

WL-TR-92-4069

AD-A279 166



CHARACTERIZATION OF EA9394 ADHESIVE FOR REPAIR APPLICATIONS

Ronald J. Kuhbander
University of Dayton
300 College Park Avenue
Dayton, Ohio 45469-0130

DTIC
ELECTE
MAY 12 1994
S B D

JANUARY 1994

Interim Technical Report for Period September 1, 1988 - April 30, 1992

Approved for Public Release; Distribution is Unlimited.

2454
94-14064

MATERIALS DIRECTORATE
WRIGHT LABORATORY
AIR FORCE MATERIEL COMMAND
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433- 7734

DTIC

04 5 10 017

NOTICE

When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely Government-related procurement, the United States Government incurs no responsibility or any obligation whatsoever. The fact that the government may have formulated or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication, or otherwise in any manner construed, as licensing the holder, or any other person or corporation; or as conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

This report is releasable to the National Technical Information Service (NTIS). At NTIS, it will be available to the general public, including foreign nations.

This technical report has been reviewed and is approved for publication.

James J. Mazza

JAMES J. MAZZA, Materials Engineer
Materials Engineering Branch
Systems Support Division
Materials Directorate

Theodore J. Reinhart

THEODORE J. REINHART, Chief
Materials Engineering Branch
Systems Support Division
Materials Directorate

Thomas D. Cooper

THOMAS D. COOPER, Chief
Systems Support Division
Materials Directorate

If your address has changed, if you wish to be removed from our mailing list, or if the addressee is no longer employed by your organization please notify WL/MLSE. WPAFB, OH 45433-7718 to help us maintain a current mailing list.

Copies of this report should not be returned unless return is required by security considerations, contractual obligations, or notice on a specific document.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

This reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (leave blank)		2. REPORT DATE JAN 1994	3. REPORT TYPE AND DATES COVERED INTERIM 09/01/88--04/30/92	
4. TITLE AND SUBTITLE CHARACTERIZATION OF EA9394 ADHESIVE FOR REPAIR APPLICATIONS			5. FUNDING NUMBERS C F33615-89-C-5643 PE 62102 PR 2418 TA 04 WU 69	
6. AUTHOR(S) R. KUH BANDER				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) UNIVERSITY OF DAYTON 300 COLLEGE PARK AVENUE DAYTON OH 45469-0130			8. PERFORMING ORGANIZATION REPORT NUMBER UDR-TR-94-28	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) MATERIALS DIRECTORATE WRIGHT LABORATORY AIR FORCE MATERIEL COMMAND WRIGHT PATTERSON AFB OH 45433-7734			10. SPONSORING/MONITORING AGENCY REPORT NUMBER WL-TR-92-4069	
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION/AVAILABILITY STATEMENT APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED.			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) An effort was undertaken to thoroughly characterize an adhesive, EA 9394 (Hysol). The characterization was directed toward repair applications for aluminum and/or composite structures. The study includes data on the effects of time, pressure, and temperature on adhesive tensile lap shear properties. The mechanical properties measured included tensile lap shear, floating roller peel, and flatwise tension and climbing drum peel on adhesively bonded honeycomb structures. The mechanical properties were measured at reduced, room, and elevated temperatures and after humidity aging. Effects of storage time and temperature, cure temperature, primed adherends, bondline thickness, and batch-to-batch variation were also investigated. Several physical and chemical characteristics were investigated to measure the effects of storage conditions and to aid in selection of cure conditions.				
14. SUBJECT TERMS ADHESIVE, FLOATING ROLLER PEEL, FLATWISE TENSION, REPAIR, SHEAR STRENGTH, CURE STUDY, CLIMBING DRUM TENSION			15. NUMBER OF PAGES 248	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	18. SECURITY CLASSIFICATION OF THIS PAGE UNCLASSIFIED	19. SECURITY CLASSIFICATION OF ABSTRACT UNCLASSIFIED	20. LIMITATION OF ABSTRACT UL	

PREFACE

This report covers work performed by the University of Dayton Research Institute (UDRI), Dayton, Ohio 45469-0130, during the period from September 1988 to April 1992. It was carried out under Air Force Contracts No. F33615-86-C-5031, "Composites Supportability Rapid Test and Evaluation," and No. F33615-89-C-5643, "Nonmetallics, Test and Evaluation." The work was administered under the direction of Mr. Robert Urzi of the Systems Support Division of the Air Force Materials Laboratory, Wright Laboratory, Wright-Patterson Air Force Base, Ohio. Mr. William Purcell (WL/MLSE) was the Program Project Engineer for the preliminary investigation. Mr. James Mazza (WL/MLSE) was the Program Project Engineer for the remainder of the program.

The work described herein was conducted at UDRI in the Plastics, Adhesives, and Composites Laboratory of the Materials Engineering Division. The technical effort was directed by Mr. Ronald J. Kuhbander with Mr. John Wright and Marianne Piekutowski being responsible for much of the laboratory work.

This report was submitted by the authors for publication in January 1994.

Accession For	
NTIS	☒
DTIC TAB	☐
Unannounced	☐
Justification	
By	
Distribution	
Availability Code	
Dist	Avail and/or Special
A-1	

TABLE OF CONTENTS

<u>SECTION</u>		<u>PAGE</u>
1	INTRODUCTION	1
2	CONTROL DATA	2
	2.1 TENSILE LAP SHEAR CONTROL DATA	3
	2.2 FLOATING ROLLER PEEL CONTROL DATA	5
	2.3 HONEYCOMB SANDWICH FLATWISE TENSION CONTROL DATA	5
	2.4 HONEYCOMB SANDWICH CLIMBING DRUM PEEL CONTROL DATA	7
3	HUMIDITY EXPOSURE	8
4	TENSILE LAP SHEAR STRESS DURABILITY	11
5	STORAGE LIFE	12
6	POT LIFE	14
7	GLASS TRANSITION TEMPERATURE DETERMINATION	16
8	MISCELLANEOUS EFFECTS	17
	8.1 PRIMER THICKNESS	17
	8.2 BONDLINE THICKNESS	17
	8.3 OVERLAP LENGTH	19
	8.4 350°F EXPOSURE	19
	8.5 THERMAL PULSE	20
	8.6 COMPOSITE ADHERENDS	21
	8.7 SURFACE PREPARATION	22
9	CONCLUSIONS	24

TABLE OF CONTENTS (Continued)

<u>SECTION</u>	<u>PAGE</u>
<u>APPENDICES</u>	
A RESULTS OF INDIVIDUAL TEST SPECIMENS FOR TENSILE LAP SHEAR CONTROL DATA.....	A-1
B RESULTS OF INDIVIDUAL TEST SPECIMENS FOR FLOATING ROLLER PEEL CONTROL DATA.....	B-1
C RESULTS OF INDIVIDUAL TEST SPECIMENS FOR HONEYCOMB SANDWICH FLATWISE TENSION CONTROL DATA	C-1
D RESULTS OF INDIVIDUAL TEST SPECIMENS FOR HONEYCOMB SANDWICH CLIMBING DRUM PEEL CONTROL DATA	D-1
E RESULTS OF INDIVIDUAL HUMIDITY AGED TEST SPECIMENS FOR TENSILE LAP SHEAR.....	E-1
F RESULTS OF INDIVIDUAL HUMIDITY AGED TEST SPECIMENS FOR FLOATING ROLLER PEEL.....	F-1
G RESULTS OF INDIVIDUAL HUMIDITY AGED TEST SPECIMENS FOR HONEYCOMB SANDWICH FLATWISE TENSION.....	G-1
H RESULTS OF INDIVIDUAL HUMIDITY AGED TEST SPECIMENS FOR HONEYCOMB SANDWICH CLIMBING DRUM PEEL	H-1
I RESULTS OF INDIVIDUAL TEST SPECIMENS TO DETERMINE THE AVERAGE TENSILE LAP SHEAR STRENGTH OF EA9394 ADHESIVE AT 120°F	I-1
J RESULTS OF INDIVIDUAL TEST SPECIMENS TO DETERMINE THE EFFECT OF STORAGE LIFE	J-1
K RESULTS OF INDIVIDUAL TEST SPECIMENS TO DETERMINE THE EFFECT OF POT LIFE.....	K-1
L RESULTS OF INDIVIDUAL T _g TEST SPECIMENS.....	L-1

TABLE OF CONTENTS (Concluded)

<u>SECTION</u>	<u>PAGE</u>
<u>APPENDICES</u>	
M	RESULTS OF INDIVIDUAL TEST SPECIMENS TO DETERMINE THE EFFECT OF ADHESIVE PRIMER THICKNESS M-1
N	RESULTS OF INDIVIDUAL TEST SPECIMENS TO DETERMINE THE EFFECT OF ADHESIVE GLUELINE THICKNESS N-1
O	RESULTS OF INDIVIDUAL TEST SPECIMENS TO DETERMINE THE EFFECT OF OVERLAP LENGTH O-1
P	RESULTS OF INDIVIDUAL TEST SPECIMENS FOR FLOATING ROLLER PEEL AFTER EXPOSURE TO 350°F P-1
Q	RESULTS OF INDIVIDUAL TEST SPECIMENS TO DETERMINE THE EFFECT OF THERMAL PULSE ON TENSILE LAP SHEAR AND FLOATING ROLLER PEEL STRENGTH..... Q-1
R	RESULTS OF INDIVIDUAL TEST SPECIMENS FOR THE EFFECT OF ADHERENDS ON TENSILE LAP SHEAR STRENGTH..... R-1
S	RESULTS OF INDIVIDUAL TEST SPECIMENS TO DETERMINE THE EFFECT OF SURFACE PREPARATION ON TENSILE LAP SHEAR AND FLOATING ROLLER PEEL STRENGTHS..... S-1

LIST OF TABLES

<u>TABLE</u>	<u>PAGE</u>
1 Tensile Lap Shear Strengths for EA9394 Adhesive vs. Processing Techniques	4
2 Floating Roller Peel Strengths Processed in Full Vacuum vs. Positive Pressure	4
3 Tensile Lap Shear Strength Control Data for Three Production Batches of EA9394 Adhesive.....	5
4 Floating Roller Peel Strength Control Data for Three Production Batches of EA9394 Adhesive.....	6
5 Honeycomb Sandwich Flatwise Tensile Strength Control Data for Three Production Batches of EA9394 Adhesive	6
6 Honeycomb Sandwich Climbing Drum Peel Strength Control Data for Three Production Batches of EA9394 Adhesive.....	7
7 Effect of Humidity Exposure on Tensile Lap Shear Strength for Three Production Batches of EA9394 Adhesive.....	9
8 Effect of Humidity Exposure on Floating Roller Peel Strength for Three Production Batches of EA9394 Adhesive.....	9
9 Effect of Humidity Exposure on Honeycomb Sandwich Flatwise Tension Strength for Three Production Batches of EA9394 Adhesive...	10
10 Effect of Humidity Exposure on Honeycomb Sandwich Climbing Drum Peel Strength for Three Production Batches of EA9394 Adhesive.....	10
11 Stress Durability of EA9394 Adhesive per ASTM D 2919 at 120°F and 95-100% R.H.....	11
12 Effect of Long Term Storage at Various Temperatures on the Tensile Lap Shear Strength and Viscosity of EA9394 Adhesive.....	13
13 Effect of Pot Life on Tensile Lap Shear Strength of EA9394 Adhesive.....	15
14 Effect of Pot Life on Floating Roller Peel Strength of EA9394 Adhesive.....	15

LIST OF TABLES (Continued)

<u>TABLE</u>	<u>PAGE</u>
15	Glass Transition Temperature on EA9394..... 16
16	Effect of BR 127 Adhesive Primer Thickness Upon Tensile Lap Shear and Floating Roller Peel Strengths of EA9394 Adhesive..... 18
17	Effect of Bondline Thickness on Tensile Lap Shear and Floating Roller Peel Strengths of EA9394 Adhesive..... 18
18	Effect of Overlap Length on Tensile Lap Shear Strength of EA9394 Adhesive..... 19
19	Effect of High Temperature Exposure on Floating Roller Peel Strength of EA9394 Adhesive..... 20
20	Effect of Thermal Pulse on EA9394 and FM300K Repair Adhesives.... 21
21	Tensile Lap Shear Strength Using Various Adherend Materials and EA9394 Adhesive 22
22	Effect of Surface Preparation and Non-Primed Surface on Mechanical Properties..... 23
A.1	Control Data, Individual Tensile Lap Shear Specimen Strength at 75°F for Production Batch 0010..... A-2
A.2	Control Data, Individual Tensile Lap Shear Specimen Strength at 200°F for Production Batch 0010..... A-3
A.3	Control Data, Individual Tensile Lap Shear Specimen Strength at -65°F for Production Batch 0010..... A-4
A.4	Control Data, Individual Tensile Lap Shear Specimen Strength at -65°F for Production Batch 9199..... A-5
A.5	Control Data, Individual Tensile Lap Shear Specimen Strength at 75°F for Production Batch 9199..... A-6
A.6	Control Data, Individual Tensile Lap Shear Specimen Strength at 200°F for Production Batch 9199..... A-7

LIST OF TABLES (Continued)

TABLE		PAGE
A.7	Control Data, Individual Tensile Lap Shear Specimen Strength at -65°F for Production Batch 0204.....	A-8
A.8	Control Data, Individual Tensile Lap Shear Specimen Strength at 75°F for Production Batch 0204.....	A-9
A.9	Control Data, Individual Tensile Lap Shear Specimen Strength at 200°F for Production Batch 0204.....	A-10
B.1	Control Data, Individual Floating Roller Peel Specimen Strength at 75°F for Production Batch 0010.....	B-2
B.2	Control Data, Individual Floating Roller Peel Specimen Strength at 200°F for Production Batch 0010.....	B-3
B.3	Control Data, Individual Floating Roller Peel Specimen Strength at -65°F for Production Batch 0010.....	B-4
B.4	Control Data, Individual Floating Roller Peel Specimen Strength at 75°F for Production Batch 9199.....	B-5
B.5	Control Data, Individual Floating Roller Peel Specimen Strength at 200°F for Production Batch 9199.....	B-6
B.6	Control Data, Individual Floating Roller Peel Specimen Strength at -65°F for Production Batch 9199.....	B-7
B.7	Control Data, Individual Floating Roller Peel Specimen Strength at 75°F for Production Batch 0204.....	B-8
B.8	Control Data, Individual Floating Roller Peel Specimen Strength at 200°F for Production Batch 0204.....	B-9
B.9	Control Data, Individual Floating Roller Peel Specimen Strength at -65°F for Production Batch 0204.....	B-10
C.1	Control Data, Individual Honeycomb Tension Specimen Strength at 75°F for Production Batch 0204.....	C-2
C.2	Control Data, Individual Honeycomb Tension Specimen Strength at 200°F for Production Batch 0204.....	C-3

LIST OF TABLES (Continued)

TABLE		PAGE
C.3	Control Data, Individual Honeycomb Tension Specimen Strength at -65°F for Production Batch 0204.....	C-4
C.4	Control Data, Individual Honeycomb Tension Specimen Strength at 75°F for Production Batch 9199.....	C-5
C.5	Control Data, Individual Honeycomb Tension Specimen Strength at 200°F for Production Batch 9199.....	C-6
C.6	Control Data, Individual Honeycomb Tension Specimen Strength at -65°F for Production Batch 9199.....	C-7
C.7	Control Data, Individual Honeycomb Tension Specimen Strength at 75°F for Production Batch 0010.....	C-8
C.8	Control Data, Individual Honeycomb Tension Specimen Strength at 200°F for Production Batch 0010.....	C-9
C.9	Control Data, Individual Honeycomb Tension Specimen Strength at -65°F for Production Batch 0010.....	C-10
D.1	Control Data, Individual Honeycomb Climbing Drum Peel Specimen Strength at 75°F for Production Batch 0010.....	D-2
D.2	Control Data, Individual Honeycomb Climbing Drum Peel Specimen Strength at 200°F for Production Batch 0010.....	D-3
D.3	Control Data, Individual Honeycomb Climbing Drum Peel Specimen Strength at -65°F for Production Batch 0010.....	D-4
D.4	Control Data, Individual Honeycomb Climbing Drum Peel Specimen Strength at 75°F for Production Batch 9199.....	D-5
D.5	Control Data, Individual Honeycomb Climbing Drum Peel Specimen Strength at 200°F for Production Batch 9199.....	D-6
D.6	Control Data, Individual Honeycomb Climbing Drum Peel Specimen Strength at -65°F for Production Batch 9199.....	D-7
D.7	Control Data, Individual Honeycomb Climbing Drum Peel Specimen Strength at 75°F for Production Batch 0204.....	D-8

LIST OF TABLES (Continued)

<u>TABLE</u>		<u>PAGE</u>
D.8	Control Data, Individual Honeycomb Climbing Drum Peel Specimen Strength at 200°F for Production Batch 0204.....	D-9
D.9	Control Data, Individual Honeycomb Climbing Drum Peel Specimen Strength at -65°F for Production Batch 0204	D-10
E.1	Humidity Data, Individual Tensile Lap Shear Specimen Strength at 75°F for Production Batch 0010.....	E-2
E.2	Humidity Data, Individual Tensile Lap Shear Specimen Strength at 200°F for Production Batch 0010.....	E-3
E.3	Humidity Data, Individual Tensile Lap Shear Specimen Strength at -65°F for Production Batch 0010	E-4
E.4	Humidity Data, Individual Tensile Lap Shear Specimen Strength at 75°F for Production Batch 9199.....	E-5
E.5	Humidity Data, Individual Tensile Lap Shear Specimen Strength at 200°F for Production Batch 9199.....	E-6
E.6	Humidity Data, Individual Tensile Lap Shear Specimen Strength at -65°F for Production Batch 9199	E-7
E.7	Humidity Data, Individual Tensile Lap Shear Specimen Strength at 75°F for Production Batch 0204.....	E-8
E.8	Humidity Data, Individual Tensile Lap Shear Specimen Strength at 200°F for Production Batch 0204.....	E-9
E.9	Humidity Data, Individual Tensile Lap Shear Specimen Strength at -65°F for Production Batch 0204	E-10
F.1	Humidity Data, Individual Floating Roller Peel Specimen Strength at 75°F for Production Batch 0010.....	F-2
F.2	Humidity Data, Individual Floating Roller Peel Specimen Strength at 200°F for Production Batch 0010.....	F-3
F.3	Humidity Data, Individual Floating Roller Peel Specimen Strength at -65°F for Production Batch 0010	F-4

LIST OF TABLES (Continued)

TABLE		PAGE
F.4	Humidity Data, Individual Floating Roller Peel Specimen Strength at 75°F for Production Batch 9199	F-5
F.5	Humidity Data, Individual Floating Roller Peel Specimen Strength at 200°F for Production Batch 9199	F-6
F.6	Humidity Data, Individual Floating Roller Peel Specimen Strength at -65°F for Production Batch 9199	F-7
F.7	Humidity Data, Individual Floating Roller Peel Specimen Strength at 75°F for Production Batch 0204	F-8
F.8	Humidity Data, Individual Floating Roller Peel Specimen Strength at 200°F for Production Batch 0204	F-9
F.9	Humidity Data, Individual Floating Roller Peel Specimen Strength at -65°F for Production Batch 0204	F-10
G.1	Humidity Data, Individual Honeycomb Tension Specimen Strength at 75°F for Production Batch 0010	G-2
G.2	Humidity Data, Individual Honeycomb Tension Specimen Strength at 200°F for Production Batch 0010	G-3
G.3	Humidity Data, Individual Honeycomb Tension Specimen Strength at -65°F for Production Batch 0010	G-4
G.4	Humidity Data, Individual Honeycomb Tension Specimen Strength at 75°F for Production Batch 9199	G-5
G.5	Humidity Data, Individual Honeycomb Tension Specimen Strength at 200°F for Production Batch 9199	G-6
G.6	Humidity Data, Individual Honeycomb Tension Specimen Strength at -65°F for Production Batch 9199	G-7
G.7	Humidity Data, Individual Honeycomb Tension Specimen Strength at 75°F for Production Batch 0204	G-8
G.8	Humidity Data, Individual Honeycomb Tension Specimen Strength at 200°F for Production Batch 0204	G-9

LIST OF TABLES (Continued)

TABLE		PAGE
G.9	Humidity Data, Individual Honeycomb Tension Specimen Strength at -65°F for Production Batch 0204	G-10
H.1	Humidity Data, Individual Honeycomb Climbing Drum Peel Specimen Strength at 75°F for Production Batch 0010.....	H-2
H.2	Humidity Data, Individual Honeycomb Climbing Drum Peel Specimen Strength at 75°F for Production Batch 9199.....	H-3
H.3	Humidity Data, Individual Honeycomb Climbing Drum Peel Specimen Strength at 75°F for Production Batch 0204.....	H-4
I.1	Tensile Lap Shear Strength of EA9394 Adhesive at 120°F	I-2
J.1	Effect of Long Term Storage at 75°F on Tensile Lap Shear Strengths, Individual Test Specimens at 75°F and 200°F for EA9394 Adhesive, Batch No. 8204	J-2
J.2	Effect of Long Term Storage at 100°F on Tensile Lap Shear Strengths, Individual Test Specimens at 75°F and 200°F for EA9394 Adhesive, Batch No. 8204	J-3
J.3	Effect of Long Term Storage at 120°F on Tensile Lap Shear Strengths, Individual Test Specimens at 75°F and 200°F for EA9394 Adhesive, Batch No. 8204	J-4
K.1	Effect of Applied EA9394 Adhesive Pot Life Upon Individual Tensile Lap Shear Strength at 75°F for Production Batch No. 0010 When Exposed to 75°F for 270 Minutes	K-2
K.2	Effect of Applied EA9394 Adhesive Pot Life Upon Individual Tensile Lap Shear Strength at 75°F for Production Batch No. 0010 When Exposed to 75°F for 225 Minutes	K-3
K.3	Effect of Applied EA9394 Adhesive Pot Life Upon Individual Tensile Lap Shear Strength at 200°F for Production Batch No. 0010 When Exposed to 75°F for 225 Minutes	K-4
K.4	Effect of Applied EA9394 Adhesive Pot Life Upon Individual Tensile Lap Shear Strength at 75°F for Production Batch No. 0010 When Exposed to 75°F for 150 Minutes	K-5

LIST OF TABLES (Continued)

<u>TABLE</u>		<u>PAGE</u>
K.5	Effect of Applied EA9394 Adhesive Pot Life Upon Individual Tensile Lap Shear Strength at 200°F for Production Batch No. 0010 When Exposed to 75°F for 150 Minutes	K-6
K.6	Effect of Applied EA9394 Adhesive Pot Life Upon Individual Tensile Lap Shear Strength at 75°F for Production Batch No. 0010 When Exposed to 100°F for 80 Minutes	K-7
K.7	Effect of Applied EA9394 Adhesive Pot Life Upon Individual Tensile Lap Shear Strength at 200°F for Production Batch No. 0010 When Exposed to 100°F for 80 Minutes	K-8
K.8	Effect of Applied EA9394 Adhesive Pot Life Upon Individual Tensile Lap Shear Strength at 75°F for Production Batch No. 0010 When Exposed to 100°F for 60 Minutes	K-9
K.9	Effect of Applied EA9394 Adhesive Pot Life Upon Individual Tensile Lap Shear Strength at 200°F for Production Batch No. 0010 When Exposed to 100°F for 60 Minutes	K-10
K.10	Effect of Applied EA9394 Adhesive Pot Life Upon Individual Floating Roller Peel Strength at 75°F for Production Batch No. 0010 When Exposed to 75°F for 150 Minutes	K-11
K.11	Effect of Applied EA9394 Adhesive Pot Life Upon Individual Floating Roller Peel Strength at 200°F for Production Batch No. 0010 When Exposed to 75°F for 150 Minutes	K-12
K.12	Effect of Applied EA9394 Adhesive Pot Life Upon Individual Floating Roller Peel Strength at -65°F for Production Batch No. 0010 When Exposed to 75°F for 150 Minutes	K-13
K.13	Effect of Applied EA9394 Adhesive Pot Life Upon Individual Floating Roller Peel Strength at 75°F for Production Batch No. 0010 When Exposed to 75°F for 225 Minutes	K-14
K.14	Effect of Applied EA9394 Adhesive Pot Life Upon Individual Floating Roller Peel Strength at 200°F for Production Batch No. 0010 When Exposed to 75°F for 225 Minutes	K-15

LIST OF TABLES (Continued)

