certification, conforms to the type design therefor.

☐ D. The engine or propeller described above produced under type certificate only (FAR 21 Subpart F), conforms to its type certificate and is in a condition for safe operation. The engine or, if applicable, the variable pitch propeller was subjected by the manufacturer to a final operational check on _____ (Date).

Deviations: NONE

SIGNATURE OF CERTIFIER	TITLE
Lane A. Tomm	TECHNICAL ENGINEER
ORGANIZATION	DATE
TORAY COMPOSITES (AMERICA), INC	12/15/00

FAA Form 8130-9 (9-78) USE PREVIOUS EDITION

OMB: 2120-0018

STATEMENT OF CONFORMITY

Section I — Aircraft

1. Make	2. Model N/A
3. Serial No.	4. Registration No.

Section II — Engine

1. Make	2. Model
3. Serial No.	

Section III — Propeller

1. Make	2. Hub Model
3. Blade Model	4. Hub Serial No.
5. Blade Serial Nos.	

Section IV — Certification

I hereby certify that:

☑ A. I have complied with Section 21.33(a.). CONFORMS TO TESPF-7-UD06 Rev. 3, DATE 12-18-00.

☐ B. The aircraft described above, produced under type certificate only (FAR 21 Subpart F), conforms to its type certificate, is in a condition for safe operation, and was flight checked on _____ *(Date)*

☐ C. The engine or propeller described above, presented herewith for type certification, conforms to the type design therefor.

☐ D. The engine or propeller described above produced under type certificate only (FAR 21 Subpart F), conforms to its type certificate and is in a condition for safe operation. The engine or, if applicable, the variable pitch propeller was subjected by the manufacturer to a final operation check on _____ *(Date)*

Deviations:

NONE

Signature of Certifier Tama A Tamura	Title TECHNICAL ENGINEER
Organization TORAY COMPOSITES (AMERICA), INC.	Date 1-4-2001

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OMB: 2120-0018

STATEMENT OF CONFORMITY

Section I — Aircraft

1. Make	2. Model
3. Serial No.	4. Registration No.

Section II — Engine

1. Make	2. Model
3. Serial No.	

Section III — Propeller

1. Make	2. Hub Model
3. Blade Model	4. Hub Serial No.
5. Blade Serial Nos.	

Section IV — Certification

I hereby certify that:

☐ A. I have complied with Section 21.33(a.). TCSPF-T-UD06 Rev 3 12-18-00

☐ B. The aircraft described above, produced under type certificate only (FAR 21 Subpart F), conforms to its type certificate, is in a condition for safe operation, and was flight checked on _____ (Date)

☐ C. The engine or propeller described above, presented herewith for type certification, conforms to the type design therefor.

☐ D. The engine or propeller described above produced under type certificate only (FAR 21 Subpart F), conforms to its type certificate and is in a condition for safe operation. The engine or, if applicable, the variable pitch propeller was subjected by the manufacturer to a final operation check on _____ (Date)

Deviations:

None.

Signature of Certifier	Title
Lana A. Fournier	TECHNICAL ENGINEER
Organization: TORAY COMPOSITES (AMERICA), INC	Date: 2/28/2001

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*U.S.GPO:1994-568-012/56

OMB: 2120-0018

STATEMENT OF CONFORMITY

Section I — Aircraft

1. Make	2. Model
3. Serial No.	4. Registration No.

Section II — Engine

1. Make	2. Model
3. Serial No.	

Section III — Propeller

1. Make	2. Hub Model
3. Blade Model	4. Hub Serial No.
5. Blade Serial Nos.	

Section IV — Certification

I hereby certify that:

- [X] A. I have complied with Section 21.33(a.).
- [ ] B. The aircraft described above, produced under type certificate only (FAR 21 Subpart F), conforms to its type certificate, is in a condition for safe operation, and was flight checked on _____ *(Date)*
- [ ] C. The engine or propeller described above, presented herewith for type certification, conforms to the type design therefor.
- [ ] D. The engine or propeller described above produced under type certificate only (FAR 21 Subpart F), conforms to its type certificate and is in a condition for safe operation. The engine or, if applicable, the variable pitch propeller was subjected by the manufacturer to a final operation check on _____ *(Date)*

Deviations: NONE

Signature of Certifier	Title
Samuel T. Train	Senior Technical Engineer
Organization: Toray Composites (America), Inc.	Date: 3/21/01

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*U.S.GPO:1994-568-012/56

OMB: 2120-0018

STATEMENT OF CONFORMITY

Section I — Aircraft

1. Make	2. Model
3. Serial No.	4. Registration No.

Section II — Engine

1. Make	2. Model
3. Serial No.	

Section III — Propeller

1. Make	2. Hub Model
3. Blade Model	4. Hub Serial No.
5. Blade Serial Nos.	

Section IV — Certification

I hereby certify that:

☑ A. I have complied with Section 21.33(a.).

☐ B. The aircraft described above, produced under type certificate only (FAR 21 Subpart F), conforms to its type certificate, is in a condition for safe operation, and was flight checked on _____ *(Date)*

☐ C. The engine or propeller described above, presented herewith for type certification, conforms to the type design therefor.

☐ D. The engine or propeller described above produced under type certificate only (FAR 21 Subpart F), conforms to its type certificate and is in a condition for safe operation. The engine or, if applicable, the variable pitch propeller was subjected by the manufacturer to a final operation check on _____ *(Date)*

Deviations:

None

Signature of Certifier	Title
Laura A. Fournier	TECHNICAL ENGINEER
Organization: TORAY COMPOSITES (AMERICA), INC.	Date: 4/16/2001

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*U.S.GPO:1994-568-012/56