TABLE		PAGE
K.15	Effect of Applied EA9394 Adhesive Pot Life Upon Individual Floating Roller Peel Strength at -65°F for Production Batch No. 0010 When Exposed to 75°F for 225 Minutes	K-16
K.16	Effect of Applied EA9394 Adhesive Pot Life Upon Individual Floating Roller Peel Strength at 75°F for Production Batch No. 0010 When Exposed to 100°F for 60 Minutes	K-17
K.17	Effect of Applied EA9394 Adhesive Pot Life Upon Individual Floating Roller Peel Strength at 200°F for Production Batch No. 0010 When Exposed to 100°F for 60 Minutes	K-18
K.18	Effect of Applied EA9394 Adhesive Pot Life Upon Individual Floating Roller Peel Strength at -65°F for Production Batch No. 0010 When Exposed to 100°F for 60 Minutes	K-19
K.19	Effect of Applied EA9394 Adhesive Pot Life Upon Individual Floating Roller Peel Strength at 75°F for Production Batch No. 0010 When Exposed to 100°F for 80 Minutes	K-20
K.20	Effect of Applied EA9394 Adhesive Pot Life Upon Individual Floating Roller Peel Strength at 200°F for Production Batch No. 0010 When Exposed to 100°F for 80 Minutes	K-21
K.21	Effect of Applied EA9394 Adhesive Pot Life Upon Individual Floating Roller Peel Strength at -65°F for Production Batch No. 0010 When Exposed to 100°F for 80 Minutes	K-22
L.1	T _g of EA9394 Adhesive as Determined by DMA, Individual Specimens After 2 Hours at 180°F.	L-2
L.2	T _g of EA9394 Adhesive as Determined by DMA, Individual Specimens After 2 Hours at 200°F	L-3
M.1	Effect of Primer Thickness Data, Individual Tensile Lap Shear Specimen Strength at 75°F for Production Batch 0010.....	M-1
M.2	Effect of Primer Thickness Data, Individual Tensile Lap Shear Specimen Strength at 200°F for Production Batch 0010	M-3

LIST OF TABLES (Continued)

<u>TABLE</u>		<u>PAGE</u>
M.3	Effect of Primer Thickness Data, Individual Tensile Lap Shear Specimen Strength at -65°F for Production Batch 0010	M-4
M.4	Effect of Primer Thickness Data, Individual Tensile Lap Shear Specimen Strength at 75°F for Production Batch 0010.....	M-5
M.5	Effect of Primer Thickness Data, Individual Tensile Lap Shear Specimen Strength at 200°F for Production Batch 0010.....	M-6
M.6	Effect of Primer Thickness Data, Individual Tensile Lap Shear Specimen Strength at -65°F for Production Batch 0010	M-7
M.7	Effect of Primer Thickness Data, Individual Floating Roller Peel Specimen Strength at -65°F for Production Batch 0010	M-8
M.8	Effect of Primer Thickness Data, Individual Floating Roller Peel Specimen Strength at 200°F for Production Batch 0010.....	M-9
M.9	Effect of Primer Thickness Data, Individual Floating Roller Peel Specimen Strength at 75°F for Production Batch 0010.....	M-10
M.10	Effect of Primer Thickness Data, Individual Floating Roller Peel Specimen Strength at 75°F for Production Batch 0010.....	M-11
M.11	Effect of Primer Thickness Data, Individual Floating Roller Peel Specimen Strength at 200°F for Production Batch 0010.....	M-12
M.12	Effect of Primer Thickness Data, Individual Floating Roller Peel Specimen Strength at -65°F for Production Batch 0010	M-13
N.1	Effect of Glueline Thickness Data, Individual Tensile Lap Shear Specimen Strength at 75°F for Production Batch 0010.....	N-2
N.2	Effect of Glueline Thickness Data, Individual Tensile Lap Shear Specimen Strength at 200°F for Production Batch 0010.....	N-3
N.3	Effect of Glueline Thickness Data, Individual Tensile Lap Shear Specimen Strength at -65°F for Production Batch 0010	N-4
N.4	Effect of Glueline Thickness Data, Individual Tensile Lap Shear Specimen Strength at 75°F for Production Batch 0010.....	N-5

LIST OF TABLES (Continued)

<u>TABLE</u>		<u>PAGE</u>
N.5	Effect of Glueline Thickness Data, Individual Tensile Lap Shear Specimen Strength at 200°F for Production Batch 0010.....	N-6
N.6	Effect of Glueline Thickness Data, Individual Tensile Lap Shear Specimen Strength at -65°F for Production Batch 0010	N-7
N.7	Effect of Glueline Thickness Data, Individual Tensile Lap Shear Specimen Strength at 75°F for Production Batch 0010.....	N-8
N.8	Effect of Glueline Thickness Data, Individual Tensile Lap Shear Specimen Strength at 200°F for Production Batch 0010.....	N-9
N.9	Effect of Glueline Thickness Data, Individual Tensile Lap Shear Specimen Strength at -65°F for Production Batch 0010	N-10
N.10	Effect of Glueline Thickness Data, Individual Floating Roller Peel Specimen Strength at -65°F for Production Batch 0010	N-11
N.11	Effect of Glueline Thickness Data, Individual Floating Roller Peel Specimen Strength at 200°F for Production Batch 0010.....	N-12
N.12	Effect of Glueline Thickness Data, Individual Floating Roller Peel Specimen Strength at 75°F for Production Batch 0010.....	N-13
N.13	Effect of Glueline Thickness Data, Individual Floating Roller Peel Specimen Strength at 75°F for Production Batch 0010.....	N-14
N.14	Effect of Glueline Thickness Data, Individual Floating Roller Peel Specimen Strength at 200°F for Production Batch 0010.....	N-15
N.15	Effect of Glueline Thickness Data, Individual Floating Roller Peel Specimen Strength at -65°F for Production Batch 0010	N-16
N.16	Effect of Glueline Thickness Data, Individual Floating Roller Peel Specimen Strength at 75°F for Production Batch 0010.....	N-17
N.17	Effect of Glueline Thickness Data, Individual Floating Roller Peel Specimen Strength at 200°F for Production Batch 0010.....	N-18
N.18	Effect of Glueline Thickness Data, Individual Floating Roller Peel Specimen Strength at -65°F for Production Batch 0010	N-19

LIST OF TABLES (Continued)

<u>TABLE</u>		<u>PAGE</u>
N.19	Effect of Glueline Thickness Data, Individual Floating Roller Peel Specimen Strength at 75°F for Production Batch 0010.....	N-20
N.20	Effect of Glueline Thickness Data, Individual Floating Roller Peel Specimen Strength at 200°F for Production Batch 0010.....	N-21
N.21	Effect of Glueline Thickness Data, Individual Floating Roller Peel Specimen Strength at -65°F for Production Batch 0010	N-22
O.1	Effect of Overlap Length, Individual Tensile Lap Shear Specimen Strength at 75°F for Production Batch 0010.....	O-2
O.2	Effect of Overlap Length, Individual Tensile Lap Shear Specimen Strength at 75°F for EA9394 Adhesive Batch 0010	O-3
O.3	Effect of Overlap Length, Individual Tensile Lap Shear Specimen Strength at 75°F for EA9394 Adhesive Batch 0010	O-4
O.4	Effect of Overlap Length, Individual Tensile Lap Shear Specimen Strength at 75°F for EA9394 Adhesive Batch 0010	O-5
P.1	Effect of 350°F Exposure, Individual Floating Roller Peel Specimen Strength at 75°F for EA9394 Adhesive Batch 0010	P-2
P.2	Effect of 350°F Exposure, Individual Floating Roller Peel Specimen Strength at 200°F for EA9394 Adhesive Batch 0010	P-3
P.3	Effect of 350°F Exposure, Individual Floating Roller Peel Specimen Strength at 75°F for EA9394 Adhesive Batch 0010	P-4
P.4	Effect of 350°F Exposure, Individual Floating Roller Peel Specimen Strength at 200°F for EA9394 Adhesive Batch 0010	P-5
P.5	Effect of 350°F Exposure, Individual Floating Roller Peel Specimen Strength at 75°F for EA9394 Adhesive Batch 0010	P-6
P.6	Effect of 350°F Exposure, Individual Floating Roller Peel Specimen Strength at 200°F for EA9394 Adhesive Batch 0010	P-7
Q.1	Individual EA9394 Adhesive Tensile Lap Shear Strengths at 75°F After Thermal Pulse	Q-2

LIST OF TABLES (Continued)

TABLE		PAGE
Q.2	Individual EA9394 Adhesive Tensile Lap Shear Strengths at 75°F After 30 Days at 140°F and 95-100% R.H. Then Subjected to Thermal Pulse.....	Q-3
Q.3	Individual Autoclave Cured FM300 Adhesive Tensile Lap Shear Strengths at 75°F.....	Q-4
Q.4	Individual Autoclave Cured FM300 Adhesive Tensile Lap Shear Strengths at 75°F After 30 Days at 140°F and 95-100% R.H.....	Q-5
Q.5	Individual Autoclave Cured FM300 Adhesive Tensile Lap Shear Strengths at 75°F After Being Subjected to Thermal Pulse.....	Q-6
Q.6	Individual Autoclave Cured FM300 Adhesive Tensile Lap Shear Strengths at 75°F After 30 Days at 140°F and 95-100% R.H. Then Subjected to Thermal Pulse	Q-7
Q.7	Individual Vacuum Bag Cured FM300 Adhesive Tensile Lap Shear Strengths at 75°F.....	Q-8
Q.8	Individual Vacuum Bag Cured FM300 Adhesive Tensile Lap Shear Strengths at 75°F After 30 Days at 140°F and 95-100% R.H.....	Q-9
Q.9	Individual Vacuum Bag Cured FM300 Adhesive Tensile Lap Shear Strengths at 75°F After Being Subjected to Thermal Pulse.....	Q-10
Q.10	Individual Vacuum Bag Cured FM300 Adhesive Tensile Lap Shear Strengths at 75°F After 30 Days at 140°F and 95-100% R.H. Then Subjected to Thermal Pulse	Q-11
Q.11	Individual EA9394 Adhesive Floating Roller Peel Strengths at 75°F After Thermal Pulse	Q-12
Q.12	Individual EA9394 Adhesive Floating Roller Peel Strengths at 75°F After 30 Days at 140°F and 95-100% R.H. Then Subjected to Thermal Pulse.....	Q-13
Q.13	Individual Autoclave Cured FM300 Adhesive Floating Roller Peel Strengths at 75°F	Q-14

LIST OF TABLES (Continued)

TABLE		PAGE
Q.14	Individual Autoclave Cured FM300 Adhesive Floating Roller Peel Strengths at 75°F After 30 Days at 140°F and 95-100% R.H.	Q-15
Q.15	Individual Autoclave Cured FM300 Adhesive Floating Roller Peel Strengths at 75°F After Thermal Pulse.....	Q-16
Q.16	Individual Autoclave Cured FM300 Adhesive Floating Roller Peel Strengths at 75°F After 30 Days at 140°F and 95-100% R.H. Then Subjected to Thermal Pulse.....	Q-17
Q.17	Individual Vacuum Bag Cured FM300 Adhesive Floating Roller Peel Strengths at 75°F	Q-18
Q.18	Individual Vacuum Bag Cured FM300 Adhesive Floating Roller Peel Strengths at 75°F After 30 Days at 140°F and 95-100% R.H.	Q-19
Q.19	Individual Vacuum Bag Cured FM300 Adhesive Floating Roller Peel Strengths at 75°F After Thermal Pulse.....	Q-20
Q.20	Individual Vacuum Bag Cured FM300 Adhesive Floating Roller Peel Strengths at 75°F After 30 Days at 140°F and 95-100% R.H. Then Subjected to Thermal Pulse.....	Q-21
R.1	Tensile Lap Shear Strength at 75°F Using 7781 Glass/EA9396 Epoxy Adherends, Individual Tensile Lap Shear Specimen Strength for EA9394 Adhesive Batch No. 0010	R-2
R.2	Tensile Lap Shear Strength at 200°F Using 7781 Glass/EA9396 Epoxy Adherends, Individual Tensile Lap Shear Specimen Strength for EA9394 Adhesive Batch No. 0010	R-3
R.3	Tensile Lap Shear Strength at -65°F Using 7781 Glass/EA9396 Epoxy Adherends, Individual Tensile Lap Shear Specimen Strength for EA9394 Adhesive Batch No. 0010	R-4
R.4	Tensile Lap Shear Strength at 75°F Using W133 Graphite/EA9396 Epoxy Adherends, Individual Tensile Lap Shear Specimen Strength for EA9394 Adhesive Batch No. 0010	R-5

LIST OF TABLES (Continued)

<u>TABLE</u>		<u>PAGE</u>
R.5	Tensile Lap Shear Strength at 200°F Using W133 Graphite/EA9394 Epoxy Adherends, Individual Tensile Lap Shear Specimen Strength for EA9394 Adhesive Batch No. 0010.....	R-6
R.6	Tensile Lap Shear Strength at -65°F Using W133 Graphite/EA9394 Epoxy Adherends, Individual Tensile Lap Shear Specimen Strength for EA9394 Adhesive Batch No. 0010.....	R-7
R.7	Tensile Lap Shear Strength at 75°F Using 6-4 Titanium Adherends, Individual Tensile Lap Shear Specimen Strength for EA9394 Adhesive Batch No. 0010.....	R-8
R.8	Tensile Lap Shear Strength at 200°F Using 6-4 Titanium Adherends, Individual Tensile Lap Shear Specimen Strength for EA9394 Adhesive Batch No. 0010.....	R-9
R.9	Tensile Lap Shear Strength at -65°F Using 6-4 Titanium Adherends, Individual Tensile Lap Shear Specimen Strength for EA9394 Adhesive Batch No. 0010.....	R-10
R.10	Tensile Lap Shear Strength at 75°F Using 2024-T3 Aluminum Adherends, Individual Tensile Lap Shear Specimen Strength for EA9394 Adhesive Batch No. 0010.....	R-11
R.11	Tensile Lap Shear Strength at 200°F Using 2024-T3 Aluminum Adherends, Individual Tensile Lap Shear Specimen Strength for EA9394 Adhesive Batch No. 0010.....	R-12
R.12	Tensile Lap Shear Strength at -65°F Using 2024-T3 Aluminum Adherends, Individual Tensile Lap Shear Specimen Strength for EA9394 Adhesive Batch No. 0010.....	R-13
S.1	Effect of PANTA Surface Preparation on Unprimed Aluminum Adherends, Individual Tensile Lap Shear Specimen Strength at 75°F for EA9394 Adhesive, Batch No. 0010.....	S-2
S.2	Effect of PANTA Surface Preparation on Unprimed Aluminum Adherends, Individual Tensile Lap Shear Specimen Strength at 75°F After 30 Days at 140°F and 95-100% R.H. for EA9394 Adhesive, Batch No. 0010.....	S-3

LIST OF TABLES (Continued)

<u>TABLE</u>		<u>PAGE</u>
S.3	Effect of Sanded Surface Preparation on Unprimed Aluminum Adherends, Individual Tensile Lap Shear Specimen Strength at 75°F for EA9394 Adhesive, Batch No. 0010.....	S-4
S.4	Effect of Sanded Surface Preparation on Unprimed Aluminum Adherends, Individual Tensile Lap Shear Specimen Strength at 75°F After 30 Days at 140°F and 95-100% R.H. for EA9394 Adhesive, Batch No. 0010.....	S-5
S.5	Effect of Sanded Surface Preparation on BR 127 Primed Aluminum Adherends, Individual Tensile Lap Shear Specimen Strength at 75°F for EA9394 Adhesive, Batch No. 0010.....	S-6
S.6	Effect of Sanded Surface Preparation on BR 127 Primed Aluminum Adherends, Individual Tensile Lap Shear Specimen Strength at 75°F After 30 Days at 140°F and 95-100% R.H. for EA9394 Adhesive, Batch No. 0010.....	S-7
S.7	Effect of Wet Aging and Sanded Surface Preparation on Unprimed Graphite/EA9396 Epoxy Adherends, Individual Tensile Lap Shear Specimen Strength at 75°F for EA9394 Adhesive, Batch No. 0010.....	S-8
S.8	Effect of Weg Aging and Sanded Surface Preparation on Unprimed Graphite/EA9396 Epoxy Adherends, Individual Tensile Lap Shear Specimen Strength at 75°F After 30 Days at 140°F and 95-100% R.H. for EA9394 Adhesive, Batch No. 0010	S-9
S.9	Effect of Pasa Jell 105 Surface Preparation on Unprimed Aluminum Adherends, Individual Tensile Lap Shear Specimen Strength at 75°F for EA9394 Adhesive, Batch No. 0010.....	S-10
S.10	Effect of Pasa Jell 105 Surface Preparation on Unprimed Aluminum Adherends, Individual Tensile Lap Shear Specimen Strength at 75°F After 30 Days at 140°F and 95-100% R.H. for EA9394 Adhesive, Batch No. 0010	S-11

LIST OF TABLES (Concluded)

<u>TABLE</u>		<u>PAGE</u>
S.11	Effect of PANTA Surface Preparation on Aluminum and Sanded Surface Preparation on Graphite/EA9396 Epoxy Unprimed Adherends, Individual Floating Roller Peel Specimen Strength at 75°F for EA9394 Adhesive, Batch No. 0010.....	S-12
S.12	Effect of PANTA Surface Preparation on Aluminum and Sanded Surface Preparation on Graphite/EA9396 Epoxy Unprimed Adherends, Individual Floating Roller Peel Specimen Strength at 75°F After 30 Days at 140°F and 95-100% R.H. for EA9394 Adhesive, Batch No. 0010.....	S-13

SECTION 1

INTRODUCTION

Developments in the formulation of two-part paste epoxy adhesives have resulted in material systems which exhibit excellent elevated temperature properties when cured at reduced temperature. Reduced temperature curing is advantageous when bonding materials of dissimilar coefficients of expansion. This capability combined with excellent room temperature storability, good pot life, and excellent handleability makes this material of considerable interest for on-aircraft field repair operations. This program was conducted to obtain design allowable type data for Hysol EA9394 paste adhesive to be applied to aircraft repair.

SECTION 2

CONTROL DATA

Control data were obtained from three production batches of Hysol EA9394 A/B paste adhesive. Part A batches were 0010, 9199, and 0204. Part B batches were 0010, 9172-1, and 0204. Testing included: tensile lap shear (ASTM D 1002), floating roller peel (ASTM D 3167), honeycomb sandwich flatwise tension (ASTM C 297), and honeycomb sandwich climbing drum peel (ASTM D 1781). Tests were conducted at -65°F, 75°F, and 200°F on specimens that were in the dry, as-fabricated condition. The data from these control data tests were used as the basis for comparison of all other test data unless specifically noted in the appropriate test discussion. Criteria for materials, processes and techniques used in preparation of specimens for control data testing are listed below. Any deviations from these criteria are described in the appropriate section of this report.

- Adherend alloy: 2024 T3 bare aluminum,
- Surface preparation: phosphoric acid anodize per ASTM D 3933
- Adhesive primer: American Cyanamid's BR 127
- Primer thickness and cure: 0.0002 inch, cured 30 minutes at 75°F followed by 60 minutes at 250°F
- Bondline control: 0.15 mm dia. glass beads, 0.5% by wt. of Part A
- The test chamber temperature for -65°F and 200°F tests was stabilized for 45 minutes prior to inserting the specimen into the grips. The specimen was held at the test temperature for 10 minutes prior to testing to insure temperature equilibration. All temperatures were monitored by a thermocouple in close proximity to the adhesive joint being tested.
- All test specimens were cut from larger panels fabricated in accordance with appropriate criteria. Specimens for a particular test group were selected at random from several panels to assure test integrity.

Curing conditions were established based upon the manufacturer recommended cure cycle and the realities of field level repair operations. Hysol recommended 7 days at room temperature or 1 hour at 200°F. A 7-day cure cycle was considered to be unreasonably long for repair operations. 200°F is considered to be a practicable maximum for field level repair. Therefore, 190°F ± 10°F was established as the baseline cure temperature for this program. The cure time was established at 2 hours to insure that adhesive that only reached 180°F would be sufficiently cured. The criteria for

curing the various types of test specimens was established to assure worst case mechanical properties. It was independently determined that lower lap shear strength was obtained for a 180°F cure than for a 200°F cure while the reverse was true for peel strength. Consequently, lap shear specimens were cured at 180°F, and peel specimens were cured at 200°F.

It is widely known that the mixing process for two-part paste adhesives causes considerable air to be mixed into the adhesive blend. This mixed-in air usually results in higher levels of porosity for paste adhesive than for film adhesives. When paste adhesives are exposed to heat and/or vacuum the tiny mixed-in air bubbles expand, causing the porosity to increase. Some low viscosity adhesives can be vacuum degassed to eliminate the mixed-in air. Observations of the Hysol EA9394 adhesive have shown that as vacuum is increased the mixed-in air bubbles expand slowly until the bubble internal pressure overcomes the adhesive viscosity effects. At this point the bubble size increases dramatically with higher vacuum. It was also noted that at the maximum attainable vacuum the bubbles did not escape the adhesive. This phenomenon results in the generation of extremely high porosity at the free edges of bonded joints (or panels) that are cured under high vacuum. The porosity was observed to decrease as distance from the free edge increased. At distances greater than approximately 3/4-inch from a free edge the adhesive porosity did not vary further. This phenomenon had little effect on the fabrication of the large panels required to generate peel specimens because the panel edge pieces were discarded after the machining process. The preparation of tensile lap shear specimens, however, is greatly affected because the bond line has only a 1/2-inch overlap. Solutions for reducing the porosity in the bondline and recovering lap shear strength include reduced vacuum and positive pressure. A positive pressure of 20 psi was selected for this study. Tensile lap shear and floating roller peel data illustrating the affect of this phenomenon are summarized in Tables 1 and 2.

2.1 TENSILE LAP SHEAR CONTROL DATA

All specimens were fabricated in accordance with ASTM D 1002 and the criteria listed above. Adhesive curing conditions were 180°F for 2 hours with 20 psi positive pressure. Specimen width, overlap length, bondline thickness, failure load, and failure mode were recorded. Ten replicates were tested for each condition.

The tensile lap shear control data are summarized in Table 3. A complete listing of all tensile lap shear control data is included as Appendix A.

TABLE 1
TENSILE LAP SHEAR STRENGTHS FOR EA9394
ADHESIVE VS. PROCESSING TECHNIQUES

Pressure Application	Bondline Pressure		Tensile Lap Shear Strength 75°F (psi)
	(in-Hg)	(psi)	
Vacuum Bag	27	---	3134
Vacuum Bag	24	---	2600
Vacuum Bag	21	---	4183
Vacuum Bag	13	---	4194
Vacuum Bag	7	---	4244
Positive Pressure	---	5	4503
Positive Pressure	---	10	4127
Positive Pressure	---	14.7	4552
Positive Pressure	---	20	4247

TABLE 2
FLOATING ROLLER PEEL STRENGTHS PROCESSED
IN FULL VACUUM VS. POSITIVE PRESSURE

Test Temperature	Floating Roller Peel (pli)	
	Full Vacuum (27 in.Hg)	Positive Pressure (20 psi)
75°F	12.8	10.8
-65°F	9.2	8.7
200°F	12.1	13.7
Edge @ 75°F	13.1	10.9
Center @ 75°F	11.5	10.4

TABLE 3
TENSILE LAP SHEAR STRENGTH CONTROL DATA
FOR THREE PRODUCTION BATCHES OF EA9394 ADHESIVE

Adhesive Batch Number		Tensile Lap Shear Strength (psi)		
		-65°F	75°F	200°F
0100	Avg.	4203	4294	3081
	S.D.	102	138	72
9199	Avg.	4000	4311	3016
	S.D.	117	171	58
0204	Avg.	4377	5189	3352
	S.D.	149	127	71
Overall Avg.		4193	4598	3150

2.2 FLOATING ROLLER PEEL CONTROL DATA

All floating roller peel control specimens were fabricated in accordance with ASTM D 3167 and the aforementioned criteria. Adhesive cure was accomplished at 200°F for 2 hours with full vacuum. Specimen width, overlap length, bondline thickness, failure load, and failure mode were recorded. Five replicates were tested for each test condition.

Floating roller peel control data are summarized in Table 4. A complete listing of all floating roller peel control data is included as Appendix B.

2.3 HONEYCOMB SANDWICH FLATWISE TENSION CONTROL DATA

All honeycomb sandwich flatwise tensile control specimens were fabricated in accordance with ASTM C 297 and the criteria listed above. The honeycomb core was Hexcel 1/4-5052-7.9 aluminum. The glass beads were not expected to provide bondline control but were included to keep the adhesive consistent with other tests. The adhesive cure was accomplished at 2 hours at 200°F under full vacuum for 2 hours. Five replicates were tested for each condition. Aluminum loading blocks were bonded to the specimen at room temperature using Hysol EA9320. Specimen dimensions, failure load, and failure mode were recorded.

TABLE 4
FLOATING ROLLER PEEL STRENGTH CONTROL DATA
FOR THREE PRODUCTION BATCHES OF EA9394 ADHESIVE

Adhesive Batch Number		Floating Roller Peel Strength (pli)		
		-65°F	75°F	200°F
0100	Avg.	7.3	9.9	10.7
	S.D.	0.7	2.4	1.3
9199	Avg.	9.8	12.7	11.9
	S.D.	1.5	2.9	0.7
0204	Avg.	5.6	7.3	8.5
	S.D.	0.8	1.9	1.5
Overall Avg.		7.6	10.0	10.4

Honeycomb sandwich flatwise tension control data are summarized in Table 5. A complete listing of all honeycomb sandwich flatwise tension control data is included as Appendix C.

TABLE 5
HONEYCOMB SANDWICH FLATWISE TENSILE STRENGTH CONTROL DATA
FOR THREE PRODUCTION BATCHES OF EA9394 ADHESIVE

Adhesive Batch Number		Honeycomb Sandwich Flatwise Tensile Strength (psi)		
		-65°F	75°F	200°F
0100	Avg.	771	770	472
	S.D.	54	43	37
9199	Avg.	1162	975	685
	S.D.	41	32	36
0204	Avg.	1093	1185	760
	S.D.	22	26	18
Overall Avg.		1009	977	639

2.4 HONEYCOMB SANDWICH CLIMBING DRUM PEEL CONTROL DATA

All honeycomb sandwich climbing drum peel control specimens were fabricated in accordance with ASTM D 1781, and the above criteria. The honeycomb core was Hexcel 1/4-5052-7.9 aluminum. Glass beads were incorporated in the adhesive as for the other control data tests. The adhesive was cured at 200°F for 2 hours under a full vacuum. Five replicates were tested for each test condition. Specimen dimensions, failure load, and failure mode were recorded.

Honeycomb sandwich climbing drum peel control data are summarized in Table 6. A complete listing of all honeycomb sandwich climbing drum peel control data is included as Appendix D.

TABLE 6
HONEYCOMB SANDWICH CLIMBING DRUM PEEL STRENGTH
CONTROL DATA FOR THREE PRODUCTION BATCHES OF EA9394 ADHESIVE

Adhesive Batch Number		Honeycomb Sandwich Climbing Drum Peel Strength (in-lbs/in)		
		-65°F	75°F	200°F
0100	Avg.	8.4	10.5	7.4
	S.D.	2.3	1.2	0.7
9199	Avg.	7.5	10.6	6.9
	S.D.	2.0	2.3	0.4
0204	Avg.	7.4	12.2	8.0
	S.D.	1.6	1.2	0.8
Overall Avg.		7.8	11.1	74.3

SECTION 3

HUMIDITY EXPOSURE

Tensile lap shear, floating roller peel, honeycomb sandwich flatwise tension, and honeycomb sandwich climbing drum peel tests were conducted after humidity exposure to determine property degradation caused by absorbed moisture. Humidity exposure was for 30 days at 140°F and 95-100% relative humidity. All aspects of the fabrication and testing of the specimens exposed to humidity were identical to those used with the control data specimens with one minor exception. The soak time at temperature was reduced from 10 minutes to 4 minutes for all -65°F and 200°F tests to minimize dryout. All data generated for humidity aged specimens can be compared directly to the control data of Section 2 to obtain degree of degradation.

All humidity exposure specimens were tested as soon as possible after removal from the exposure chamber. All specimens were held in plastic bags with wet towels during the period from chamber removal to test. The tensile lap shear data are summarized in Table 7 and included in detail in Appendix E. Floating roller peel data are presented in Table 8 and Appendix F. Honeycomb sandwich flatwise tension data are presented in Table 9 and Appendix G. Honeycomb climbing drum peel data are presented in Table 10 and Appendix H. Control data are also included to facilitate comparison.

TABLE 7
EFFECT OF HUMIDITY EXPOSURE ON TENSILE LAP SHEAR STRENGTH
FOR THREE PRODUCTION BATCHES OF EA9394 ADHESIVE

Adhesive Batch Number		Tensile Lap Shear Strength (psi)					
		-65°F		75°F		200°F	
		Dry (1)	Wet (2)	Dry (1)	Wet (2)	Dry (1)	Wet (2)
0010	Avg.	4203	4798	4294	4060	3081	2425
	S.D.	102	129	138	106	72	41
9199	Avg.	4000	4526	4311	3957	3016	2458
	S.D.	117	150	171	67	58	35
0204	Avg.	4377	4522	5189	4974	3352	3099
	S.D.	149	172	127	106	71	33
Overall Avg.		4193	4615	4598	4330	3150	2660

- (1) Dry data are control data from Section 2.
(2) Wet data are for 30-day aging at 140°F and 95-100% R.H.

TABLE 8
EFFECT OF HUMIDITY EXPOSURE ON FLOATING ROLLER PEEL STRENGTH
FOR THREE PRODUCTION BATCHES OF EA9394 ADHESIVE

Adhesive Batch Number		Floating Roller Peel Strength (pli)					
		-65°F		75°F		200°F	
		Dry (1)	Wet (2)	Dry (1)	Wet (2)	Dry (1)	Wet (2)
0010	Avg.	7.3	9.3	9.9	11.7	10.7	7.8
	S.D.	0.7	2.7	2.4	2.5	1.3	2.1
9199	Avg.	9.8	5.9	12.7	11.8	11.9	10.2
	S.D.	1.5	0.5	2.9	1.7	0.7	0.9
0204	Avg.	5.6	2.6	7.3	6.3	8.5	6.4
	S.D.	0.8	0.5	1.9	0.9	1.5	1.0
Overall Avg.		7.6	5.9	10.0	9.9	10.4	8.1

- (1) Dry data are control data from Section 2.
(2) Wet data are for 30-day aging at 140°F and 95-100% R.H.

TABLE 9
EFFECT OF HUMIDITY EXPOSURE ON HONEYCOMB SANDWICH
FLATWISE TENSION STRENGTH
FOR THREE PRODUCTION BATCHES OF EA9394 ADHESIVE

Adhesive Batch Number		Honeycomb Sandwich Flatwise Tension Strength (psi)					
		-65°F		75°F		200°F	
		Dry (1)	Wet (2)	Dry (1)	Wet (2)	Dry (1)	Wet (2)
0010	Avg.	771	621	770	505	472	357
	S.D.	54	27	43	23	37	14
9199	Avg.	1162	586	975	533	685	289
	S.D.	41	25	32	20	36	13
0204	Avg.	1093	600	1185	619	760	349
	S.D.	22	19	26	21	18	14
Overall Avg.		1009	602	977	552	639	332

- (1) Dry data are control data from Section 2.
- (2) Wet data are for 30-day aging at 140°F and 95-100% R.H.

TABLE 10
EFFECT OF HUMIDITY EXPOSURE ON HONEYCOMB SANDWICH
CLIMBING DRUM PEEL STRENGTH FOR THREE PRODUCTION
BATCHES OF EA9394 ADHESIVE

Adhesive Batch Number		Honeycomb Sandwich Climbing Drum Peel (in·lbs/in)	
		75°F Dry (1)	75°F Wet (2)
0010	Avg.	10.5	9.1
	S.D.	1.2	0.7
9199	Avg.	10.6	9.0
	S.D.	2.3	1.1
0204	Avg.	12.2	9.9
	S.D.	1.2	0.4
Overall Avg.		11.1	9.33

- (1) Dry data are control data from Section 2.
- (2) Wet data are for 30-day aging at 140°F and 95-100% R.H.

SECTION 4

TENSILE LAP SHEAR STRESS DURABILITY

Tensile lap shear stress durability per ASTM D 2919 was determined on EA9394 adhesive, Batch No. 0010, at 120°F and 95-100% R.H. The dry tensile lap shear strength was determined at 120°F, then six specimens were subjected to 60% of that stress in the humid environment until failure. The tensile lap shear specimens used for stress durability are fabricated according to ASTM D 1002 except the adherend length is 5 inches rather than 4 inches. The materials and fabrication procedures were identical to those used in fabricating the control test specimens (see Section 2).

Seven tensile lap shear specimens were tested at 120°F. Each specimen was soaked at temperature for 10 minutes prior to testing. The average tensile strength measured was 3926 psi and the standard deviation was ± 154 psi. Six tensile lap shear specimens were placed in the ASTM D 2919 durability fixtures and loaded to 2356 psi (60%). The stress durability fixture was then placed in the humidity cabinet and monitored daily. Elapsed time to failure was recorded.

The creep durability results are shown in Table 11. The individual test specimen static lap shear strength results at 120°F dry are shown in Appendix I, along with specimen dimensions and failure modes.

TABLE 11
STRESS DURABILITY OF EA9394 ADHESIVE PER ASTM D 2919
AT 120°F AND 95-100% R.H.

Tensile Shear Stress (psi)	Time to Failure (days)
2356	18
2356	31
2356	63
2356	77
2356	90
2356	124

SECTION 5

STORAGE LIFE

One critical property for any field repair adhesive is room temperature storage life. While reduced temperature storage is commonplace in factory or depot operations, it presents significant problems for many field repair operations. Additionally many field activities are conducted in tropical or desert climates. Room temperature storage can often occur at temperatures exceeding 100°F.

Viscosity and tensile lap shear strength were determined to be appropriate indicators of storage life along with workability. Storage temperatures of 75°F, 100°F and 120°F were selected to represent a reasonable range of field storage temperatures. Viscosity measurements were obtained using a Brookfield viscometer model RVF. Tensile lap shear specimens were fabricated in accordance with the criteria listed in Section 2 and tested in accordance with ASTM D 1002. Test results are summarized in Table 12. A complete listing of all data is included as Appendix J.

TABLE 12
EFFECT OF LONG TERM STORAGE AT VARIOUS
TEMPERATURES ON THE TENSILE LAP SHEAR STRENGTH
AND VISCOSITY OF EA9394 ADHESIVE

Storage Temperature	Storage Time	Viscosity, poise		Tensile Lap Shear Strength (psi) (1)	
		Part 'A'	Part 'B'	75°F	200°F
Initial	0	10,820	540	4026	3192
75°F	1 mo.	12,100	650	---	---
	6 mos.	13,340	566	---	---
	9 mos.	11,820	684	---	---
	12 mos.	11,940	710	4237	3563
	18 mos.	12,100	728	4102	3127
	24 mos.	12,360	752	5431	3699
	30 mos.	12,900	764	4819	3610
100°F	1 mo.	11,100	634	---	---
	6 mos.	11,300	768	---	---
	9 mos.	12,140	702	---	---
	12 mos.	12,900	730	4254	3511
	18 mos.	13,400	766	4208	3077
	24 mos.	---	818	---	---
120°F	1 mo.	13,260	663	---	---
	6 mos.	12,940	818	---	---
	9 mos.	13,440	880	---	---
	12 mos.	15,160	868	4228	3312
	18 mos.	Solid	898	---	---

- (1) Specimens fabricated into lap shear specimens using adhesive that had been stored at the indicated temperature for the indicated time.

SECTION 6

POT LIFE

Pot life or work life is an important property when considering field repair adhesives. It is important to know how much time is available after the two-part paste is mixed for adhesive application, part fit up, application of vacuum bag (or other pressure application devices), heat-up, etc. The manufacturer specified pot life of 100 minutes at 75°F for a 450 gram sample was verified by tensile lap shear and floating roller peel testing along with observations of workability and flow during cure. Test specimens were fabricated exactly as the control data specimens using batch 0010 except the time lapse between adhesive application and panel assembly was extended and noted. Ambient temperatures of 75°F and 100°F were tested knowing that many repair operations take place at temperatures above 75°F. Tensile lap shear testing was in accordance with ASTM D 1002. Five replicates were tested at 75°F and 200°F. Floating roller peel testing was in accordance with ASTM D 3167. Five replicates were tested at -67°F, 75°F, and 200°F.

The EA9394 adhesive maintained some tack for 270 minutes at 75°F but, once assembled and cured, very little flow was observed. But, once assembled and cured, very little flow as observed. Panels fabricated after an open assembly time of 150 minutes at 75°F also had reduced flow, but was sufficient to yield tensile lap shear strengths similar to the control data. The floating roller peel strengths were much higher than the control data. This is due, at least in part, to the glue line thickness which is much higher than the control, which is due to the reduced flow. Typically bonds having thick bondlines have an apparent higher floating roller peel strength than thin bondlines.

Pot life verification test data are summarized in Tables 13 and 14. A complete listing of all data is included as Appendix K.

TABLE 13
EFFECT OF POT LIFE ON TENSILE LAP
SHEAR STRENGTH OF EA9394 ADHESIVE

Open Assembly Time (1)	Tensile Lap Shear Strength (psi)	
	75°F	200°F
Control	5189	3352
150 mins. at 75°F	5247	3348
200 mins. at 75°F	2230	1586
270 mins. at 75°F	2215	---
60 mins. at 100°F	4864	3223
80 mins. at 100°F	4017	3006

- (1) Adhesive was mixed, then applied to adherends but adherends were not assembled until after the indicated time and temperature had elapsed.

TABLE 14
EFFECT OF POT LIFE ON FLOATING ROLLER
PEEL STRENGTH OF EA9394 ADHESIVE

Open Assembly Time (1)	Floating Roller Peel Strength (pli)		
	-65°F	75°F	200°F
Control	5.6	7.3	8.5
150 mins. at 75°F	14.8	19.3	6.6
200 mins. at 75°F	5.8	4.0	2.0
270 mins. at 75°F	---	---	---
60 mins. at 100°F	5.3	2.7	2.3
80 mins. at 100°F	4.0	2.4	1.4

- (1) Adhesive was mixed, then applied to adherends but adherends were not assembled after the indicated time and temperature elapsed.

SECTION 7 GLASS TRANSITION TEMPERATURE DETERMINATION

The glass transition temperature (T_g) for both dry and moisture saturated Hysol EA9394 paste adhesive was determined by means of dynamic mechanical analysis (DMA). Neat resin moisture gain determinations were also made in conjunction with the T_g measurements. Samples from the three production batches used in the control data tests were cured at 180°F (tensile lap shear specimen cure temperature) and 200°F (peel and flatwise tension specimen cure temperature). Samples were tested in the as cured (dry) condition and after saturation at 140°F and 95 to 100% relative humidity. Three replicates for each condition were tested. Weight gain and T_g data are summarized in Table 15. Complete data listings are included as Appendix L.

TABLE 15
GLASS TRANSITION TEMPERATURE OF EA9394

Adhesive Batch No.	T _g After 200°F Cure		T _g After 180°F Cure		% Weight Gain	
	Dry (°F)	Wet (°F)	Dry (°F)	Wet (°F)	200°F Cure	180°F Cure
0010	316	231	279	241	5.6	5.2
9199	325	246	311	244	4.7	4.9
0204	342	262	334	264	5.0	5.3

SECTION 8

MISCELLANEOUS EFFECTS

In considering a two-part paste adhesive for field level structural repair operations, several effects, many of which are well understood for film adhesives, must be considered. Due to the complications and uncertainties of on-aircraft field level repair, many design and processing variables cannot be controlled as stringently as is possible in factory or depot operations. This section discusses the effects of several variables deemed to be significant in field repair operations.

8.1 PRIMER THICKNESS

Primer thickness is known to have significant effects on mechanical properties and failure modes of structural adhesive bonds. Since primer thickness control is more difficult in field repair operations and since it is more likely that the primer will be applied too thick rather than too thin, tests were conducted to determine the effect a primer layer that was thicker than the 0.0002 inch optimum. Hysol EA9394 Batch 0010 was used for these tests. The materials processes and criteria described for the control data tests were used in the preparation of the specimens for these tests with the exception of primer thickness. Tensile lap shear (ASTM D 1002) and floating roller peel (ASTM D 3167) tests were conducted at -67°F, 75°F, and 200°F using primer thicknesses of 0.0002 inch (control) and 0.0006 inch. Five replicates per test condition were tested.

Test results are summarized in Table 16. Complete data listings are included in Appendix M.

8.2 BONDLINE THICKNESS

Bondline thickness control is an important facet of adhesive bond joint preparation. Classically, lap shear strength decreases and peel strength increases with increasing bondline thickness. Tensile lap shear and floating roller peel tests were conducted at -67°F, 75°F, and 200°F using specimens fabricated from EA9394 Batch 0010 both thin and thick bondlines. The test results were compared to the control data. All specimens were fabricated and tested identically with the control data tests, with the exception of bondline thickness. Test results are summarized in Table 17. A complete listing of all test data is included as Appendix N.

TABLE 16
EFFECT OF BR 127 ADHESIVE PRIMER THICKNESS
UPON TENSILE LAP SHEAR AND FLOATING ROLLER
PEEL STRENGTHS OF EA9394 ADHESIVE

Test Temperature (°F)	Tensile Lap Shear Strength (psi)	
	0.2 mils Control	0.6 mil
-65	4203	4583
75	4294	4209
200	3081	3022
	Floating Roller Peel Strength (pli)	
-65	7.3	3.2
75	9.9	2.8
200	10.7	1.9

TABLE 17
EFFECT OF BONDLINE THICKNESS ON TENSILE
LAP SHEAR AND FLOATING ROLLER
PEEL STRENGTHS OF EA9394 ADHESIVE

Bondline Thickness (inch)	Tensile Lap Shear Strength (psi)		
	-65°F	75°F	200°F
0.001	4853	5401	3740
0.007*	4203	4294	4020
0.017	3740	3081	3120
	Floating Roller Peel Strength (pli)		
0.004	12.9	7.3	15.0
0.010*	12.5	9.9	14.5
0.021	10.4	10.7	8.4

* Control data.

8.3 OVERLAP LENGTH

Single lap shear tests were conducted using EA9394 Batch 0010 to determine the effect of overlap length. Tests were conducted at 75°F on specimens fabricated exactly the same as the control data specimens except overlap length (and total specimen length) were increased as noted. Test results are summarized in Table 18. Complete test results are included as Appendix O.

TABLE 18
EFFECT OF OVERLAP LENGTH ON TENSILE
LAP SHEAR STRENGTH OF EA9394 ADHESIVE

Overlap Length (inches)	Tensile Lap Shear Strength (psi)
0.5*	4294
1.0	3486
1.5	2372
2.0	1817

* Control data.

8.4 350°F EXPOSURE

It is not uncommon that a part previously repaired in the field might be returned to the depot for a repair action separate from the field repair. Depot repair is normally conducted in an autoclave using 350°F curing materials because of their superior mechanical and physical properties. This depot repair operation would result in the field repair being exposed to 350°F for some period of time during the subsequent operation. Tests were conducted to determine what effect 350°F exposure might have on EA9394 Batch 0010 cured at 200°F. Floating roller peel tests were conducted at 75°F and 200°F after 350°F exposure for 2 hours and 16 hours. Specimens were fabricated and tested exactly the same as the control data specimens. Five replicates were tested at each condition. Test data are summarized in Table 19. Complete test results are included in Appendix P.

TABLE 19
EFFECT OF HIGH TEMPERATURE EXPOSURE ON FLOATING
ROLLER PEEL STRENGTH OF EA9394 ADHESIVE

Temperature Exposure	Floating Roller Peel Strength	
	75°F (pli)	200°F (pli)
Control	9.9	10.6
2 hours at 350°F	8.4	4.6
16 hours at 350°F	4.2	1.7

8.5 THERMAL PULSE

Military combat aircraft are designed for exposure to various weapons effects. Both conventional and special weapons can impose thermal pulses of considerable intensity for a brief time. It is important to know if field installed bonded patches can withstand this exposure. Tensile lap shear and floating roller peel tests were conducted on specimens fabricated with EA9394 Batch 0010 after exposure to a typical thermal pulse. Since this type test is not normally conducted for adhesives, identical tests were conducted using FM300K film adhesive to create a more meaningful baseline. Tests were conducted on as-fabricated and on specimens that had been exposed to a hot/humid environment of 140°F and 95-100% RH for 30 days. The EA9394 specimens were fabricated and tested exactly the same as the control data and humidity exposure specimens. The FM300K specimens were fabricated in accordance with ASTM D 1002 using the materials and processes specified for the EA9394 specimens except that two cure techniques were used. FM300K specimens were cured in an autoclave at 350°F and 25 psi plus vacuum to simulate manufacturing operations and at 350°F under vacuum only to simulate repair operations. The only other deviation from the control data tests was that the thermal pulse exposure specimens were painted to simulate actual military surface finish. Specimen painting was accomplished using MIL-P-23377 epoxy/polyamide primer and MIL-C-83286 polyurethane topcoat Color No. 36018. Paint and primer application and thickness were typical of military combat aircraft. Only that side of each specimen that was to be exposed to the thermal pulse was painted. The floating roller peel specimen was exposed with both the thin adherend and the thick adherend toward the thermal pulse. Only that floating roller peel data for the thick adherend toward the pulse are reported since all of the specimens exposed with the thin side toward

the pulse delaminated and could not be tested. Test results are summarized in Table 20. Complete test results are included in Appendix Q.

TABLE 20
EFFECT OF THERMAL PULSE ON EA9394 AND
FM300K REPAIR ADHESIVES

Adhesive	Type Cure	Tensile Lap Shear (psi)				Floating Roller Peel (pli)			
		Control		After Pulse		Control		After Pulse	
		Dry	Wet(1)	Dry	Wet(1)	Dry	Wet(1)	Dry	Wet(1)
EA9394	Standard	4203	4798	4773	3658	7.3	9.3	9.4	9.9
FM300	Autoclave	4494	4423	4158	4832	31.0	32.8	32.7	32.5
FM300	Vacuum Bag	4252	4337	3769	4051	28.4	28.2	32.4	35.2

(1) After 30 days exposure to 140°F and 95-100% R.H.

8.6 COMPOSITE ADHERENDS

The characterization of EA9394 adhesive is directed toward repair of military aircraft. Therefore, it is likely that it would be used with adherends other than aluminum. Both titanium and reinforced composites are candidates. Hysol's EA9396 epoxy resin has also been characterized for a candidate repair resin and was chosen for the matrix to be used with both glass and graphite cloth reinforcements. The following lists the adherend materials, surface preparations, and primer combinations:

Adherend Material	Surface Preparation	Primer
7781 Glass/EA9396 Epoxy	Light sanding and solvent wipe	None
W133 Graphite/EA9396 Epoxy	Light sanding and solvent wipe	None
6-4 Titanium	Pasa Jell 107	BR 127
2024 T3 Bare Aluminum	Phosphoric acid anodize	BR 127

The following lists the physical properties of the composite fabricated:

Reinforcement	Sizing	No. of Plies	Thickness		% Fiber Volume	% Void Volume
			(cm)	(inches)		
7781 Glass	A1100	8	0.168	0.066	56.4	1.96
W133 Graphite	Epoxy	4	0.145	0.057	59.2	4.18

The panels were fabricated using the same procedures used to obtain the tensile lap shear control data previously reported. Ten specimens were tested at -65°F, 75°F, and 200°F using EA9394 Batch 0010. Test results are summarized in Table 21. Complete test results are included in Appendix R.

TABLE 21
TENSILE LAP SHEAR STRENGTH USING VARIOUS ADHEREND
MATERIALS AND EA9394 ADHESIVE

Adherend Material	Tensile Lap Shear Strength (psi)		
	-65°F	75°F	200°F
7781 Glass/Epoxy	2334	2095	1755
W133 Graphite/Epoxy	3566	4117	2866
6-4 Titanium	2981	3578	2318
2024 T3 Aluminum	4203	4294	3081

8.7 SURFACE PREPARATION

In particular for field repair, phosphoric acid anodize (PAA) tank surface preparation and the use of corrosion inhibiting primers may be impractical or impossible. A non-tank PAA (PANTA) surface preparation per AFML-TR-77-206, scuff sand with 3M Scotchbrite general purpose pad No. 7447, and Pasa Jell 105 were used to prepare test panels. The bonded panels were cured using the same conditions as that for control data. Tensile lap shear and floating roller peel tests were conducted at 75°F. Test results are summarized in Table 22. Complete test results are included in Appendix S.

TABLE 22
EFFECT OF SURFACE PREPARATION AND NON-PRIMED
SURFACE ON MECHANICAL PROPERTIES

Test Type	Adherend Material	Surface Preparation	Primer	Pre-Test Aging	Strength (psi)
Lap Shear	Al/Al	PANTA (1)	None	None Wet (5)	4787 4489
Lap Shear	Al/Al	Sanded (2)	None	None Wet (5)	1524 1454
Lap Shear	Al/Al	Sanded (2)	BR 127	None Wet (5)	2861 2196
Lap Shear	Al/Al	Pasa Jell 105	None	None Wet (5)	4772 3727
Lap Shear	Gr/Gr (3)	Wet Aged (5) & Sanded	None	None Wet (5)	1823 1727
					PLI
Peel	Gr(3)/Al(4)	Gr-sanded Al-PANTA (1)	None None	None Wet (5)	15.2 13.1

NOTES:

- (1) Non-tank PAA.
- (2) With red Scotchbrite.
- (3) W133 Cloth/EA9396, 4 ply.
- (4) Flexible adherend (0.020).
- (5) 30 days at 140°F and 95-100% R.H.

SECTION 9

CONCLUSIONS

This effort was directed toward the characterization of the Hysol EA9394 two-part paste adhesive as a field level repair adhesive for military aircraft. Test results and appropriate conclusions resulting from this program are as follows:

1. The EA9394 paste adhesive cured at $190 \pm 10^{\circ}\text{F}$ exhibits excellent shear strength at -67°F to 200°F . Strength retention after humidity exposure is also excellent.
2. EA9394 peel strength is relatively low when compared to high temperature film adhesives such as FM300. However, peel strength retention is good at low and high temperatures as well as after humidity exposure.
3. The tensile lap shear strength (ASTM D 1002) properties are affected by the vacuum level applied during vacuum bag curing; higher vacuum levels increased porosity and reduced lap shear strength. This effect of high vacuum appears to be limited to specimen edges, so it caused the reduction in shear strengths while leaving peel unaffected. Positive pressure application and reduced vacuum levels were two methods found to reduce porosity and recover lap shear strength.
4. The Hysol recommended storage shelf life of 1 year at room temperature has been verified with considerable margin. A 75°F storage life of over 2 years was demonstrated during testing on this program. One year storage life at 120°F was demonstrated. It appears that if the material has sufficient viscosity to allow proper mixing of the two parts it is usable as a repair adhesive.
5. The Hysol recommended pot life of 100 minutes at 75°F is considered to be valid.
6. The relatively low peel strength of 200°F -cured EA9394 adhesive was reduced by a significant amount after exposure at 350°F .
7. Exposure of EA9394 bonded joints to thermal pulses was examined briefly. The resistance of the bonded joint system appears to be heavily dependent upon the thickness of the metal adherend exposed to the pulse. In both lap shear and peel strengths, the EA9394 performed as well as the control film adhesive.

APPENDIX A

RESULTS OF INDIVIDUAL TEST SPECIMENS
FOR TENSILE LAP SHEAR CONTROL DATA

TABLE A.1
CONTROL DATA, INDIVIDUAL TENSILE LAP SHEAR SPECIMEN
STRENGTH AT 75°F FOR PRODUCTION
BATCH 0010

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A23-14-2	4063	0.006	Adhesive-primer to metal
RB1B-A23-14-7	4016	0.005	Adhesive-primer to metal
RB1B-A23-15-4	4208	0.006	Adhesive-primer to metal
RB1B-A23-16-1	3845	0.008	Cohesive-in adhesive
RB1B-A23-16-5	4568	0.007	Adhesive-primer to metal
RB1B-A23-17-6	4462	0.005	Adhesive-primer to metal
RB1B-A23-20-3	4899	0.006	Adhesive-primer to metal
RB1B-A23-29-4	4213	0.006	Adhesive-primer to metal
RB1B-A23-33-3	4379	0.005	Adhesive-primer to metal
RB1B-A23-33-7	4289	0.005	Adhesive-primer to metal
Average	4294		
Std. Dev.	138		

TABLE A.2
CONTROL DATA, INDIVIDUAL TENSILE LAP SHEAR SPECIMEN
STRENGTH AT 200°F FOR PRODUCTION
BATCH 0010

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A23-14-1	2966	0.007	Cohesive-in Adhesive
RB1B-A23-15-6	2988	0.006	Cohesive-in Adhesive
RB1B-A23-16-7	3019	0.006	Cohesive-in Adhesive
RB1B-A23-17-1	2946	0.007	Cohesive-in adhesive
RB1B-A23-17-4	3090	0.006	Cohesive-in Adhesive
RB1B-A23-20-2	3051	0.006	Cohesive-in Adhesive
RB1B-A23-20-7	3112	0.006	Cohesive-in Adhesive
RB1B-A23-29-6	3222	0.005	Cohesive-in Adhesive
RB1B-A23-33-2	3254	0.005	Cohesive-in Adhesive
RB1B-A23-33-6	3146	0.005	Cohesive-in Adhesive
Average	3081		
Std. Dev.	72		

TABLE A.3
 CONTROL DATA, INDIVIDUAL TENSILE LAP SHEAR SPECIMEN
 STRENGTH AT -65°F FOR PRODUCTION
 BATCH 0010

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A23-14-4	4273	0.005	Adhesive-primer to metal
RB1B-A23-15-2	4207	0.006	Adhesive-primer to metal
RB1B-A23-15-7	4257	0.006	Adhesive-primer to metal
RB1B-A23-16-4	4330	0.005	Adhesive-primer to metal
RB1B-A23-17-2	3953	0.006	Cohesive-in Adhesive
RB1B-A23-20-4	4419	0.006	Adhesive-primer to metal
RB1B-A23-20-6	3883	0.008	Cohesive-in Adhesive
RB1B-A23-29-1	4188	0.007	Adhesive-primer to metal
RB1B-A23-29-3	4281	0.006	Adhesive-primer to metal
RB1B-A23-33-5	4233	0.005	Adhesive-primer to metal
Average	4203		
Std. Dev.	102		

TABLE A.4
CONTROL DATA, INDIVIDUAL TENSILE LAP SHEAR SPECIMEN
STRENGTH AT -65°F FOR PRODUCTION
BATCH 9199

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A23-21-1	4292	0.005	Adhesive-primer to metal
RB1B-A23-22-2	3684	0.006	Cohesive-in Adhesive
RB1B-A23-22-7	3680	0.005	Cohesive-in Adhesive
RB1B-A23-23-4	4464	0.005	Adhesive-primer to metal
RB1B-A23-24-2	3631	0.006	Cohesive-in Adhesive
RB1B-A23-25-1	3835	0.007	Cohesive-in Adhesive
RB1B-A23-25-3	3827	0.006	Cohesive-in Adhesive
RB1B-A23-26-5	4001	0.005	Adhesive-primer to metal
RB1B-A23-34-3	4253	0.005	Adhesive-primer to metal
RB1B-A23-34-6	4308	0.006	Adhesive-primer to metal
Average	4000		
Std. Dev.	117		

TABLE A.5
CONTROL DATA, INDIVIDUAL TENSILE LAP SHEAR SPECIMEN
STRENGTH AT 75°F FOR PRODUCTION
BATCH 9199

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A23-21-2	4630	0.005	Adhesive-primer to metal
RB1B-A23-21-7	4130	0.006	Adhesive-primer to metal
RB1B-A23-22-4	4265	0.005	Adhesive-primer to metal
RB1B-A23-23-1	3768	0.007	Cohesive-in Adhesive
RB1B-A23-23-5	4641	0.005	Adhesive-primer to metal
RB1B-A23-24-6	4474	0.005	Adhesive-primer to metal
RB1B-A23-25-4	4356	0.006	Adhesive-primer to metal
RB1B-A23-26-3	4162	0.006	Adhesive-primer to metal
RB1B-A23-26-7	4426	0.005	Adhesive-primer to metal
RB1B-A23-34-3	4261	0.006	Adhesive-primer to metal
Average	4311		
Std. Dev.	171		

TABLE A.6
CONTROL DATA, INDIVIDUAL TENSILE LAP SHEAR SPECIMEN
STRENGTH AT 200°F FOR PRODUCTION
BATCH 9199

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A23-21-1	3117	0.006	Cohesive-in Adhesive
RB1B-A23-22-6	2898	0.005	Cohesive-in Adhesive
RB1B-A23-23-7	2981	0.005	Cohesive-in Adhesive
RB1B-A23-24-1	2880	0.007	Cohesive-in Adhesive
RB1B-A23-24-4	2982	0.005	Cohesive-in Adhesive
RB1B-A23-25-6	3056	0.005	Cohesive-in Adhesive
RB1B-A23-26-2	3012	0.007	Cohesive-in Adhesive
RB1B-A23-26-6	2946	0.005	Cohesive-in Adhesive
RB1B-A23-34-2	3226	0.006	Cohesive-in Adhesive
RB1B-A23-34-7	3066	0.007	Cohesive-in Adhesive
Average	3016		
Std. Dev.	58		

TABLE A.7
CONTROL DATA, INDIVIDUAL TENSILE LAP SHEAR SPECIMEN
STRENGTH AT -65°F FOR PRODUCTION
BATCH 0204

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A23-84-4	4024	0.006	Adhesive-primer to metal
RB1B-A23-85-2	4698	0.006	Adhesive-primer to metal
RB1B-A23-85-7	4326	0.006	Adhesive-primer to metal
RB1B-A23-87-4	4513	0.005	Adhesive-primer to metal
RB1B-A23-88-2	4065	0.007	Adhesive-primer to metal
RB1B-A23-89-4	4030	0.006	Adhesive-primer to metal
RB1B-A23-89-6	3994	0.005	Adhesive-primer to metal
RB1B-A23-90-1	4554	0.009	Adhesive-primer to metal
RB1B-A23-90-3	4548	0.006	Adhesive-primer to metal
RB1B-A23-91-5	5118	0.006	Adhesive-primer to metal
Average	4377		
Std. Dev.	149		

TABLE A.8
CONTROL DATA, INDIVIDUAL TENSILE LAP SHEAR SPECIMEN
STRENGTH AT 75°F FOR PRODUCTION
BATCH 0204

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A23-84-2	5701	0.005	Adhesive-primer to metal
RB1B-A23-84-7	5549	0.006	Adhesive-primer to metal
RB1B-A23-85-4	5667	0.006	Adhesive-primer to metal
RB1B-A23-87-1	5360	0.006	Adhesive-primer to metal
RB1B-A23-87-5	5288	0.005	Adhesive-primer to metal
RB1B-A23-88-6	4900	0.005	Adhesive-primer to metal
RB1B-A23-89-3	5214	0.006	Adhesive-primer to metal
RB1B-A23-90-4	4954	0.005	Adhesive-primer to metal
RB1B-A23-91-3	4522	0.006	Adhesive-primer to metal
RB1B-A23-91-7	4739	0.006	Adhesive-primer to metal
Average	5189		
Std. Dev.	127		

TABLE A.9
CONTROL DATA, INDIVIDUAL TENSILE LAP SHEAR SPECIMEN
STRENGTH AT 200°F FOR PRODUCTION
BATCH 0204

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A23-84-1	3382	0.006	Cohesive-in Adhesive
RB1B-A23-85-6	3403	0.006	Cohesive-in Adhesive
RB1B-A23-87-7	3483	0.006	Cohesive-in Adhesive
RB1B-A23-88-1	3126	0.007	Cohesive-in Adhesive
RB1B-A23-88-4	3517	0.006	Cohesive-in Adhesive
RB1B-A23-89-2	3357	0.007	Cohesive-in Adhesive
RB1B-A23-89-7	3391	0.006	Cohesive-in Adhesive
RB1B-A23-90-6	3355	0.005	Cohesive-in Adhesive
RB1B-A23-91-2	3242	0.006	Cohesive-in Adhesive
RB1B-A23-91-6	3259	0.006	Cohesive-in Adhesive
Average	3352		
Std. Dev.	71		

APPENDIX B

**RESULTS OF INDIVIDUAL TEST SPECIMENS
FOR FLOATING ROLLER PEEL CONTROL DATA**

TABLE B.1
CONTROL DATA, INDIVIDUAL FLOATING ROLLER PEEL
SPECIMEN STRENGTH AT 75°F FOR
PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Peel Strength PLI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B23-47-1	9.9	0.013	Cohesive-in primer
RB1B-B23-48-3	7.6	0.011	Cohesive-in primer
RB1B-B23-49-2	7.9	0.011	Cohesive-in primer
RB1B-B23-50-1	10.3	0.009	Cohesive-in primer
RB1B-B23-51-3	13.5	0.009	Cohesive-in primer
Average	9.9		
Std. Dev.	2.4		

TABLE B.2
CONTROL DATA, INDIVIDUAL FLOATING ROLLER PEEL
SPECIMEN STRENGTH AT 200°F FOR
PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Peel Strength PLI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B23-47-2	10.0	0.010	Cohesive-in adhesive
RB1B-B23-48-1	9.2	0.009	Cohesive-in adhesive
RB1B-B23-49-3	10.1	0.012	Cohesive-in adhesive
RB1B-B23-50-2	11.6	0.010	Cohesive-in adhesive
RB1B-B23-51-1	12.3	0.008	Cohesive-in adhesive
Average	10.7		
Std. Dev.	1.3		

TABLE B.3
CONTROL DATA, INDIVIDUAL FLOATING ROLLER PEEL
SPECIMEN STRENGTH AT -65°F FOR
PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Peel Strength PLI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B23-47-3	7.8	0.012	Cohesive-in primer
RB1B-B23-48-2	7.0	0.011	Cohesive-in primer
RB1B-B23-49-1	6.4	0.011	Cohesive-in primer
RB1B-B23-50-3	7.2	0.010	Cohesive-in primer
RB1B-B23-51-2	8.3	0.009	Cohesive-in primer
Average	7.3		
Std. Dev.	0.7		

TABLE B.4
CONTROL DATA, INDIVIDUAL FLOATING ROLLER PEEL
SPECIMEN STRENGTH AT 75°F FOR
PRODUCTION BATCH 9199

<u>Specimen Number</u>	<u>Peel Strength PLI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B23-54-1	16.7	0.008	Cohesive-in adhesive
RB1B-B23-55-3	9.1	0.013	Cohesive-in adhesive
RB1B-B23-56-2	13.5	0.008	Cohesive-in adhesive
RB1B-B23-57-1	13.2	0.009	Cohesive-in adhesive
RB1B-B23-58-3	11.1	0.010	Cohesive-in adhesive
Average	12.7		
Std. Dev.	2.9		

TABLE B.5
CONTROL DATA, INDIVIDUAL FLOATING ROLLER PEEL
SPECIMEN STRENGTH AT 200°F FOR
PRODUCTION BATCH 9199

<u>Specimen Number</u>	<u>Peel Strength PLI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B23-54-2	12.2	0.009	Cohesive-in adhesive
RB1B-B23-55-1	12.9	0.009	Cohesive-in adhesive
RB1B-B23-56-3	12.0	0.010	Cohesive-in adhesive
RB1B-B23-57-2	11.5	0.011	Cohesive-in adhesive
RB1B-B23-58-1	10.9	0.009	Cohesive-in adhesive
Average	11.9		
Std. Dev.	0.7		

TABLE B.6
CONTROL DATA, INDIVIDUAL FLOATING ROLLER PEEL
SPECIMEN STRENGTH AT -65°F FOR
PRODUCTION BATCH 9199

<u>Specimen Number</u>	<u>Peel Strength PLI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B23-54-3	9.9	0.010	Cohesive-in primer
RB1B-B23-55-2	9.1	0.012	Cohesive-in primer
RB1B-B23-56-1	11.4	0.007	Cohesive-in primer
RB1B-B23-57-3	7.5	0.013	Cohesive-in primer
RB1B-B23-58-2	10.9	0.010	Cohesive-in primer
Average	9.8		
Std. Dev.	1.5		

TABLE B.7
 CONTROL DATA, INDIVIDUAL FLOATING ROLLER PEEL
 SPECIMEN STRENGTH AT 75°F FOR
 PRODUCTION BATCH 0204

<u>Specimen Number</u>	<u>Peel Strength PLI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B23-72-1	10.6	0.009	Cohesive-in primer
RB1B-B23-73-3	6.2	0.013	Cohesive-in primer
RB1B-B23-74-2	6.4	0.009	Cohesive-in primer
RB1B-B23-75-1	6.3	0.009	Cohesive-in primer
RB1B-B23-76-3	6.8	0.012	Cohesive-in primer
Average	7.3		
Std. Dev.	1.9		

TABLE B.8
CONTROL DATA, INDIVIDUAL FLOATING ROLLER PEEL
SPECIMEN STRENGTH AT 200°F FOR
PRODUCTION BATCH 0204

<u>Specimen Number</u>	<u>Peel Strength PLI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B23-72-2	6.6	0.011	Cohesive-in adhesive
RB1B-B23-73-1	8.7	0.010	Cohesive-in adhesive
RB1B-B23-74-3	9.0	0.010	Cohesive-in adhesive
RB1B-B23-75-2	10.5	0.010	Cohesive-in adhesive
RB1B-B23-76-1	7.7	0.011	Cohesive-in adhesive
Average	8.5		
Std. Dev.	1.5		

TABLE B.9
CONTROL DATA, INDIVIDUAL FLOATING ROLLER PEEL
SPECIMEN STRENGTH AT -65°F FOR
PRODUCTION BATCH 0204

<u>Specimen Number</u>	<u>Peel Strength ELI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B23-73-2	6.1	0.011	Cohesive-in primer
RB1B-B23-74-1	5.9	0.012	Cohesive-in primer
RB1B-B23-75-3	4.5	0.009	Cohesive-in primer
RB1B-B23-76-2	6.0	0.010	Cohesive-in primer
Average	5.6		
Std. Dev.	0.8		

APPENDIX C

**RESULTS OF INDIVIDUAL TEST SPECIMENS
FOR HONEYCOMB SANDWICH FLATWISE
TENSION CONTROL DATA**

TABLE C.1
 CONTROL DATA, INDIVIDUAL HONEYCOMB TENSION
 SPECIMENS STRENGTH AT 75°F FOR
 PRODUCTION BATCH 0204

<u>Specimen Number</u>	<u>Tensile Strength psi</u>	<u>Failure Mode</u>
RB1B-C23-149-1	1227	Adhesive-core to adhesive
RB1B-C23-149-2	1213	Adhesive-core to adhesive
RB1B-C23-149-3	1095	Adhesive-core to adhesive
RB1B-C23-149-4	1205	Adhesive-core to adhesive
RB1B-C23-149-5	1186	Adhesive-core to adhesive
Average	1185	
Std. Dev.	26	

TABLE C2
 CONTROL DATA, INDIVIDUAL HONEYCOMB TENSION
 SPECIMENS STRENGTH AT 200°F FOR
 PRODUCTION BATCH 0204

<u>Specimen Number</u>	<u>Tensile Strength psi</u>	<u>Failure Mode</u>
RB1B-C23-149-6	808	Adhesive-core to adhesive
RB1B-C23-149-7	780	Adhesive-core to adhesive
RB1B-C23-149-8	789	Adhesive-core to adhesive
RB1B-C23-149-9	751	Adhesive-core to adhesive
RB1B-C23-149-10	671	Adhesive-core to adhesive
Average	760	
Std. Dev.	18	

TABLE C.3
 CONTROL DATA, INDIVIDUAL HONEYCOMB TENSION
 SPECIMENS STRENGTH AT -65°F FOR
 PRODUCTION BATCH 0204

<u>Specimen Number</u>	<u>Tensile Strength psi</u>	<u>Failure Mode</u>
RB1B-C23-149-11	1015	Adhesive-core to adhesive
RB1B-C23-149-12	1186	Adhesive-core to adhesive
RB1B-C23-149-13	963	Adhesive-core to adhesive
RB1B-C23-149-14	1113	Adhesive-core to adhesive
RB1B-C23-149-15	1190	Adhesive-core to adhesive
Average	1093	
Std. Dev.	22	

TABLE C.4
 CONTROL DATA, INDIVIDUAL HONEYCOMB TENSION
 SPECIMENS STRENGTH AT 75°F FOR
 PRODUCTION BATCH 9199

<u>Specimen Number</u>	<u>Tensile Strength psi</u>	<u>Failure Mode</u>
RB1B-C23-147-1	1033	Adhesive-core to adhesive
RB1B-C23-147-2	979	Adhesive-core to adhesive
RB1B-C23-147-3	910	Adhesive-core to adhesive
RB1B-C23-147-4	902	Adhesive-core to adhesive
RB1B-C23-147-5	1050	Adhesive-core to adhesive
Average	975	
Std. Dev.	32	

TABLE C.5
 CONTROL DATA, INDIVIDUAL HONEYCOMB TENSION
 SPECIMENS STRENGTH AT 200°F FOR
 PRODUCTION BATCH 9199

<u>Specimen Number</u>	<u>Tensile Strength psi</u>	<u>Failure Mode</u>
RB1B-C23-147-6	784	Adhesive-core to adhesive
RB1B-C23-147-7	752	Adhesive-core to adhesive
RB1B-C23-147-8	557	Adhesive-core to adhesive
RB1B-C23-147-9	669	Adhesive-core to adhesive
RB1B-C23-147-10	665	Adhesive-core to adhesive
Average	685	
Std. Dev.	36	

TABLE C.6
CONTROL DATA, INDIVIDUAL HONEYCOMB TENSION
SPECIMENS STRENGTH AT -65°F FOR
PRODUCTION BATCH 9199

<u>Specimen Number</u>	<u>Tensile Strength psi</u>	<u>Failure Mode</u>
RB1B-C23-147-11	1261	Adhesive-core to adhesive
RB1B-C23-147-12	996	Adhesive-core to adhesive
RB1B-C23-147-13	1046	Adhesive-core to adhesive
RB1B-C23-147-14	1283	Adhesive-core to adhesive
RB1B-C23-147-15	1236	Adhesive-core to adhesive
Average	1162	
Std. Dev.	41	

TABLE C.7
CONTROL DATA, INDIVIDUAL HONEYCOMB TENSION
SPECIMENS STRENGTH AT 75°F FOR
PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Tensile Strength psi</u>	<u>Failure Mode</u>
RB1B-C23-145-1	860	Adhesive-core to adhesive
RB1B-C23-145-2	649	Adhesive-core to adhesive
RB1B-C23-145-3	620	Adhesive-core to adhesive
RB1B-C23-145-4	844	Adhesive-core to adhesive
RB1B-C23-145-5	880	Adhesive-core to adhesive
Average	770	
Std. Dev.	43	

TABLE C.8
CONTROL DATA, INDIVIDUAL HONEYCOMB TENSION
SPECIMENS STRENGTH AT 200°F FOR
PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Tensile Strength psi</u>	<u>Failure Mode</u>
RB1B-C23-145-6	591	Adhesive-core to adhesive
RB1B-C23-145-7	439	Adhesive-core to adhesive
RB1B-C23-145-8	450	Adhesive-core to adhesive
RB1B-C23-145-9	388	Adhesive-core to adhesive
RB1B-C23-145-10	491	Adhesive-core to adhesive
Average	472	
Std. Dev.	37	

TABLE C.9
 CONTROL DATA, INDIVIDUAL HONEYCOMB TENSION
 SPECIMENS STRENGTH AT -65°F FOR
 PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Tensile Strength psi</u>	<u>Failure Mode</u>
RB1B-C23-145-11	761	Adhesive-core to adhesive
RB1B-C23-145-12	1152	Adhesive-core to adhesive
RB1B-C23-145-13	612	Adhesive-core to adhesive
RB1B-C23-145-14	745	Adhesive-core to adhesive
RB1B-C23-145-15	583	Adhesive-core to adhesive
Average	771	
Std. Dev.	54	

APPENDIX D

RESULTS OF INDIVIDUAL TEST SPECIMENS
FOR HONEYCOMB SANDWICH CLIMBING
DRUM PEEL CONTROL DATA

TABLE D.1
 CONTROL DATA, INDIVIDUAL HONEYCOMB CLIMBING DRUM
 PEEL SPECIMEN STRENGTH AT 75°F FOR
 PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Peel Strength in lbs/in</u>	<u>Failure Mode</u>
RB1B-D23-151-1	12.5	Cohesive-in adhesive
RB1B-D23-152-3	10.6	Cohesive-in adhesive
RB1B-D23-155-2	10.3	Cohesive-in adhesive
RB1B-D23-156-1	10.1	Cohesive-in primer
RB1B-D23-157-3	9.2	Cohesive-in primer
Average	10.5	
Std. Dev.	1.2	

TABLE D.2
 CONTROL DATA, INDIVIDUAL HONEYCOMB CLIMBING DRUM
 PEEL SPECIMEN STRENGTH AT 200°F FOR
 PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Peel Strength in lbs/in</u>	<u>Failure Mode</u>
RB1B-D23-151-2	7.7	Cohesive-in adhesive
RB1B-D23-152-1	6.7	Cohesive-in adhesive
RB1B-D23-155-3	7.1	Cohesive-in adhesive
RB1B-D23-156-2	8.4	Cohesive-in adhesive
RB1B-D23-157-1	7.1	Cohesive-in adhesive
Average	7.4	
Std. Dev.	0.7	

TABLE D.3
CONTROL DATA, INDIVIDUAL HONEYCOMB CLIMBING DRUM
PEEL SPECIMEN STRENGTH AT -65°F FOR
PRODUCTION BATCH 0010

Specimen Number	Peel Strength <u>in-lbs/in</u>	<u>Failure Mode</u>
RB1B-D23-151-3	10.6	Cohesive-in adhesive
RB1B-D23-152-2	10.3	Cohesive-in adhesive
RB1B-D23-155-1	8.9	Cohesive-in adhesive
RB1B-D23-156-3	6.7	Cohesive-in primer
RB1B-D23-157-2	5.3	Cohesive-in primer
Average	8.4	
Std. Dev.	2.3	

TABLE D.4
CONTROL DATA, INDIVIDUAL HONEYCOMB CLIMBING DRUM
PEEL SPECIMEN STRENGTH AT 75°F FOR
PRODUCTION BATCH 9199

<u>Specimen Number</u>	<u>Peel Strength in lbs/in</u>	<u>Failure Mode</u>
RB1B-D23-160-1	11.8	Cohesive-in adhesive
RB1B-D23-161-3	7.5	Cohesive-in adhesive
RB1B-D23-162-2	10.1	Cohesive-in adhesive
RB1B-D23-163-1	13.7	Cohesive-in adhesive
RB1B-D23-164-3	10.1	Cohesive-in adhesive
Average	10.6	
Std. Dev.	2.3	

TABLE D.5
CONTROL DATA, INDIVIDUAL HONEYCOMB CLIMBING DRUM
PEEL SPECIMEN STRENGTH AT 200°F FOR
PRODUCTION BATCH 9199

<u>Specimen Number</u>	<u>Peel Strength in·lbs/in</u>	<u>Failure Mode</u>
RB1B-D23-160-2	6.9	Cohesive-in adhesive
RB1B-D23-161-1	7.6	Cohesive-in adhesive
RB1B-D23-162-3	6.9	Cohesive-in adhesive
RB1B-D23-163-2	6.8	Cohesive-in adhesive
RB1B-D23-164-1	6.4	Cohesive-in adhesive
Average	6.9	
Std. Dev.	0.4	

TABLE D.6
CONTROL DATA, INDIVIDUAL HONEYCOMB CLIMBING DRUM
PEEL SPECIMEN STRENGTH AT -65°F FOR
PRODUCTION BATCH 9199

<u>Specimen Number</u>	<u>Peel Strength in lbs/in</u>	<u>Failure Mode</u>
RB1B-D23-160-3	7.6	Cohesive-in adhesive
RB1B-D23-161-2	4.7	Cohesive-in adhesive
RB1B-D23-162-1	6.4	Cohesive-in primer
RB1B-D23-163-3	9.2	Cohesive-in adhesive
RB1B-D23-164-2	9.4	Cohesive-in adhesive
Average	7.5	
Std. Dev.	2.0	

TABLE D.7
CONTROL DATA, INDIVIDUAL HONEYCOMB CLIMBING DRUM
PEEL SPECIMEN STRENGTH AT 75°F FOR
PRODUCTION BATCH 0204

<u>Specimen Number</u>	<u>Peel Strength in lbs/in</u>	<u>Failure Mode</u>
RB1B-D23-169-1	11.7	Cohesive-in adhesive
RB1B-D23-170-3	12.4	Cohesive-in adhesive
RB1B-D23-171-2	10.5	Cohesive-in adhesive
RB1B-D23-172-1	13.6	Cohesive-in adhesive
RB1B-D23-173-3	13.0	Cohesive-in adhesive
Average	12.2	
Std. Dev.	1.2	

TABLE D.8
CONTROL DATA, INDIVIDUAL HONEYCOMB CLIMBING DRUM
PEEL SPECIMEN STRENGTH AT 200°F FOR
PRODUCTION BATCH 0204

<u>Specimen Number</u>	<u>Peel Strength in lbs/in</u>	<u>Failure Mode</u>
RB1B-D23-169-2	8.1	Cohesive-in adhesive
RB1B-D23-170-1	7.2	Cohesive-in adhesive
RB1B-D23-171-3	7.9	Cohesive-in adhesive
RB1B-D23-172-2	9.3	Cohesive-in adhesive
RB1B-D23-173-1	7.7	Cohesive-in adhesive
Average	8.0	
Std. Dev.	0.8	

TABLE D.9
CONTROL DATA, INDIVIDUAL HONEYCOMB CLIMBING DRUM
PEEL SPECIMEN STRENGTH AT -65°F FOR
PRODUCTION BATCH 0204

<u>Specimen Number</u>	<u>Peel Strength in-lbs/in</u>	<u>Failure Mode</u>
RB1B-D23-169-3	6.0	Cohesive-in primer
RB1B-D23-170-2	6.5	Cohesive-in primer
RB1B-D23-171-1	6.5	Cohesive-in primer
RB1B-D23-172-3	8.1	Cohesive-in adhesive
RB1B-D23-173-2	9.8	Cohesive-in adhesive
Average	7.4	
Std. Dev.	1.6	

•
•

APPENDIX E

RESULTS OF INDIVIDUAL HUMIDITY AGED
TEST SPECIMEN FOR TENSILE LAP SHEAR

TABLE E.1
HUMIDITY DATA, INDIVIDUAL TENSILE LAP SHEAR
SPECIMEN STRENGTH AT 75°F FOR
PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A23-14-3	3942	0.005	Cohesive-in adhesive
RB1B-A23-15-2	3798	0.005	Cohesive-in adhesive
RB1B-A23-17-5	4032	0.006	Adhesive-primer to metal
RB1B-A23-29-2	3830	0.006	Cohesive-in adhesive
RB1B-A23-33-4	4699	0.005	Adhesive-primer to metal
Average	4060		
Std. Dev.	106		

TABLE E.2
HUMIDITY DATA, INDIVIDUAL TENSILE LAP SHEAR
SPECIMEN STRENGTH AT 200°F FOR
PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A23-15-5	2667	0.006	Cohesive-in adhesive
RB1B-A23-16-2	2341	0.008	Cohesive-in adhesive
RB1B-A23-17-3	2463	0.005	Cohesive-in adhesive
RB1B-A23-20-5	2197	0.007	Cohesive-in adhesive
RB1B-A23-33-1	2457	0.005	Cohesive-in adhesive
Average	2425		
Std. Dev.	41		

TABLE E.3
HUMIDITY DATA, INDIVIDUAL TENSILE LAP SHEAR
SPECIMEN STRENGTH AT -65°F FOR
PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A23-14-6	4599	0.005	Adhesive-primer to metal
RB1B-A23-16-3	4839	0.006	Adhesive-primer to metal
RB1B-A23-20-1	4840	0.005	Adhesive-primer to metal
RB1B-A23-29-5	4281	0.006	Adhesive-primer to metal
RB1B-A23-17-7	4877	0.005	Adhesive-primer to metal
Average	4798		
Std. Dev.	129		

TABLE E.4
HUMIDITY DATA, INDIVIDUAL TENSILE LAP SHEAR
SPECIMEN STRENGTH AT 75°F FOR
PRODUCTION BATCH 9199

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A23-21-3	4208	0.005	Adhesive-primer to metal
RB1B-A23-22-1	4023	0.006	Adhesive-primer to metal
RB1B-A23-24-5	4027	0.005	Adhesive-primer to metal
RB1B-A23-25-2	3669	0.008	Cohesive-in adhesive
RB1B-A23-26-4	3856	0.005	Cohesive-in adhesive
Average	3957		
Std. Dev.	67		

TABLE E.5
HUMIDITY DATA, INDIVIDUAL TENSILE LAP SHEAR
SPECIMEN STRENGTH AT 200°F FOR
PRODUCTION BATCH 9199

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A23-22-5	2595	0.006	Cohesive-in adhesive
RB1B-A23-23-2	2640	0.006	Cohesive-in adhesive
RB1B-A23-24-3	2261	0.005	Cohesive-in adhesive
RB1B-A23-26-1	2331	0.007	Cohesive-in adhesive
RB1B-A23-34-5	2464	0.005	Cohesive-in adhesive
Average	2458		
Std. Dev.	35		

TABLE E.6
HUMIDITY DATA, INDIVIDUAL TENSILE LAP SHEAR
SPECIMEN STRENGTH AT -65°F FOR
PRODUCTION BATCH 9199

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A23-21-6	4835	0.006	Adhesive-primer to metal
RB1B-A23-23-3	4628	0.005	Adhesive-primer to metal
RB1B-A23-24-7	4852	0.005	Adhesive-primer to metal
RB1B-A23-25-5	4172	0.005	Adhesive-primer to metal
RB1B-A23-34-1	4143	0.006	Adhesive-primer to metal
Average	4526		
Std. Dev.	150		

TABLE E.7
HUMIDITY DATA, INDIVIDUAL TENSILE LAP SHEAR
SPECIMEN STRENGTH AT 75°F FOR
PRODUCTION BATCH 0204

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A23-84-3	4985	0.006	Adhesive-primer to metal
RB1B-A23-85-1	4955	0.006	Adhesive-primer to metal
RB1B-A23-88-5	4964	0.005	Adhesive-primer to metal
RB1B-A23-90-2	4944	0.007	Adhesive-primer to metal
RB1B-A23-91-4	5023	0.006	Adhesive-primer to metal
Average	4974		
Std. Dev.	106		

TABLE E.8
HUMIDITY DATA, INDIVIDUAL TENSILE LAP SHEAR
SPECIMEN STRENGTH AT 200°F FOR
PRODUCTION BATCH 0204

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A23-85-5	3157	0.005	Cohesive-in adhesive
RB1B-A23-87-2	3098	0.006	Cohesive-in adhesive
RB1B-A23-88-3	2942	0.006	Cohesive-in adhesive
RB1B-A23-89-5	3170	0.005	Cohesive-in adhesive
RB1B-A23-91-1	3124	0.006	Cohesive-in adhesive
Average	3099		
Std. Dev.	33		

TABLE E.9
HUMIDITY DATA, INDIVIDUAL TENSILE LAP SHEAR
SPECIMEN STRENGTH AT -65°F FOR
PRODUCTION BATCH 0204

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A23-84-6	4566	0.006	Adhesive-primer to metal
RB1B-A23-87-3	5106	0.005	Adhesive-primer to metal
RB1B-A23-88-7	4511	0.005	Adhesive-primer to metal
RB1B-A23-89-1	4361	0.007	Adhesive-primer to metal
RB1B-A23-90-5	4699	0.005	Adhesive-primer to metal
Average	4522		
Std. Dev.	172		

APPENDIX F

**RESULTS OF INDIVIDUAL HUMIDITY AGED
TEST SPECIMENS FOR FLOATING ROLLER PEEL**

TABLE F.1
HUMIDITY DATA, INDIVIDUAL FLOATING ROLLER PEEL
SPECIMEN STRENGTH AT 75°F FOR
PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Peel Strength PLI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B23-47-4	10.5	0.012	Cohesive-in primer
RB1B-B23-48-6	12.2	0.008	Cohesive-in primer
RB1B-B23-49-5	9.5	0.012	Cohesive-in primer
RB1B-B23-50-4	10.3	0.010	Cohesive-in primer
RB1B-B23-51-6	15.8	0.011	Cohesive-in primer
Average	11.7		
Std. Dev.	2.5		

TABLE F.2
HUMIDITY DATA, INDIVIDUAL FLOATING ROLLER PEEL
SPECIMEN STRENGTH AT 200°F FOR
PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Peel Strength PLI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B23-47-5	6.2	0.010	Cohesive-in adhesive
RB1B-B23-48-4	6.4	0.010	Cohesive-in adhesive
RB1B-B23-49-6	7.1	0.009	Cohesive-in adhesive
RB1B-B23-50-5	8.0	0.009	Cohesive-in adhesive
RB1B-B23-51-4	11.4	0.009	Cohesive-in adhesive
Average	7.8		
Std. Dev.	2.1		

TABLE F.3
HUMIDITY DATA, INDIVIDUAL FLOATING ROLLER PEEL
SPECIMEN STRENGTH AT -65°F FOR
PRODUCTION BATCH 0010

Specimen <u>Number</u>	Peel Strength <u>PLI</u>	Glueline Thickness in	<u>Failure Mode</u>
RB1B-B23-47-6	9.8	0.009	Cohesive-in primer
RB1B-B23-48-5	9.5	0.009	Cohesive-in primer
RB1B-B23-49-4	6.1	0.013	Cohesive-in primer
RB1B-B23-50-6	7.8	0.009	Cohesive-in primer
RB1B-B23-51-5	13.3	0.009	Cohesive-in primer
Average	9.3		
Std. Dev.	2.7		

TABLE F.4
HUMIDITY DATA, INDIVIDUAL FLOATING ROLLER PEEL
SPECIMEN STRENGTH AT 75°F FOR
PRODUCTION BATCH 9199

<u>Specimen Number</u>	<u>Peel Strength PLI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B23-54-4	12.2	0.008	Cohesive-in primer
RB1B-B23-55-6	11.5	0.013	Cohesive-in primer
RB1B-B23-56-5	12.6	0.008	Cohesive-in primer
RB1B-B23-57-4	9.1	0.011	Cohesive-in primer
RB1B-B23-58-6	13.5	0.009	Cohesive-in primer
Average	11.8		
Std. Dev.	1.7		

TABLE F.5
HUMIDITY DATA, INDIVIDUAL FLOATING ROLLER PEEL
SPECIMEN STRENGTH AT 200°F FOR
PRODUCTION BATCH 9199

<u>Specimen Number</u>	<u>Peel Strength PLI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B23-54-5	11.6	0.009	Cohesive-in adhesive
RB1B-B23-55-4	10.2	0.013	Cohesive-in adhesive
RB1B-B23-56-6	10.3	0.009	Cohesive-in adhesive
RB1B-B23-57-5	10.3	0.010	Cohesive-in adhesive
RB1B-B23-58-4	12.0	0.010	Cohesive-in adhesive
Average	10.2		
Std. Dev.	0.9		

TABLE F.6
HUMIDITY DATA, INDIVIDUAL FLOATING ROLLER PEEL
SPECIMEN STRENGTH AT -65°F FOR
PRODUCTION BATCH 9199

<u>Specimen Number</u>	<u>Peel Strength PLI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B23-54-6	6.7	0.008	Cohesive-in primer
RB1B-B23-55-5	5.3	0.011	Cohesive-in primer
RB1B-B23-56-4	6.2	0.011	Cohesive-in primer
RB1B-B23-57-6	5.5	0.008	Cohesive-in primer
RB1B-B23-58-5	5.9	0.009	Cohesive-in primer
Average	5.9		
Std. Dev.	0.5		

TABLE F.7
HUMIDITY DATA, INDIVIDUAL FLOATING ROLLER PEEL
SPECIMEN STRENGTH AT 75°F FOR
PRODUCTION BATCH 0204

Specimen Number	Peel Strength PLI	Glueline Thickness in	<u>Failure Mode</u>
RB1B-B23-72-4	6.1	0.012	Cohesive-in primer
RB1B-B23-73-6	7.0	0.011	Cohesive-in primer
RB1B-B23-74-5	5.8	0.010	Cohesive-in primer
RB1B-B23-75-4	5.2	0.012	Cohesive-in primer
RB1B-B23-76-6	7.5	0.009	Cohesive-in primer
Average	6.3		
Std. Dev.	0.9		

TABLE F.8
HUMIDITY DATA, INDIVIDUAL FLOATING ROLLER PEEL
SPECIMEN STRENGTH AT 200°F FOR
PRODUCTION BATCH 0204

<u>Specimen Number</u>	<u>Peel Strength PLI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B23-72-5	6.0	0.011	Cohesive-in adhesive
RB1B-B23-73-4	7.4	0.012	Cohesive-in adhesive
RB1B-B23-74-6	5.4	0.009	Cohesive-in adhesive
RB1B-B23-75-5	5.6	0.012	Cohesive-in adhesive
RB1B-B23-76-4	7.6	0.012	Cohesive-in adhesive
Average	6.4		
Std. Dev.	1.0		

TABLE F.9
HUMIDITY DATA, INDIVIDUAL FLOATING ROLLER PEEL
SPECIMEN STRENGTH AT -65°F FOR
PRODUCTION BATCH 0204

Specimen Number	Peel Strength PLI	Glueline Thickness in	Failure Mode
RB1B-B23-72-6	3.2	0.011	Cohesive-in adhesive
RB1B-B23-73-5	2.5	0.011	Cohesive-in adhesive
RB1B-B23-74-4	2.6	0.011	Cohesive-in adhesive
RB1B-B23-75-6	1.8	0.011	Cohesive-in adhesive
RB1B-B23-76-5	3.0	0.010	Cohesive-in adhesive
Average	2.6		
Std. Dev.	0.5		

APPENDIX G

RESULTS OF INDIVIDUAL HUMIDITY AGED TEST SPECIMENS FOR HONEYCOMB SANDWICH FLATWISE TENSION

TABLE G.1
HUMIDITY DATA, INDIVIDUAL HONEYCOMB TENSION
SPECIMEN STRENGTH AT 75°F FOR
PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Tensile Strength psi</u>	<u>Failure Mode</u>
RB1B-C23-146-1	480	Adhesive-core to Adhesive
RB1B-C23-146-2	450	Adhesive-core to Adhesive
RB1B-C23-146-3	443	Adhesive-core to Adhesive
RB1B-C23-146-4	412	Adhesive-core to Adhesive
RB1B-C23-146-5	738	Adhesive-core to Adhesive
Average	505	
Std. Dev.	23	

TABLE G.2
HUMIDITY DATA, INDIVIDUAL HONEYCOMB TENSION
SPECIMEN STRENGTH AT 200°F FOR
PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Tensile Strength psi</u>	<u>Failure Mode</u>
RB1B-C23-146-6	360	Adhesive-core to Adhesive
RB1B-C23-146-7	376	Adhesive-core to Adhesive
RB1B-C23-146-8	371	Adhesive-core to Adhesive
RB1B-C23-146-9	333	Adhesive-core to Adhesive
RB1B-C23-146-10	347	Adhesive-core to Adhesive
Average	357	
Std. Dev.	14	

TABLE G.3
HUMIDITY DATA, INDIVIDUAL HONEYCOMB TENSION
SPECIMEN STRENGTH AT -65°F FOR
PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Tensile Strength psi</u>	<u>Failure Mode</u>
RB1B-C23-146-11	629	Adhesive-core to Adhesive
RB1B-C23-146-12	809	Adhesive-core to Adhesive
RB1B-C23-146-13	570	Adhesive-core to Adhesive
RB1B-C23-146-14	579	Adhesive-core to Adhesive
RB1B-C23-146-15	516	Adhesive-core to Adhesive
Average	621	
Std. Dev.	27	

TABLE G.4
HUMIDITY DATA, INDIVIDUAL HONEYCOMB TENSION
SPECIMEN STRENGTH AT 75°F FOR
PRODUCTION BATCH 9199

<u>Specimen Number</u>	<u>Tensile Strength psi</u>	<u>Failure Mode</u>
RB1B-C23-148-1	503	Adhesive-core to Adhesive
RB1B-C23-148-2	498	Adhesive-core to Adhesive
RB1B-C23-148-3	489	Adhesive-core to Adhesive
RB1B-C23-148-4	551	Adhesive-core to Adhesive
RB1B-C23-148-5	622	Adhesive-core to Adhesive
Average	533	
Std. Dev.	20	

TABLE G.5
HUMIDITY DATA, INDIVIDUAL HONEYCOMB TENSION
SPECIMEN STRENGTH AT 200°F FOR
PRODUCTION BATCH 9199

<u>Specimen Number</u>	<u>Tensile Strength psi</u>	<u>Failure Mode</u>
RB1B-C23-148-6	292	Adhesive-core to Adhesive
RB1B-C23-148-7	323	Adhesive-core to Adhesive
RB1B-C23-148-8	285	Adhesive-core to Adhesive
RB1B-C23-148-9	286	Adhesive-core to Adhesive
RB1B-C23-148-10	257	Adhesive-core to Adhesive
Average	289	
Std. Dev.	13	

TABLE G.6
HUMIDITY DATA, INDIVIDUAL HONEYCOMB TENSION
SPECIMEN STRENGTH AT -65°F FOR
PRODUCTION BATCH 9199

<u>Specimen Number</u>	<u>Tensile Strength psi</u>	<u>Failure Mode</u>
RB1B-C23-148-11	727	Adhesive-core to Adhesive
RB1B-C23-148-12	625	Adhesive-core to Adhesive
RB1B-C23-148-13	511	Adhesive-core to Adhesive
RB1B-C23-148-14	506	Adhesive-core to Adhesive
RB1B-C23-148-15	560	Adhesive-core to Adhesive
Average	586	
Std. Dev.	25	

TABLE G.7
HUMIDITY DATA, INDIVIDUAL HONEYCOMB TENSION
SPECIMEN STRENGTH AT 75°F FOR
PRODUCTION BATCH 0204

<u>Specimen Number</u>	<u>Tensile Strength psi</u>	<u>Failure Mode</u>
RB1B-C23-150-1	576	Adhesive-core to Adhesive
RB1B-C23-150-2	505	Adhesive-core to Adhesive
RB1B-C23-150-3	569	Adhesive-core to Adhesive
RB1B-C23-150-4	733	Adhesive-core to Adhesive
RB1B-C23-150-5	711	Adhesive-core to Adhesive
Average	619	
Std. Dev.	21	

TABLE G.8
HUMIDITY DATA, INDIVIDUAL HONEYCOMB TENSION
SPECIMEN STRENGTH AT 200°F FOR
PRODUCTION BATCH 0204

<u>Specimen Number</u>	<u>Tensile Strength psi</u>	<u>Failure Mode</u>
RB1B-C23-150-6	319	Adhesive-core to Adhesive
RB1B-C23-150-7	393	Adhesive-core to Adhesive
RB1B-C23-150-8	394	Adhesive-core to Adhesive
RB1B-C23-150-9	307	Adhesive-core to Adhesive
RB1B-C23-150-10	331	Adhesive-core to Adhesive
Average	349	
Std. Dev.	14	

TABLE G.9
HUMIDITY DATA, INDIVIDUAL HONEYCOMB TENSION
SPECIMEN STRENGTH AT -65°F FOR
PRODUCTION BATCH 0204

<u>Specimen Number</u>	<u>Tensile Strength psi</u>	<u>Failure Mode</u>
RB1B-C23-150-11	528	Adhesive-core to Adhesive
RB1B-C23-150-12	565	Adhesive-core to Adhesive
RB1B-C23-150-13	664	Adhesive-core to Adhesive
RB1B-C23-150-14	591	Adhesive-core to Adhesive
RB1B-C23-150-15	694	Adhesive-core to Adhesive
Average	600	
Std. Dev.	19	

APPENDIX H
RESULTS OF INDIVIDUAL HUMIDITY AGED
TEST SPECIMENS FOR HONEYCOMB SANDWICH
CLIMBING DRUM PEEL

TABLE H.1
HUMIDITY DATA, INDIVIDUAL HONEYCOMB CLIMBING
DRUM PEEL SPECIMEN STRENGTH AT 75°F
FOR PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Peel Strength in-lbs/in</u>	<u>Failure Mode</u>
RB1B-D23-158-1	10.1	Cohesive-in Adhesive
RB1B-D23-158-2	9.4	Cohesive-in Adhesive
RB1B-D23-158-3	9.4	Cohesive-in Adhesive
RB1B-D23-159-1	8.3	Cohesive-in Adhesive
RB1B-D23-159-2	8.5	Cohesive-in Adhesive
Average	9.1	
Std. Dev.	0.7	

TABLE H.2
HUMIDITY DATA, INDIVIDUAL HONEYCOMB CLIMBING
DRUM PEEL SPECIMEN STRENGTH AT 75°F
FOR PRODUCTION BATCH 9199

<u>Specimen Number</u>	<u>Peel Strength in lbs/in</u>	<u>Failure Mode</u>
RB1B-D23-165-1	8.9	Cohesive-in Adhesive
RB1B-D23-165-2	9.3	Cohesive-in Adhesive
RB1B-D23-165-3	7.1	Cohesive-in Adhesive
RB1B-D23-166-1	9.6	Cohesive-in Adhesive
RB1B-D23-166-2	10.1	Cohesive-in Adhesive
Average	9.0	
Std. Dev.	1.1	

TABLE H.3
HUMIDITY DATA, INDIVIDUAL HONEYCOMB CLIMBING
DRUM PEEL SPECIMEN STRENGTH AT 75°F
FOR PRODUCTION BATCH 0204

<u>Specimen Number</u>	<u>Peel Strength in lbs/in</u>	<u>Failure Mode</u>
RB1B-D23-167-1	9.8	Cohesive-in Adhesive
RB1B-D23-167-2	10.1	Cohesive-in Adhesive
RB1B-D23-167-3	9.2	Cohesive-in Adhesive
RB1B-D23-168-1	10.0	Cohesive-in Adhesive
RB1B-D23-168-2	10.2	Cohesive-in Adhesive
Average	9.9	
Std. Dev.	0.4	

APPENDIX I

RESULTS OF INDIVIDUAL TEST SPECIMENS TO DETERMINE THE AVERAGE TENSILE LAP SHEAR STRENGTH OF EA 9394 ADHESIVE AT 120°F

TABLE I.1
TENSILE LAP SHEAR STRENGTH OF EA 9394
ADHESIVE AT 120°F

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A13-60-1	3730	0.005	Cohesive-in Adhesive
RB1B-A13-60-2	4073	0.006	Cohesive-in Adhesive
RB1B-A13-60-3	4007	0.005	Cohesive-in Adhesive
RB1B-A13-60-4	3962	0.005	Cohesive-in Adhesive
RB1B-A13-60-5	3345	0.006	Cohesive-in Adhesive
RB1B-A13-60-6	3809	0.006	Cohesive-in Adhesive
RB1B-A13-60-7	4053	0.006	Cohesive-in Adhesive
Average	3926		

APPENDIX J

RESULTS OF INDIVIDUAL TEST SPECIMENS
TO DETERMINE THE EFFECT OF
STORAGE LIFE

TABLE J.1
EFFECT OF LONG TERM STORAGE AT 75°F ON TENSILE
LAP SHEAR STRENGTHS, INDIVIDUAL TEST SPECIMENS
AT 75°F AND 200°F FOR EA 9394 ADHESIVE, BATCH NO. 8204

Storage Time <u>mos.</u>	Tensile Lap Shear Strength <u>psi</u>	
	<u>75°F</u>	<u>200°F</u>
12	4333	3666
	4156	3518
	4304	<u>3505</u>
	<u>4154</u>	
Avg.	4237	3563
18	4363	3207
	4125	3153
	4054	<u>3020</u>
	<u>3867</u>	
Avg.	4102	3127
24	5518	3805
	5262	3505
	5511	<u>3786</u>
	<u>5433</u>	
Avg.	5431	3699
30	4688	3419
	4885	3679
	4911	<u>3733</u>
	<u>4790</u>	
Avg.	4819	3610

TABLE J.2
EFFECT OF LONG TERM STORAGE AT 100°F ON TENSILE
LAP SHEAR STRENGTHS, INDIVIDUAL TEST SPECIMENS
AT 75°F AND 200°F FOR EA 9394 ADHESIVE, BATCH NO. 8204

Storage Time <u>mos.</u>	Tensile Lap Shear Strength <u>psi</u>	
	<u>75°F</u>	<u>200°F</u>
12	4226	3409
	4099	3524
	4339	<u>3600</u>
	<u>4352</u>	
Avg.	4254	3511
18	4037	2796
	3976	3117
	4041	<u>3194</u>
	<u>4143</u>	
Avg.	4049	3036

TABLE J.3
EFFECT OF LONG TERM STORAGE AT 120°F ON TENSILE
LAP SHEAR STRENGTHS, INDIVIDUAL TEST SPECIMENS
AT 75°F AND 200°F FOR EA 9394 ADHESIVE, BATCH NO. 8204

Storage Time <u>mos.</u>	Tensile Lap Shear Strength <u>psi</u>	
	<u>75°F</u>	<u>200°F</u>
12	4029	3233
	4235	3332
	4274	<u>3370</u>
	<u>4372</u>	
Avg.	4228	3312

APPENDIX K

RESULTS OF INDIVIDUAL TEST SPECIMENS
TO DETERMINE THE EFFECT OF POT LIFE

TABLE K.1
EFFECT OF APPLIED EA 9394 ADHESIVE POT LIFE
UPON INDIVIDUAL TENSILE LAP SHEAR
STRENGTH AT 75°F FOR PRODUCTION BATCH NO. 0010
WHEN EXPOSED TO 75°F FOR 270 MINUTES

<u>Specimen Number</u>	<u>Tensile Lap Shear Strength psi</u>	<u>Failure Mode</u>
RB1B-A12-127-1	2118	Cohesive-in Adhesive
RB1B-A12-127-2	2517	Cohesive-in Adhesive
RB1B-A12-127-3	2173	Cohesive-in Adhesive
RB1B-A12-127-4	2052	Cohesive-in Adhesive
Average	2215	

TABLE K.2
EFFECT OF APPLIED EA 9394 ADHESIVE POT LIFE
UPON INDIVIDUAL TENSILE LAP SHEAR
STRENGTH AT 75°F FOR PRODUCTION BATCH NO. 0010
WHEN EXPOSED TO 75°F FOR 225 MINUTES

<u>Specimen Number</u>	<u>Tensile Lap Shear Strength psi</u>	<u>Failure Mode</u>
RB1B-A12-128-1	2207	Cohesive-in Adhesive
RB1B-A12-128-3	2047	Cohesive-in Adhesive
RB1B-A12-128-5	2397	Cohesive-in Adhesive
RB1B-A12-128-7	2269	Cohesive-in Adhesive
Average	2230	

TABLE K.3
EFFECT OF APPLIED EA 9394 ADHESIVE POT LIFE
UPON INDIVIDUAL TENSILE LAP SHEAR
STRENGTH AT 200°F FOR PRODUCTION BATCH NO. 0010
WHEN EXPOSED TO 75°F FOR 225 MINUTES

<u>Specimen Number</u>	<u>Tensile Lap Shear Strength psi</u>	<u>Failure Mode</u>
RB1B-A12-128-2	1218	Cohesive-in Adhesive
RB1B-A12-128-4	1729	Cohesive-in Adhesive
RB1B-A12-128-6	1812	Cohesive-in Adhesive
Average	1586	

TABLE K.4
EFFECT OF APPLIED EA 9394 ADHESIVE POT LIFE
UPON INDIVIDUAL TENSILE LAP SHEAR
STRENGTH AT 75°F FOR PRODUCTION BATCH NO. 0010
WHEN EXPOSED TO 75°F FOR 150 MINUTES

<u>Specimen Number</u>	<u>Tensile Lap Shear Strength psi</u>	<u>Failure Mode</u>
RB1B-A12-129-1	5700	Adhesive-Primer to Metal
RB1B-A12-129-3	4844	Adhesive-Primer to Metal
RB1B-A12-129-5	4790	Adhesive-Primer to Metal
RB1B-A12-129-7	5654	Adhesive-Primer to Metal
Average	5247	

TABLE K.5
EFFECT OF APPLIED EA 9394 ADHESIVE POT LIFE
UPON INDIVIDUAL TENSILE LAP SHEAR
STRENGTH AT 200°F FOR PRODUCTION BATCH NO. 0010
WHEN EXPOSED TO 75°F FOR 150 MINUTES

<u>Specimen Number</u>	<u>Tensile Lap Shear Strength psi</u>	<u>Failure Mode</u>
RB1B-A12-129-2	3260	Cohesive-in Adhesive
RB1B-A12-129-4	3645	Cohesive-in Adhesive
RB1B-A12-129-6	3439	Cohesive-in Adhesive
Average	3448	

TABLE K.6
EFFECT OF APPLIED EA 9394 ADHESIVE POT LIFE
UPON INDIVIDUAL TENSILE LAP SHEAR
STRENGTH AT 75°F FOR PRODUCTION BATCH NO. 0010
WHEN EXPOSED TO 100°F FOR 80 MINUTES

<u>Specimen Number</u>	<u>Tensile Lap Shear Strength psi</u>	<u>Failure Mode</u>
RB1B-A12-131-1	4001	Cohesive-in Adhesive
RB1B-A12-131-3	3998	Cohesive-in Adhesive
RB1B-A12-131-5	4180	Adhesive-Primer to Metal
RB1B-A12-131-7	3886	Cohesive-in Adhesive
Average	4017	

TABLE K.7
EFFECT OF APPLIED EA 9394 ADHESIVE POT LIFE
UPON INDIVIDUAL TENSILE LAP SHEAR
STRENGTH AT 200°F FOR PRODUCTION BATCH NO. 0010
WHEN EXPOSED TO 100°F FOR 80 MINUTES

Specimen Number	Tensile Lap Shear Strength psi	<u>Failure Mode</u>
RB1B-A12-131-2	3096	Cohesive-in Adhesive
RB1B-A12-131-4	3104	Cohesive-in Adhesive
RB1B-A12-131-6	2817	Cohesive-in Adhesive
Average	3006	

TABLE K.8
EFFECT OF APPLIED EA 9394 ADHESIVE POT LIFE
UPON INDIVIDUAL TENSILE LAP SHEAR
STRENGTH AT 75°F FOR PRODUCTION BATCH NO. 0010
WHEN EXPOSED TO 100°F FOR 60 MINUTES

<u>Specimen Number</u>	<u>Tensile Lap Shear Strength psi</u>	<u>Failure Mode</u>
RB1B-A12-132-1	5583	Adhesive-Primer to Metal
RB1B-A12-132-3	4561	Adhesive-Primer to Metal
RB1B-A12-132-5	4704	Adhesive-Primer to Metal
RB1B-A12-132-7	4606	Adhesive-Primer to Metal
Average	4864	

TABLE K.9
EFFECT OF APPLIED EA 9394 ADHESIVE POT LIFE
UPON INDIVIDUAL TENSILE LAP SHEAR
STRENGTH AT 200°F FOR PRODUCTION BATCH NO. 0010
WHEN EXPOSED TO 100°F FOR 60 MINUTES

Specimen Number	Tensile Lap Shear Strength psi	Failure Mode
RB1B-A12-132-2	3530	Cohesive-in Adhesive
RB1B-A12-132-4	3117	Cohesive-in Adhesive
RB1B-A12-132-6	2962	Cohesive-in Adhesive
Average	3223	

TABLE K.10
EFFECT OF APPLIED EA 9394 ADHESIVE POT LIFE
UPON INDIVIDUAL FLOATING ROLLER PEEL
STRENGTH AT 75°F FOR PRODUCTION BATCH NO. 0010
WHEN EXPOSED TO 75°F FOR 150 MINUTES

Specimen Number	Floating Roller Peel PLI	Failure Mode
RB1B-B12-133-1	21.4	Cohesive-in Adhesive
RB1B-B12-133-4	19.3	Cohesive-in Adhesive
RB1B-B12-134-2	16.1	Cohesive-in Adhesive
RB1B-B12-134-5	20.4	Cohesive-in Adhesive
Average	19.3	

TABLE K.11
EFFECT OF APPLIED EA 9394 ADHESIVE POT LIFE
UPON INDIVIDUAL FLOATING ROLLER PEEL
STRENGTH AT 200°F FOR PRODUCTION BATCH NO. 0010
WHEN EXPOSED TO 75°F FOR 150 MINUTES

<u>Specimen Number</u>	<u>Floating Roller Peel PLI</u>	<u>Failure Mode</u>
RB1B-B12-133-2	7.4	Cohesive-in Adhesive
RB1B-B12-133-5	7.6	Cohesive-in Adhesive
RB1B-B12-134-3	4.8	Cohesive-in Adhesive
Average	6.6	

TABLE K.12
EFFECT OF APPLIED EA 9394 ADHESIVE POT LIFE
UPON INDIVIDUAL FLOATING ROLLER PEEL
STRENGTH AT -65°F FOR PRODUCTION BATCH NO. 0010
WHEN EXPOSED TO 75°F FOR 150 MINUTES

Specimen <u>Number</u>	Floating Roller Peel <u>PLI</u>	<u>Failure Mode</u>
RB1B-B12-133-3	12.6	Cohesive-in Adhesive
RB1B-B12-134-1	16.4	Cohesive-in Adhesive
RB1B-B12-134-4	15.5	Cohesive-in Adhesive
Average	14.8	

TABLE K.13
EFFECT OF APPLIED EA 9394 ADHESIVE POT LIFE
UPON INDIVIDUAL FLOATING ROLLER PEEL
STRENGTH AT 75°F FOR PRODUCTION BATCH NO. 0010
WHEN EXPOSED TO 75°F FOR 225 MINUTES

<u>Specimen Number</u>	<u>Floating Roller Peel PLI</u>	<u>Failure Mode</u>
RB1B-B12-135-1	5.2	Cohesive-in Adhesive
RB1B-B12-135-4	4.2	Cohesive-in Adhesive
RB1B-B12-136-2	3.8	Cohesive-in Adhesive
RB1B-B12-136-5	2.9	Cohesive-in Adhesive
Average	4.0	

TABLE K.14
EFFECT OF APPLIED EA 9394 ADHESIVE POT LIFE
UPON INDIVIDUAL FLOATING ROLLER PEEL
STRENGTH AT 200°F FOR PRODUCTION BATCH NO. 6010
WHEN EXPOSED TO 75°F FOR 225 MINUTES

<u>Specimen Number</u>	<u>Floating Roller Peel PLI</u>	<u>Failure Mode</u>
RB1B-B12-135-2	1.7	Cohesive-in Adhesive
RB1B-B12-135-5	2.2	Cohesive-in Adhesive
RB1B-B12-136-3	2.0	Cohesive-in Adhesive
Average	2.0	

TABLE K.15
EFFECT OF APPLIED EA 9394 ADHESIVE POT LIFE
UPON INDIVIDUAL FLOATING ROLLER PEEL
STRENGTH AT -65°F FOR PRODUCTION BATCH NO. 0010
WHEN EXPOSED TO 75°F FOR 225 MINUTES

<u>Specimen Number</u>	<u>Floating Roller Peel PLI</u>	<u>Failure Mode</u>
RB1B-B12-135-3	9.8	Cohesive-in Adhesive
RB1B-B12-136-1	4.0	Cohesive-in Adhesive
RB1B-B12-136-4	3.7	Cohesive-in Adhesive
Average	5.8	

TABLE K.16
EFFECT OF APPLIED EA 9394 ADHESIVE POT LIFE
UPON INDIVIDUAL FLOATING ROLLER PEEL
STRENGTH AT 75°F FOR PRODUCTION BATCH NO. 0010
WHEN EXPOSED TO 100°F FOR 60 MINUTES

<u>Specimen Number</u>	<u>Floating Roller Peel PLI</u>	<u>Failure Mode</u>
RB1B-B12-137-1	2.1	Cohesive-in Adhesive
RB1B-B12-137-4	3.1	Cohesive-in Adhesive
RB1B-B12-138-2	3.5	Cohesive-in Adhesive
RB1B-B12-138-5	2.2	Cohesive-in Adhesive
Average	2.7	

TABLE K.17
EFFECT OF APPLIED EA 9394 ADHESIVE POT LIFE
UPON INDIVIDUAL FLOATING ROLLER PEEL
STRENGTH AT 200°F FOR PRODUCTION BATCH NO. 0010
WHEN EXPOSED TO 100°F FOR 60 MINUTES

<u>Specimen Number</u>	<u>Floating Roller Peel PLI</u>	<u>Failure Mode</u>
RB1B-B12-137-5	1.4	Cohesive-in Adhesive
RB1B-B12-138-3	1.8	Cohesive-in Adhesive
RB1B-B12-141-1	3.9	Cohesive-in Adhesive
RB1B-B12-141-4	2.2	Cohesive-in Adhesive
Average	2.3	

TABLE K.18
EFFECT OF APPLIED EA 9394 ADHESIVE POT LIFE
UPON INDIVIDUAL FLOATING ROLLER PEEL
STRENGTH AT -65°F FOR PRODUCTION BATCH NO. 0010
WHEN EXPOSED TO 100°F FOR 60 MINUTES

<u>Specimen Number</u>	<u>Floating Roller Peel PLI</u>	<u>Failure Mode</u>
RB1B-B12-137-3	3.1	Cohesive-in Adhesive
RB1B-B12-138-1	2.2	Cohesive-in Adhesive
RB1B-B12-138-4	5.8	Cohesive-in Adhesive
RB1B-B12-141-2	10.2	Cohesive-in Adhesive
RB1B-B12-141-5	5.2	Cohesive-in Adhesive
Average	5.3	

TABLE K.19
EFFECT OF APPLIED EA 9394 ADHESIVE POT LIFE
UPON INDIVIDUAL FLOATING ROLLER PEEL
STRENGTH AT 75°F FOR PRODUCTION BATCH NO. 0010
WHEN EXPOSED TO 100°F FOR 80 MINUTES

<u>Specimen Number</u>	<u>Floating Roller Peel PLI</u>	<u>Failure Mode</u>
RB1B-B12-139-1	2.4	Cohesive-in Adhesive
RB1B-B12-139-4	2.5	Cohesive-in Adhesive
RB1B-B12-140-2	2.2	Cohesive-in Adhesive
RB1B-B12-140-5	2.7	Cohesive-in Adhesive
RB1B-B12-142-3	1.9	Cohesive-in Adhesive
Average	2.4	

TABLE K.20
EFFECT OF APPLIED EA 9394 ADHESIVE POT LIFE
UPON INDIVIDUAL FLOATING ROLLER PEEL
STRENGTH AT 200°F FOR PRODUCTION BATCH NO. 0010
WHEN EXPOSED TO 100°F FOR 80 MINUTES

<u>Specimen Number</u>	<u>Floating Roller Peel PLI</u>	<u>Failure Mode</u>
RB1B-B12-139-5	1.3	Cohesive-in Adhesive
RB1B-B12-140-3	1.4	Cohesive-in Adhesive
RB1B-B12-139-2	1.6	Cohesive-in Adhesive
Average	1.4	

TABLE K.21
EFFECT OF APPLIED EA 9394 ADHESIVE POT LIFE
UPON INDIVIDUAL FLOATING ROLLER PEEL
STRENGTH AT -65°F FOR PRODUCTION BATCH NO. 0010
WHEN EXPOSED TO 100°F FOR 80 MINUTES

<u>Specimen Number</u>	<u>Floating Roller Peel PLI</u>	<u>Failure Mode</u>
RB1B-B12-139-3	3.1	Cohesive-in Adhesive
RB1B-B12-140-4	4.9	Cohesive-in Adhesive
Average	4.0	

APPENDIX L

RESULTS OF INDIVIDUAL T_g TEST SPECIMENS

TABLE L.1
T_g OF EA 9394 ADHESIVE AS DETERMINED BY DMA,
INDIVIDUAL SPECIMENS AFTER 2 HOURS
AT 180°F

Adhesive <u>Lot No.</u>	Dry T _g °F	Wet T _g ¹ °F	Weight Gain %
0010	271	244	5.0
0010	280	239	5.6
0010	282	239	4.9
Avg.	279	241	5.2
9199	315	241	4.8
9199	302	244	5.0
9199	316	246	4.8
Avg.	311	244	4.9
0204	336	270	5.4
0204	331	262	4.9
0204	334	261	5.4
Avg.	334	264	5.3

¹Wet samples were humidity aged at 140°F and 95-100% R.H. for 20 days.

TABLE L.2
T_g OF EA 9394 ADHESIVE AS DETERMINED BY DMA,
INDIVIDUAL SPECIMENS AFTER 2 HOURS
AT 200°F

Adhesive Lot No.	Dry Tg °F	Wet Tg ¹ °F	Weight Gain %
0010	320	232	5.5
0010	309	230	5.5
0010	322	232	5.7
Avg.	316	231	5.6
9199	329	241	4.6
9199	320	248	4.7
9199	329	248	4.7
Avg.	325	246	4.7
0204	338	261	4.9
0204	338	271	5.1
0204	349	255	5.2
Avg.	342	262	5.1

¹Wet samples were humidity aged at 140°F and 95-100% R.H. for 20 days.

APPENDIX M

**RESULTS OF INDIVIDUAL TEST SPECIMENS
TO DETERMINE THE EFFECT OF
ADHESIVE PRIMER THICKNESS**

TABLE M.1
EFFECT OF PRIMER THICKNESS DATA, INDIVIDUAL TENSILE
LAP SHEAR SPECIMEN STRENGTH AT 75°F
FOR PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Primer Thickness in</u>	<u>Failure Mode</u>
RB1B-A04-174-1	4143	0.0006	Cohesive-in primer
RB1B-A04-174-4	4825	0.0006	Cohesive-in primer
RB1B-A04-174-7	4465	0.0006	Cohesive-in primer
RB1B-A04-175-2	3773	0.0006	Cohesive-in primer
RB1B-A04-175-5	3841	0.0006	Cohesive-in primer
Average	4209		
Std. Dev.	138		

TABLE M.2
EFFECT OF PRIMER THICKNESS DATA, INDIVIDUAL TENSILE
LAP SHEAR SPECIMEN STRENGTH AT 200°F
FOR PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Primer Thickness in</u>	<u>Failure Mode</u>
RB1B-A04-174-2	2968	0.0006	Cohesive-in adhesive
RB1B-A04-174-5	2980	0.0006	Cohesive-in adhesive
RB1B-A04-174-8	3159	0.0006	Cohesive-in adhesive
RB1B-A04-175-3	3047	0.0006	Cohesive-in adhesive
RB1B-A04-175-6	2957	0.0006	Cohesive-in adhesive
Average	3022		
Std. Dev.	98		

TABLE M.3
EFFECT OF PRIMER THICKNESS DATA, INDIVIDUAL TENSILE
LAP SHEAR SPECIMEN STRENGTH AT -65°F
FOR PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Primer Thickness in</u>	<u>Failure Mode</u>
RB1B-A04-174-3	4944	0.0006	Cohesive-in primer
RB1B-A04-174-6	4465	0.0006	Cohesive-in primer
RB1B-A04-175-1	4095	0.0006	Cohesive-in primer
RB1B-A04-175-4	4156	0.0006	Cohesive-in primer
RB1B-A04-175-7	5080	0.0006	Cohesive-in primer
Average	4583		
Std. Dev.	113		

TABLE M.4
EFFECT OF PRIMER THICKNESS DATA, INDIVIDUAL TENSILE
LAP SHEAR SPECIMEN STRENGTH AT 75°F
FOR PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Primer Thickness in</u>	<u>Failure Mode</u>
RB1B-A23-14-2	4063	0.0002	Adhesive-primer to metal
RB1B-A23-14-7	4016	0.0002	Adhesive-primer to metal
RB1B-A23-15-4	4208	0.0002	Adhesive-primer to metal
RB1B-A23-16-1	3845	0.0002	Cohesive-in adhesive
RB1B-A23-16-5	4568	0.0002	Adhesive-primer to metal
RB1B-A23-17-6	4462	0.0002	Adhesive-primer to metal
RB1B-A23-20-3	4899	0.0002	Adhesive-primer to metal
RB1B-A23-29-4	4213	0.0002	Adhesive-primer to metal
RB1B-A23-33-3	4379	0.0002	Adhesive-primer to metal
RB1B-A23-33-7	4289	0.0002	Adhesive-primer to metal
Average	4285		
Std. Dev.	138		

TABLE M.5
EFFECT OF PRIMER THICKNESS DATA, INDIVIDUAL TENSILE
LAP SHEAR SPECIMEN STRENGTH AT 200°F
FOR PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Primer Thickness in</u>	<u>Failure Mode</u>
RB1B-A23-14-1	2966	0.0002	Cohesive-in adhesive
RB1B-A23-15-6	2988	0.0002	Cohesive-in adhesive
RB1B-A23-16-7	3019	0.0002	Cohesive-in adhesive
RB1B-A23-17-1	2946	0.0002	Cohesive-in adhesive
RB1B-A23-17-4	3090	0.0002	Cohesive-in adhesive
RB1B-A23-20-2	3061	0.0002	Cohesive-in adhesive
RB1B-A23-20-7	3112	0.0002	Cohesive-in adhesive
RB1B-A23-29-6	3222	0.0002	Cohesive-in adhesive
RB1B-A23-33-2	3254	0.0002	Cohesive-in adhesive
RB1B-A23-33-6	3146	0.0002	Cohesive-in adhesive
Average	3081		
Std. Dev.	72		

TABLE M.6
EFFECT OF PRIMER THICKNESS DATA, INDIVIDUAL TENSILE
LAP SHEAR SPECIMEN STRENGTH AT -65°F
FOR PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Primer Thickness in</u>	<u>Failure Mode</u>
RB1B-A23-14-4	4273	0.0002	Adhesive-primer to metal
RB1B-A23-15-2	4207	0.0002	Adhesive-primer to metal
RB1B-A23-15-7	4257	0.0002	Adhesive-primer to metal
RB1B-A23-16-4	4330	0.0002	Adhesive-primer to metal
RB1B-A23-17-2	3953	0.0002	Cohesive-in adhesive
RB1B-A23-20-4	4419	0.0002	Adhesive-primer to metal
RB1B-A23-20-6	3883	0.0002	Cohesive-in adhesive
RB1B-A23-29-1	4188	0.0002	Adhesive-primer to metal
RB1B-A23-29-3	4281	0.0002	Adhesive-primer to metal
RB1B-A23-33-5	4233	0.0002	Adhesive-primer to metal
Average	4203		
Std. Dev.	102		

TABLE M.7
EFFECT OF PRIMER THICKNESS DATA, INDIVIDUAL FLOATING
ROLLER PEEL SPECIMEN STRENGTH AT -65°F
FOR PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Peel Strength PLI</u>	<u>Primer Thickness in</u>	<u>Failure Mode</u>
RB1B-B04-177-3	3.6	0.0006	Cohesive-in primer
RB1B-B04-178-1	2.5	0.0006	Cohesive-in primer
RB1B-B04-178-4	2.6	0.0006	Cohesive-in primer
RB1B-B04-179-2	3.6	0.0006	Cohesive-in primer
RB1B-B04-179-5	3.5	0.0006	Cohesive-in primer
Average	3.2		
Std. Dev.	0.5		

TABLE M.8
EFFECT OF PRIMER THICKNESS DATA, INDIVIDUAL FLOATING
ROLLER PEEL SPECIMEN STRENGTH AT 200°F
FOR PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Peel Strength PLI</u>	<u>Primer Thickness in</u>	<u>Failure Mode</u>
RB1B-B04-177-2	1.0	0.0006	Cohesive-in adhesive
RB1B-B04-177-5	1.8	0.0006	Cohesive-in adhesive
RB1B-B04-178-3	2.0	0.0006	Cohesive-in adhesive
RB1B-B04-179-1	2.1	0.0006	Cohesive-in adhesive
RB1B-B04-179-4	2.5	0.0006	Cohesive-in adhesive
Average	1.9		
Std. Dev.	0.6		

TABLE M.9
EFFECT OF PRIMER THICKNESS DATA, INDIVIDUAL FLOATING
ROLLER PEEL SPECIMEN STRENGTH AT 75°F
FOR PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Peel Strength PLI</u>	<u>Primer Thickness in</u>	<u>Failure Mode</u>
RB1B-B04-177-4	3.8	0.0006	Cohesive-in primer
RB1B-B04-178-2	1.8	0.0006	Cohesive-in primer
RB1B-B04-178-4	2.1	0.0006	Cohesive-in primer
RB1B-B04-179-3	3.7	0.0006	Cohesive-in primer
Average	2.8		
Std. Dev.	1.1		

TABLE M.10
EFFECT OF PRIMER THICKNESS DATA, INDIVIDUAL FLOATING
ROLLER PEEL SPECIMEN STRENGTH AT 75°F
FOR PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Peel Strength PLI</u>	<u>Primer Thickness in</u>	<u>Failure Mode</u>
RB1B-B23-47-1	9.9	0.0002	Cohesive-in primer
RB1B-B23-48-3	7.6	0.0002	Cohesive-in primer
RB1B-B23-49-2	7.9	0.0002	Cohesive-in primer
RB1B-B23-50-1	10.3	0.0002	Cohesive-in primer
RB1B-B23-51-3	13.5	0.0002	Cohesive-in primer
Average	9.9		
Std. Dev.	2.4		

TABLE M.11
EFFECT OF PRIMER THICKNESS DATA, INDIVIDUAL FLOATING
ROLLER PEEL SPECIMEN STRENGTH AT 200°F
FOR PRODUCTION BATCH 0010

Specimen Number	Peel Strength PLI	Primer Thickness in	Failure Mode
RB1B-B23-47-2	10.0	0.0002	Cohesive-in adhesive
RB1B-B23-48-1	9.2	0.0002	Cohesive-in adhesive
RB1B-B23-49-3	10.1	0.0002	Cohesive-in adhesive
RB1B-B23-50-2	11.6	0.0002	Cohesive-in adhesive
RB1B-B23-51-1	12.3	0.0002	Cohesive-in adhesive
Average	10.7		
Std. Dev.	1.3		

TABLE M.12
EFFECT OF PRIMER THICKNESS DATA, INDIVIDUAL FLOATING
ROLLER PEEL SPECIMEN STRENGTH AT -65°F
FOR PRODUCTION BATCH 0010

Specimen Number	Peel Strength PLI	Primer Thickness in	Failure Mode
RB1B-B23-47-3	7.8	0.0002	Cohesive-in primer
RB1B-B23-48-2	7.0	0.0002	Cohesive-in primer
RB1B-B23-49-1	6.4	0.0002	Cohesive-in primer
RB1B-B23-50-3	7.2	0.0002	Cohesive-in primer
RB1B-B23-51-2	8.3	0.0002	Cohesive-in primer
Average	7.3		
Std. Dev.	0.7		

APPENDIX N

RESULTS OF INDIVIDUAL TEST SPECIMENS
TO DETERMINE THE EFFECT OF
ADHESIVE GLUELINE THICKNESS

TABLE N.1
EFFECT OF GLUELINE THICKNESS DATA, INDIVIDUAL TENSILE
LAP SHEAR SPECIMEN STRENGTH AT 75°F
FOR PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A23-14-2	4063	0.006	Adhesive-primer to metal
RB1B-A23-14-7	4016	0.005	Adhesive-primer to metal
RB1B-A23-15-4	4208	0.006	Adhesive-primer to metal
RB1B-A23-16-1	3845	0.008	Cohesive-in adhesive
RB1B-A23-16-5	4568	0.007	Adhesive-primer to metal
RB1B-A23-17-6	4462	0.005	Adhesive-primer to metal
RB1B-A23-20-3	4899	0.006	Adhesive-primer to metal
RB1B-A23-29-4	4213	0.006	Adhesive-primer to metal
RB1B-A23-33-3	4379	0.005	Adhesive-primer to metal
RB1B-A23-33-7	4289	0.005	Adhesive-primer to metal
Average	4294		
Std. Dev.	138		

TABLE N.2
EFFECT OF GLUELINE THICKNESS DATA, INDIVIDUAL TENSILE
LAP SHEAR SPECIMEN STRENGTH AT 200°F
FOR PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A23-14-1	2966	0.007	Cohesive-in adhesive
RB1B-A23-15-6	2988	0.006	Cohesive-in adhesive
RB1B-A23-16-7	3019	0.006	Cohesive-in adhesive
RB1B-A23-17-1	2946	0.007	Cohesive-in adhesive
RB1B-A23-17-4	3090	0.006	Cohesive-in adhesive
RB1B-A23-20-2	3061	0.006	Cohesive-in adhesive
RB1B-A23-20-7	3112	0.006	Cohesive-in adhesive
RB1B-A23-29-6	3222	0.005	Cohesive-in adhesive
RB1B-A23-33-2	3254	0.005	Cohesive-in adhesive
RB1B-A23-33-6	3146	0.005	Cohesive-in adhesive
Average	3081		
Std. Dev.	72		

TABLE N.3
EFFECT OF GLUELINE THICKNESS DATA, INDIVIDUAL TENSILE
LAP SHEAR SPECIMEN STRENGTH AT -65°F
FOR PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A23-14-4	4273	0.005	Adhesive-primer to metal
RB1B-A23-15-2	4207	0.006	Adhesive-primer to metal
RB1B-A23-15-7	4257	0.006	Adhesive-primer to metal
RB1B-A23-16-4	4330	0.005	Adhesive-primer to metal
RB1B-A23-17-2	3953	0.006	Cohesive-in adhesive
RB1B-A23-20-4	4419	0.006	Adhesive-primer to metal
RB1B-A23-20-6	3883	0.008	Cohesive-in adhesive
RB1B-A23-29-1	4188	0.007	Adhesive-primer to metal
RB1B-A23-29-3	4281	0.006	Adhesive-primer to metal
RB1B-A23-33-5	4233	0.005	Adhesive-primer to metal
Average	4203		
Std. Dev.	102		

TABLE N.4
EFFECT OF GLUELINE THICKNESS DATA, INDIVIDUAL TENSILE
LAP SHEAR SPECIMEN STRENGTH AT 75°F
FOR PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A05-190-1	4827	0.018	Adhesive-primer to metal
RB1B-A05-190-4	3880	0.015	Cohesive-in adhesive
RB1B-A05-190-7	4108	0.021	Adhesive-primer to metal
RB1B-A05-191-3	3347	0.014	Cohesive-in adhesive
RB1B-A05-191-6	3937	0.018	Adhesive-primer to metal
Average	4020		
Std. Dev.	188		

TABLE N.5
EFFECT OF GLUELINE THICKNESS DATA, INDIVIDUAL TENSILE
LAP SHEAR SPECIMEN STRENGTH AT 200°F
FOR PRODUCTION BATCH 0010

Specimen Number	Lap Shear Strength psi	Glueline Thickness in	<u>Failure Mode</u>
RB1B-A05-190-2	3178	0.019	Cohesive-in adhesive
RB1B-A05-190-5	3114	0.014	Cohesive-in adhesive
RB1B-A05-191-1	3082	0.014	Cohesive-in adhesive
RB1B-A05-191-4	3069	0.014	Cohesive-in adhesive
RB1B-A05-191-7	3155	0.019	Cohesive-in adhesive
Average	3120		
Std. Dev.	41		

TABLE N.6
EFFECT OF GLUELINE THICKNESS DATA, INDIVIDUAL TENSILE
LAP SHEAR SPECIMEN STRENGTH AT -65°F
FOR PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A05-190-3	4676	0.017	Adhesive-primer to metal
RB1B-A05-190-6	3584	0.016	Cohesive-in adhesive
RB1B-A05-191-2	3563	0.014	Cohesive-in adhesive
RB1B-A05-191-5	3937	0.016	Cohesive-in adhesive
RB1B-A05-191-8	3159	0.019	Cohesive-in adhesive
Average	3790		
Std. Dev.	92		

TABLE N.7
EFFECT OF GLUELINE THICKNESS DATA, INDIVIDUAL TENSILE
LAP SHEAR SPECIMEN STRENGTH AT 75°F
FOR PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A05-188-1	5529	0.001	Adhesive-primer to metal
RB1B-A05-188-4	5416	0.001	Adhesive-primer to metal
RB1B-A05-188-7	5496	0.002	Adhesive-primer to metal
RB1B-A05-189-3	5806	0.001	Adhesive-primer to metal
RB1B-A05-189-6	4857	0.002	Adhesive-primer to metal
Average	5401		
Std. Dev.	178		

TABLE N.8
EFFECT OF GLUELINE THICKNESS DATA, INDIVIDUAL TENSILE
LAP SHEAR SPECIMEN STRENGTH AT 200°F
FOR PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A05-188-2	3716	0.001	Cohesive-in adhesive
RB1B-A05-188-5	3569	0.001	Cohesive-in adhesive
RB1B-A05-189-1	3776	0.001	Cohesive-in adhesive
RB1B-A05-189-4	3846	0.001	Cohesive-in adhesive
RB1B-A05-189-7	3824	0.002	Cohesive-in adhesive
Average	3740		
Std. Dev.	92		

TABLE N.9
EFFECT OF GLUELINE THICKNESS DATA, INDIVIDUAL TENSILE
LAP SHEAR SPECIMEN STRENGTH AT -65°F
FOR PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A05-188-3	4518	0.001	Adhesive-primer to metal
RB1B-A05-188-6	4375	0.002	Adhesive-primer to metal
RB1B-A05-189-2	5376	0.001	Adhesive-primer to metal
RB1B-A05-189-5	4771	0.002	Adhesive-primer to metal
RB1B-A05-189-8	5224	0.002	Adhesive-primer to metal
Average	4853		
Std. Dev.	123		

TABLE N.10
EFFECT OF GLUELINE THICKNESS DATA, INDIVIDUAL FLOATING
ROLLER PEEL SPECIMEN STRENGTH AT -65°F
FOR PRODUCTION BATCH 0010

Specimen Number	Peel Strength PLI	Glueline Thickness in	<u>Failure Mode</u>
RB1B-B05-201-1	10.3	0.004	Cohesive-in primer
RB1B-B05-201-2	13.5	0.004	Cohesive-in primer
RB1B-B05-201-3	11.9	0.004	Cohesive-in primer
RB1B-B05-201-4	15.5	0.004	Cohesive-in primer
RB1B-B05-201-5	13.6	0.004	Cohesive-in primer
Average	12.9		
Std. Dev.	2.0		

TABLE N.11
EFFECT OF GLUELINE THICKNESS DATA, INDIVIDUAL FLOATING
ROLLER PEEL SPECIMEN STRENGTH AT 200°F
FOR PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Peel Strength PLI</u>	<u>GlueLine Thickness in</u>	<u>Failure Mode</u>
RB1B-B05-200-1	12.2	0.004	Cohesive-in adhesive
RB1B-B05-200-2	12.3	0.004	Cohesive-in adhesive
RB1B-B05-200-3	9.8	0.005	Cohesive-in adhesive
RB1B-B05-200-4	9.5	0.005	Cohesive-in adhesive
RB1B-B05-200-5	8.6	0.005	Cohesive-in adhesive
Average	10.4		
Std. Dev.	1.7		

TABLE N.12
EFFECT OF GLUELINE THICKNESS DATA, INDIVIDUAL FLOATING
ROLLER PEEL SPECIMEN STRENGTH AT 75°F
FOR PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Peel Strength PLI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B05-199-1	11.2	0.004	Cohesive-in primer
RB1B-B05-199-2	13.0	0.005	Cohesive-in primer
RB1B-B05-199-3	11.5	0.005	Cohesive-in primer
RB1B-B05-199-4	12.0	0.005	Cohesive-in primer
RB1B-B05-199-5	14.7	0.005	Cohesive-in primer
Average	12.5		
Std. Dev.	1.5		

TABLE N.13
EFFECT OF GLUELINE THICKNESS DATA, INDIVIDUAL FLOATING
ROLLER PEEL SPECIMEN STRENGTH AT 75°F
FOR PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Peel Strength PLI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B05-196-1	15.4	0.006	Cohesive-in primer
RB1B-B05-196-4	13.9	0.007	Cohesive-in primer
RB1B-B05-197-2	9.8	0.006	Cohesive-in primer
RB1B-B05-197-5	9.7	0.006	Cohesive-in primer
RB1B-B05-198-3	13.7	0.006	Cohesive-in primer
Average	12.5		
Std. Dev.	2.6		

TABLE N.14
EFFECT OF GLUELINE THICKNESS DATA, INDIVIDUAL FLOATING
ROLLER PEEL SPECIMEN STRENGTH AT 200°F
FOR PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Peel Strength PLI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B05-196-2	13.0	0.007	Cohesive-in primer
RB1B-B05-196-5	13.7	0.007	Cohesive-in primer
RB1B-B05-197-3	9.1	0.007	Cohesive-in primer
RB1B-B05-198-1	12.4	0.005	Cohesive-in primer
RB1B-B05-198-4	13.4	0.006	Cohesive-in primer
Average	12.3		
Std. Dev.	1.8		

TABLE N.15
EFFECT OF GLUELINE THICKNESS DATA, INDIVIDUAL FLOATING
ROLLER PEEL SPECIMEN STRENGTH AT -65°F
FOR PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Peel Strength PLI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B05-196-3	11.5	0.008	Cohesive-in primer
RB1B-B05-197-1	9.3	0.006	Cohesive-in primer
RB1B-B05-197-4	8.7	0.007	Cohesive-in primer
RB1B-B05-198-2	9.0	0.006	Cohesive-in primer
RB1B-B05-198-5	8.4	0.006	Cohesive-in primer
Average	9.4		
Std. Dev.	1.2		

TABLE N.16
EFFECT OF GLUELINE THICKNESS DATA, INDIVIDUAL FLOATING
ROLLER PEEL SPECIMEN STRENGTH AT 75°F
FOR PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Peel Strength PLI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B05-180-1	14.8	0.009	Cohesive-in primer
RB1B-B05-180-4	12.3	0.011	Cohesive-in primer
RB1B-B05-181-2	15.3	0.010	Cohesive-in primer
RB1B-B05-181-5	16.1	0.009	Cohesive-in primer
RB1B-B05-182-3	14.3	0.010	Cohesive-in primer
Average	14.6		
Std. Dev.	1.4		

TABLE N.17
EFFECT OF GLUELINE THICKNESS DATA, INDIVIDUAL FLOATING
ROLLER PEEL SPECIMEN STRENGTH AT 200°F
FOR PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Peel Strength PLI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B05-180-2	13.9	0.010	Cohesive-in primer
RB1B-B05-180-5	13.2	0.010	Cohesive-in primer
RB1B-B05-181-3	14.3	0.011	Cohesive-in primer
RB1B-B05-182-1	11.4	0.008	Cohesive-in primer
RB1B-B05-182-4	10.7	0.010	Cohesive-in primer
Average	12.1		
Std. Dev.	1.9		

TABLE N.18
EFFECT OF GLUELINE THICKNESS DATA, INDIVIDUAL FLOATING
ROLLER PEEL SPECIMEN STRENGTH AT -65°F
FOR PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Peel Strength PLI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B05-180-3	10.2	0.010	Cohesive-in primer
RB1B-B05-181-1	12.6	0.009	Cohesive-in primer
RB1B-B05-181-4	11.5	0.011	Cohesive-in primer
RB1B-B05-182-2	12.0	0.010	Cohesive-in primer
RB1B-B05-182-5	12.7	0.009	Cohesive-in primer
Average	11.8		
Std. Dev.	1.0		

TABLE N.19
EFFECT OF GLUELINE THICKNESS DATA, INDIVIDUAL FLOATING
ROLLER PEEL SPECIMEN STRENGTH AT 75°F
FOR PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Peel Strength PLI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B05-183-1	15.9	0.020	Cohesive-in primer
RB1B-B05-184-1	15.1	0.021	Cohesive-in primer
RB1B-B05-185-1	13.8	0.021	Cohesive-in primer
RB1B-B05-185-5	12.6	0.021	Cohesive-in primer
RB1B-B05-186-5	15.3	0.023	Cohesive-in primer
Average	14.5		
Std. Dev.	1.3		

TABLE N.20
EFFECT OF GLUELINE THICKNESS DATA, INDIVIDUAL FLOATING
ROLLER PEEL SPECIMEN STRENGTH AT 200°F
FOR PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Peel Strength PLI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B05-183-2	9.0	0.018	Cohesive-in primer
RB1B-B05-184-2	8.1	0.018	Cohesive-in primer
RB1B-B05-185-2	9.5	0.020	Cohesive-in primer
RB1B-B05-186-1	9.1	0.022	Cohesive-in primer
RB1B-B05-187-1	6.9	0.021	Cohesive-in primer
Average	8.4		
Std. Dev.	1.1		

TABLE N.21
EFFECT OF GLUELINE THICKNESS DATA, INDIVIDUAL FLOATING
ROLLER PEEL SPECIMEN STRENGTH AT -65°F
FOR PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Peel Strength PLI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B05-183-5	15.5	0.019	Cohesive-in primer
RB1B-B05-184-5	16.8	0.019	Cohesive-in primer
RB1B-B05-185-4	16.8	0.020	Cohesive-in primer
RB1B-B05-186-2	12.9	0.023	Cohesive-in primer
RB1B-B05-187-5	12.9	0.022	Cohesive-in primer
Average	15.0		
Std. Dev.	2.0		

APPENDIX O

**RESULTS OF INDIVIDUAL TEST SPECIMENS
TO DETERMINE THE EFFECT OF OVERLAP LENGTH**

TABLE O.1
EFFECT OF OVERLAP LENGTH, INDIVIDUAL TENSILE
LAP SHEAR SPECIMEN STRENGTH AT 75°F
FOR PRODUCTION BATCH 0010

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Overlap Length in</u>	<u>Failure Mode</u>
RB1B-A23-14-2	4063	0.50	Adhesive-primer to metal
RB1B-A23-14-7	4016	0.50	Adhesive-primer to metal
RB1B-A23-15-4	4208	0.51	Adhesive-primer to metal
RB1B-A23-16-1	3845	0.50	Cohesive-in Adhesive
RB1B-A23-16-5	4568	0.50	Adhesive-primer to metal
RB1B-A23-17-6	4462	0.50	Adhesive-primer to metal
RB1B-A23-20-3	4899	0.51	Adhesive-primer to metal
RB1B-A23-29-4	4213	0.50	Adhesive-primer to metal
RB1B-A23-33-3	4379	0.49	Adhesive-primer to metal
RB1B-A23-33-7	4289	0.50	Adhesive-primer to metal
Average	4294		
Std. Dev.	138		

TABLE O.2
EFFECT OF OVERLAP LENGTH, INDIVIDUAL TENSILE
LAP SHEAR SPECIMEN STRENGTH AT 75°F
FOR EA 9394 ADHESIVE BATCH NO. 0010

<u>Specimen Number</u>	<u>Tensile Lap Shear Strength psi</u>	<u>Overlap Length in</u>	<u>Failure Mode</u>
RB1B-A06-125-1	3275	0.991	Cohesive-in Adhesive
RB1B-A06-125-2	3170	0.995	Cohesive-in Adhesive
RB1B-A06-125-3	3280	0.992	Cohesive-in Adhesive
RB1B-A06-125-4	3588	1.007	Cohesive-in Adhesive
RB1B-A06-125-5	3615	0.991	Cohesive-in Adhesive
RB1B-A06-125-6	3557	0.996	Cohesive-in Adhesive
RB1B-A06-125-7	3600	0.998	Cohesive-in Adhesive
Average	3486		
Std. Dev.	76		

TABLE O.3
EFFECT OF OVERLAP LENGTH, INDIVIDUAL TENSILE
LAP SHEAR SPECIMEN STRENGTH AT 75°F
FOR EA 9394 ADHESIVE BATCH NO. 0010

<u>Specimen Number</u>	<u>Tensile Lap Shear Strength psi</u>	<u>Overlap Length in</u>	<u>Failure Mode</u>
RB1B-A06-126-1	1846	2.01	Cohesive-in Adhesive
RB1B-A06-126-2	1832	2.01	Cohesive-in Adhesive
RB1B-A06-126-3	1818	2.01	Cohesive-in Adhesive
RB1B-A06-126-4	1838	2.01	Cohesive-in Adhesive
RB1B-A06-126-5	1806	2.01	Cohesive-in Adhesive
RB1B-A06-126-6	1785	2.01	Cohesive-in Adhesive
RB1B-A06-126-7	1791	2.01	Cohesive-in Adhesive
Average	1817		
Std. Dev.	13		

TABLE O.4
EFFECT OF OVERLAP LENGTH, INDIVIDUAL TENSILE
LAP SHEAR SPECIMEN STRENGTH AT 75°F
FOR EA 9394 ADHESIVE BATCH NO. 0010

<u>Specimen Number</u>	<u>Tensile Lap Shear Strength psi</u>	<u>Overlap Length in</u>	<u>Failure Mode</u>
RB1B-A05-124-1	2372	1.45	Cohesive-in Adhesive
RB1B-A06-124-2	2338	1.45	Cohesive-in Adhesive
RB1B-A06-124-3	2328	1.45	Cohesive-in Adhesive
RB1B-A06-124-4	2376	1.45	Cohesive-in Adhesive
RB1B-A06-124-5	2365	1.45	Cohesive-in Adhesive
RB1B-A06-124-6	2425	1.45	Cohesive-in Adhesive
RE1B-A05-124-7	2452	1.45	Cohesive-in Adhesive
Average	2372		
Std. Dev.	15		

APPENDIX P

RESULTS OF INDIVIDUAL TEST SPECIMENS
FOR FLOATING ROLLER PEEL AFTER
EXPOSURE TO 350°F

TABLE P.1
EFFECT OF 350°F EXPOSURE, INDIVIDUAL
FLOATING ROLLER PEEL SPECIMEN STRENGTH
AT 75°F FOR EA 9394 ADHESIVE
BATCH NO. 0010

<u>Specimen Number</u>	<u>Exposure</u>	<u>Floating Roller Peel PLI</u>	<u>Failure Mode</u>
RB1B-B23-47-1	As Cured	9.9	Cohesive-in Primer
RE1B-B23-48-3	As Cured	7.6	Cohesive-in Primer
RB1B-B23-49-2	As Cured	7.9	Cohesive-in Primer
RB1B-B23-50-1	As Cured	10.3	Cohesive-in Primer
RB1B-B23-51-3	As Cured	13.5	Cohesive-in Primer
Average		9.9	
Std. Dev.		2.4	

TABLE P.2
EFFECT OF 350°F EXPOSURE, INDIVIDUAL
FLOATING ROLLER PEEL SPECIMEN STRENGTH
AT 200°F FOR EA 9394 ADHESIVE
BATCH NO. 0010

<u>Specimen Number</u>	<u>Exposure</u>	<u>Floating Roller Peel PLI</u>	<u>Failure Mode</u>
RB1B-B23-47-2	As Cured	10.0	Cohesive-in Adhesive
RB1B-B23-48-1	As Cured	9.2	Cohesive-in Adhesive
RB1B-B23-49-3	As Cured	10.1	Cohesive-in Adhesive
RB1B-B23-50-2	As Cured	11.6	Cohesive-in Adhesive
RB1B-B23-51-1	As Cured	12.3	Cohesive-in Adhesive
Average		10.6	
Std. Dev.		1.3	

TABLE P.3
EFFECT OF 350°F EXPOSURE, INDIVIDUAL
FLOATING ROLLER PEEL SPECIMEN STRENGTH
AT 75°F FOR EA 9394 ADHESIVE
BATCH NO. 0010

<u>Specimen Number</u>	<u>Exposure</u>	<u>Floating Roller Peel PLI</u>	<u>Failure Mode</u>
RB1B-B08-119-1	2 hrs @ 350°F	8.9	Cohesive-in Primer
RB1B-B08-119-3	2 hrs @ 350°F	7.1	Cohesive-in Primer
RB1B-B08-119-5	2 hrs @ 350°F	6.5	Cohesive-in Primer
RB1B-B08-120-2	2 hrs @ 350°F	9.7	Cohesive-in Primer
RB1B-B08-120-4	2 hrs @ 350°F	9.7	Cohesive-in Primer
Average		8.4	
Std. Dev.		1.5	

TABLE P.4
EFFECT OF 350°F EXPOSURE, INDIVIDUAL
FLOATING ROLLER PEEL SPECIMEN STRENGTH
AT 200°F FOR EA 9394 ADHESIVE
BATCH NO. 0010

<u>Specimen Number</u>	<u>Exposure</u>	<u>Floating Roller Peel PLI</u>	<u>Failure Mode</u>
RB1B-B08-119-2	2 hrs @ 350°F	3.4	Cohesive-in Adhesive
RB1B-B08-119-4	2 hrs @ 350°F	4.1	Cohesive-in Adhesive
RB1B-B08-120-1	2 hrs @ 350°F	5.2	Cohesive-in Adhesive
RB1B-B08-120-3	2 hrs @ 350°F	5.1	Cohesive-in Adhesive
RB1B-B08-120-5	2 hrs @ 350°F	4.9	Cohesive-in Adhesive
Average		4.6	
Std. Dev.		0.7	

TABLE P.5
EFFECT OF 350°F EXPOSURE, INDIVIDUAL
FLOATING ROLLER PEEL SPECIMEN STRENGTH
AT 75°F FOR EA 9394 ADHESIVE
BATCH NO. 0010

<u>Specimen Number</u>	<u>Exposure</u>	<u>Floating Roller Peel PLI</u>	<u>Failure Mode</u>
RB1B-B08-121-1	16 hrs @ 350°F	3.8	Cohesive-in Adhesive
RB1B-B08-121-3	16 hrs @ 350°F	3.7	Cohesive-in Adhesive
RB1B-B08-121-5	16 hrs @ 350°F	4.0	Cohesive-in Adhesive
RB1B-B08-122-2	16 hrs @ 350°F	4.8	Cohesive-in Adhesive
RB1B-B08-122-4	16 hrs @ 350°F	4.7	Cohesive-in Adhesive
Average		4.2	
Std. Dev.		0.5	

TABLE P.6
EFFECT OF 350°F EXPOSURE, INDIVIDUAL
FLOATING ROLLER PEEL SPECIMEN STRENGTH
AT 200°F FOR EA 9394 ADHESIVE
BATCH NO. 0010

<u>Specimen Number</u>	<u>Exposure</u>	<u>Floating Roller Peel PLI</u>	<u>Failure Mode</u>
RB1B-B08-121-2	16 hrs @ 350°F	1.4	Cohesive-in Adhesive
RB1B-B08-121-4	16 hrs @ 350°F	1.5	Cohesive-in Adhesive
RB1B-B08-122-1	16 hrs @ 350°F	1.8	Cohesive-in Adhesive
RB1B-B08-122-3	16 hrs @ 350°F	1.9	Cohesive-in Adhesive
RB1B-B08-122-5	16 hrs @ 350°F	1.8	Cohesive-in Adhesive
Average		1.7	
Std. Dev.		0.2	

APPENDIX Q

**RESULTS OF INDIVIDUAL TEST SPECIMENS
TO DETERMINE THE EFFECT OF THERMAL PULSE
ON TENSILE LAP SHEAR AND FLOATING
ROLLER PEEL STRENGTH**

TABLE Q.1
INDIVIDUAL EA 9394 ADHESIVE TENSILE LAP SHEAR
STRENGTHS AT 75°F AFTER THERMAL PULSE

Specimen Number	Lap Shear Strength psi	Glueline Thickness in	<u>Failure Mode</u>
RB1B-A14-81-1	4996	0.003	Adhesive-Primer to Metal
RB1B-A14-81-2	4495	0.003	Adhesive-Primer to Metal
RB1B-A14-81-3	4955	0.003	Adhesive-Primer to Metal
RB1B-A14-81-4	4887	0.003	Adhesive-Primer to Metal
RB1B-A14-81-5	4712	0.003	Adhesive-Primer to Metal
RB1B-A14-81-6	4278	0.003	Adhesive-Primer to Metal
RB1B-A14-81-7	4819	0.003	Adhesive-Primer to Metal
Average	4773		
Std. Dev.	235		

TABLE Q.2
 INDIVIDUAL EA 9394 ADHESIVE TENSILE LAP SHEAR
 STRENGTHS AT 75°F AFTER 30 DAYS AT 140°F
 AND 95-100% R.H. THEN SUBJECTED TO THERMAL PULSE

Specimen Number	Lap Shear Strength psi	Glueline Thickness in	Failure Mode
RB1B-A14-83-1	3638	0.003	Cohesive-in Adhesive
RB1B-A14-83-2	3848	0.003	Cohesive-in Adhesive
RB1B-A14-83-3	3644	0.003	Cohesive-in Adhesive
RB1B-A14-83-4	3625	0.003	Cohesive-in Adhesive
RB1B-A14-83-5	3476	0.003	Cohesive-in Adhesive
RB1B-A14-83-6	3767	0.003	Cohesive-in Adhesive
RB1B-A14-83-7	3607	0.003	Cohesive-in Adhesive
Average	3658		
Std. Dev.	57		

TABLE Q.3
INDIVIDUAL AUTOCLAVE CURED FM 300 ADHESIVE
TENSILE LAP SHEAR STRENGTHS AT 75°F

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A14-105-1	4370	0.005	Cohesive-in Adhesive
RB1B-A14-105-2	4404	0.004	Cohesive-in Adhesive
RB1B-A14-105-3	4412	0.004	Cohesive-in Adhesive
RB1B-A14-105-4	4567	0.005	Cohesive-in Adhesive
RB1B-A14-105-5	4377	0.004	Cohesive-in Adhesive
RB1B-A14-105-6	4367	0.004	Cohesive-in Adhesive
RB1B-A14-105-7	4964	0.004	Cohesive-in Adhesive
Average	4494		
Std. Dev.	68		

TABLE Q.4
INDIVIDUAL AUTOCLAVE CURED FM 300 ADHESIVE
TENSILE LAP SHEAR STRENGTHS AT 75°F
AFTER 30 DAYS AT 140°F AND 95-100% R.H.

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A14-106-1	4370	0.005	Cohesive-in Adhesive
RB1B-A14-106-2	4379	0.006	Cohesive-in Adhesive
RB1B-A14-106-3	4408	0.006	Cohesive-in Adhesive
RB1B-A14-106-4	4499	0.006	Cohesive-in Adhesive
RB1B-A14-106-5	4289	0.006	Cohesive-in Adhesive
RB1B-A14-106-6	4545	0.006	Cohesive-in Adhesive
RB1B-A14-106-7	4474	0.006	Cohesive-in Adhesive
Average	4423		
Std. Dev.	92		

TABLE Q.5
 INDIVIDUAL AUTOCLAVE CURED FM 300 ADHESIVE
 TENSILE LAP SHEAR STRENGTHS AT 75°F
 AFTER BEING SUBJECTED TO THERMAL PULSE

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A14-107-1	4088	0.003	Cohesive-in Adhesive
RB1B-A14-107-2	4204	0.004	Cohesive-in Adhesive
RB1B-A14-107-3	4113	0.003	Cohesive-in Adhesive
RB1B-A14-107-4	4370	0.004	Cohesive-in Adhesive
RB1B-A14-107-5	4093	0.004	Cohesive-in Adhesive
RB1B-A14-107-6	3961	0.003	Cohesive-in Adhesive
RB1B-A14-107-7	4276	0.004	Cohesive-in Adhesive
Average	4158		
Std. Dev.	104		

TABLE Q.6
 INDIVIDUAL AUTOCLAVE CURED FM 300 ADHESIVE
 TENSILE LAP SHEAR STRENGTHS AT 75°F
 AFTER 30 DAYS AT 140°F AND 95-100% R.H.
 THEN SUBJECTED TO THERMAL PULSE

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A14-108-1	5109	0.003	Cohesive-in Adhesive
RB1B-A14-108-2	4856	0.003	Cohesive-in Adhesive
RB1B-A14-108-3	4716	0.003	Cohesive-in Adhesive
RB1B-A14-108-4	4717	0.003	Cohesive-in Adhesive
RB1B-A14-108-5	4706	0.003	Cohesive-in Adhesive
RB1B-A14-108-6	4876	0.003	Cohesive-in Adhesive
RB1B-A14-108-7	4841	0.003	Cohesive-in Adhesive
Average	4832		
Std. Dev.	106		

TABLE Q.7
INDIVIDUAL VACUUM BAG CURED FM 300 ADHESIVE
TENSILE LAP SHEAR STRENGTHS AT 75°F

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A14-109-1	4192	0.008	Cohesive-in Adhesive
RB1B-A14-109-2	4223	0.007	Cohesive-in Adhesive
RB1B-A14-109-3	4282	0.007	Cohesive-in Adhesive
RB1B-A14-109-4	4186	0.007	Cohesive-in Adhesive
RB1B-A14-109-5	4300	0.006	Cohesive-in Adhesive
RB1B-A14-109-6	4283	0.006	Cohesive-in Adhesive
RB1B-A14-109-7	4299	0.006	Cohesive-in Adhesive
Average	4252		
std. Dev.	55		

TABLE Q.8
INDIVIDUAL VACUUM BAG CURED FM 300 ADHESIVE
TENSILE LAP SHEAR STRENGTHS AT 75°F
AFTER 30 DAYS AT 140°F AND 95-100% R.H.

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A14-110-1	4162	0.007	Cohesive-in Adhesive
RB1B-A14-110-2	4423	0.007	Cohesive-in Adhesive
RB1B-A14-110-3	4283	0.006	Cohesive-in Adhesive
RB1B-A14-110-4	4412	0.006	Cohesive-in Adhesive
RB1B-A14-110-5	4351	0.006	Cohesive-in Adhesive
RB1B-A14-110-6	4419	0.006	Cohesive-in Adhesive
RB1B-A14-110-7	4306	0.006	Cohesive-in Adhesive
Average	4337		
Std. Dev.	94		

TABLE Q.9
 INDIVIDUAL VACUUM BAG CURED FM 300 ADHESIVE
 TENSILE LAP SHEAR STRENGTHS AT 75°F
 AFTER BEING SUBJECTED TO THERMAL PULSE

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A14-111-1	3690	0.004	Cohesive-in Adhesive
RB1B-A14-111-2	3732	0.003	Cohesive-in Adhesive
RB1B-A14-111-3	3861	0.003	Cohesive-in Adhesive
RB1B-A14-111-4	3573	0.002	Cohesive-in Adhesive
RB1B-A14-111-5	3838	0.002	Cohesive-in Adhesive
RB1B-A14-111-6	3838	0.003	Cohesive-in Adhesive
RB1B-A14-111-7	3850	0.003	Cohesive-in Adhesive
Average	3769		
Std. Dev.	68		

TABLE Q.10
 INDIVIDUAL VACUUM BAG CURED FM 300 ADHESIVE
 TENSILE LAP SHEAR STRENGTHS AT 75°F
 AFTER 30 DAYS AT 140°F AND 95-100% R.H.
 THEN SUBJECTED TO THERMAL PULSE

<u>Specimen Number</u>	<u>Lap Shear Strength psi</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-A14-112-1	3805	0.004	Cohesive-in Adhesive
RB1B-A14-112-2	3885	0.003	Cohesive-in Adhesive
RB1B-A14-112-3	4079	0.003	Cohesive-in Adhesive
RB1B-A14-112-4	4017	0.002	Cohesive-in Adhesive
RB1B-A14-112-5	4207	0.002	Cohesive-in Adhesive
RB1B-A14-112-6	4231	0.002	Cohesive-in Adhesive
RB1B-A14-112-7	4136	0.003	Cohesive-in Adhesive
Average	4051		
Std. Dev.	112		

TABLE Q.11
INDIVIDUAL EA 9394 ADHESIVE FLOATING
ROLLER PEEL STRENGTHS AT 75°F
AFTER THERMAL PULSE

<u>Specimen Number</u>	<u>Floating Roller Peel PLI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B14-77-1	12.1	0.012	Cohesive-in Adhesive
RB1B-B14-77-2	8.9	0.012	Cohesive-in Adhesive
RB1B-B14-77-3	8.4	0.013	Cohesive-in Adhesive
RB1B-B14-77-4	8.5	0.013	Cohesive-in Adhesive
RB1B-B14-77-5	9.0	0.013	Cohesive-in Adhesive
Average	9.4		
Std. Dev.	1.6		

TABLE Q.12
 INDIVIDUAL EA 9394 ADHESIVE FLOATING
 ROLLER PEEL STRENGTHS AT 75°F
 AFTER 30 DAYS AT 140°F AND 95-100% R.H.
 THEN SUBJECTED TO THERMAL PULSE

Specimen Number	Floating Roller Peel PLI	Glueline Thickness in	Failure Mode
RB1B-B14- -1	11.6	0.013	Cohesive-in Adhesive
RB1B-B14- -2	10.1	0.013	Cohesive-in Adhesive
RB1B-B14- -4	9.0	0.012	Cohesive-in Adhesive
RB1B-B14- -5	9.7	0.013	Cohesive-in Adhesive
Average	9.9		
Std. Dev.	1.1		

TABLE Q.13
INDIVIDUAL AUTOCLAVE CURED FM 300 ADHESIVE
FLOATING ROLLER PEEL STRENGTHS AT 75°F

<u>Specimen Number</u>	<u>Floating Roller Peel PLI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B14-99-1	26.2	0.006	Cohesive-in Adhesive
RB1B-B14-99-2	30.8	0.007	Cohesive-in Adhesive
RB1B-B14-99-3	36.4	0.007	Cohesive-in Adhesive
RB1B-B14-99-4	33.7	0.007	Cohesive-in Adhesive
RB1B-B14-99-5	28.1	0.006	Cohesive-in Adhesive
Average	31.0		
Std. Dev.	4.1		

TABLE Q.14
 INDIVIDUAL AUTOCLAVE CURED FM 300 ADHESIVE
 FLOATING ROLLER PEEL STRENGTHS AT 75°F
 AFTER 30 DAYS AT 140°F AND 95-100% R.H.

<u>Specimen Number</u>	<u>Floating Roller Peel PLI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B14-100-1	26.7	0.007	Cohesive-in Adhesive
RB1B-B14-100-2	32.4	0.008	Cohesive-in Adhesive
RB1B-B14-100-3	38.1	0.009	Cohesive-in Adhesive
RB1B-B14-100-4	36.2	0.009	Cohesive-in Adhesive
RB1B-B14-100-5	30.9	0.008	Cohesive-in Adhesive
Average	32.8		
Std. Dev.	4.5		

TABLE Q.15
 INDIVIDUAL AUTOCLAVE CURED FM 300 ADHESIVE
 FLOATING ROLLER PEEL STRENGTHS AT 75°F
 AFTER THERMAL PULSE

<u>Specimen Number</u>	<u>Floating Roller Peel PLI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B14-103-1	25.7	0.006	Cohesive-in Adhesive
RB1B-B14-103-2	32.0	0.007	Cohesive-in Adhesive
RB1B-B14-103-3	37.9	0.007	Cohesive-in Adhesive
RB1B-B14-103-4	36.8	0.006	Cohesive-in Adhesive
RB1B-B14-103-5	31.1	0.006	Cohesive-in Adhesive
Average	32.7		
Std. Dev.	4.9		

TABLE Q.16
 INDIVIDUAL AUTOCLAVE CURED FM 300 ADHESIVE
 FLOATING ROLLER PEEL STRENGTHS AT 75°F
 AFTER 30 DAYS AT 140°F AND 95-100% R.H.
 THEN SUBJECTED TO THERMAL PULSE

<u>Specimen Number</u>	<u>Floating Roller Peel PLI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B14-104-1	25.3	0.005	Cohesive-in Adhesive
RB1B-B14-104-2	31.4	0.005	Cohesive-in Adhesive
RB1B-B14-104-3	38.0	0.006	Cohesive-in Adhesive
RB1B-B14-104-4	37.2	0.006	Cohesive-in Adhesive
RB1B-B14-104-5	30.5	0.005	Cohesive-in Adhesive
Average	32.5		
Std. Dev.	5.2		

TABLE Q.17
INDIVIDUAL VACUUM BAG CURED FM 300 ADHESIVE
FLOATING ROLLER PEEL STRENGTHS AT 75°F

Specimen Number	Floating Roller Peel PLI	Glueline Thickness in	Failure Mode
RB1B-B11-113-1	30.8	0.009	Cohesive-in Adhesive
RB1B-B11-113-2	30.4	0.010	Cohesive-in Adhesive
RB1B-B11-113-3	27.9	0.010	Cohesive-in Adhesive
RB1B-B11-113-4	26.7	0.010	Cohesive-in Adhesive
RB1B-B11-113-5	28.2	0.010	Cohesive-in Adhesive
Average	28.4		
Std. Dev.	1.7		

TABLE Q.18
INDIVIDUAL VACUUM BAG CURED FM 300 ADHESIVE
FLOATING ROLLER PEEL STRENGTHS AT 75°F
AFTER 30 DAYS AT 140°F AND 95-100% R.H.

<u>Specimen Number</u>	<u>Floating Roller Peel PLI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B14-114-1	32.2	0.009	Cohesive-in Adhesive
RB1B-B14-114-2	26.0	0.010	Cohesive-in Adhesive
RB1B-B14-114-3	27.5	0.010	Cohesive-in Adhesive
RB1B-B14-114-4	26.1	0.009	Cohesive-in Adhesive
RB1B-B14-114-7	29.5	0.009	Cohesive-in Adhesive
Average	28.2		
Std. Dev.	2.6		

TABLE Q.19
 INDIVIDUAL VACUUM BAG CURED FM 300 ADHESIVE
 FLOATING ROLLER PEEL STRENGTHS AT 75°F
 AFTER THERMAL PULSE

Specimen Number	Floating Roller Peel PLI	Glueline Thickness in	Failure Mode
RB1B-B14-117-1	33.3	0.008	Cohesive-in Adhesive
RB1B-B14-117-2	33.2	0.009	Cohesive-in Adhesive
RB1B-B14-117-3	30.8	0.009	Cohesive-in Adhesive
RB1B-B14-117-4	30.4	0.009	Cohesive-in Adhesive
RB1B-B14-117-5	34.3	0.008	Cohesive-in Adhesive
Average	32.4		
Std. Dev.	1.7		

TABLE Q.20
 INDIVIDUAL VACUUM BAG CURED FM 306 ADHESIVE
 FLOATING ROLLER PEEL STRENGTHS AT 75°F
 AFTER 30 DAYS AT 140°F AND 95-100% R.H.
 THEN SUBJECTED TO THERMAL PULSE

<u>Specimen Number</u>	<u>Floating Roller Peel PLI</u>	<u>Glueline Thickness in</u>	<u>Failure Mode</u>
RB1B-B14-118-1	35.8	0.007	Cohesive-in Adhesive
RB1B-B14-118-2	36.2	0.008	Cohesive-in Adhesive
RB1B-B14-118-3	32.2	0.007	Cohesive-in Adhesive
RB1B-B14-118-4	32.2	0.007	Cohesive-in Adhesive
RB1B-B14-118-5	39.9	0.006	Cohesive-in Adhesive
Average	35.2		
Std. Dev.	3.2		

APPENDIX R

**RESULTS OF INDIVIDUAL TEST SPECIMENS
FOR THE EFFECT OF ADHERENDS ON TENSILE
LAP SHEAR STRENGTH**

TABLE R.1
TENSILE LAP SHEAR STRENGTH AT 75°F
USING 7781 GLASS/EA 9396 EPOXY ADHERENDS,
INDIVIDUAL TENSILE LAP SHEAR SPECIMEN
STRENGTH FOR EA 9394 ADHESIVE BATCH NO. 0010

<u>Specimen Number</u>	<u>Tensile Lap Shear Strength psi</u>	<u>Failure Mode</u>
RB1B-A07-93-1	1737	In Laminate First Ply
RB1B-A07-93-4	1963	In Laminate First Ply
RB1B-A07-93-7	1860	In Laminate First Ply
RB1B-A07-93-10	1834	In Laminate First Ply
RB1B-A07-94-3	2466	In Laminate First Ply
RB1B-A07-94-6	2077	In Laminate First Ply
RB1B-A07-94-9	2157	In Laminate First Ply
RB1B-A07-95-2	1903	In Laminate First Ply
RB1B-A07-95-5	2259	In Laminate First Ply
RB1B-A07-95-8	2289	In Laminate First Ply
Average	2095	
Std. Dev.	106	

TABLE R.2
TENSILE LAP SHEAR STRENGTH AT 200°F
USING 7781 GLASS/EA 9396 EPOXY ADHERENDS,
INDIVIDUAL TENSILE LAP SHEAR SPECIMEN
STRENGTH FOR EA 9394 ADHESIVE BATCH NO. 0010

<u>Specimen Number</u>	<u>Tensile Lap Shear Strength psi</u>	<u>Failure Mode</u>
RB1B-A07-93-2	2014	In Laminate First Ply
RB1B-A07-93-5	2009	In Laminate First Ply
RB1B-A07-93-8	1572	In Laminate First Ply
RB1B-A07-94-1	1502	In Laminate First Ply
RB1B-A07-94-4	1680	In Laminate First Ply
RB1B-A07-94-7	1844	In Laminate First Ply
RB1B-A07-94-10	1607	In Laminate First Ply
RB1B-A07-95-3	1903	In Laminate First Ply
RB1B-A07-95-6	1620	In Laminate First Ply
RB1B-A07-95-9	1797	In Laminate First Ply
Average	1755	
Std. Dev.	141	

TABLE R.3
TENSILE LAP SHEAR STRENGTH AT -65°F
USING 7781 GLASS/EA 9396 EPOXY ADHERENDS,
INDIVIDUAL TENSILE LAP SHEAR SPECIMEN
STRENGTH FOR EA 9394 ADHESIVE BATCH NO. 0010

<u>Specimen Number</u>	<u>Tensile Lap Shear Strength psi</u>	<u>Failure Mode</u>
RB1B-A07-93-3	1896	In Laminate First Ply
RB1B-A07-93-6	2428	In Laminate First Ply
RB1B-A07-93-9	2321	In Laminate First Ply
RB1B-A07-94-2	3034	In Laminate First Ply
RB1B-A07-94-5	2062	In Laminate First Ply
RB1B-A07-94-8	2382	In Laminate First Ply
RB1B-A07-95-1	2256	In Laminate First Ply
RB1B-A07-95-4	2379	In Laminate First Ply
RB1B-A07-95-7	2188	In Laminate First Ply
RB1B-A07-95-10	2392	In Laminate First Ply
Average	2334	
Std. Dev.	121	

TABLE R.4
TENSILE LAP SHEAR STRENGTH AT 75°F
USING W133 GRAPHITE/EA 9396 EPOXY ADHERENDS,
INDIVIDUAL TENSILE LAP SHEAR SPECIMEN
STRENGTH FOR EA 9394 ADHESIVE BATCH NO. 0010

<u>Specimen Number</u>	<u>Tensile Lap Shear Strength psi</u>	<u>Failure Mode</u>
RB1B-A07-39-3	2864	In Laminate First Ply
RB1B-A07-39-6	4320	In Laminate First Ply
RB1B-A07-39-9	4440	In Laminate First Ply
RB1B-A07-40-2	4144	In Laminate First Ply
RB1B-A07-40-5	4137	In Laminate First Ply
RB1B-A07-40-8	4506	In Laminate First Ply
RB1B-A07-40-11	4408	In Laminate First Ply
Average	4117	
Std. Dev.	153	

TABLE R.5
TENSILE LAP SHEAR STRENGTH AT 200°F
USING W133 GRAPHITE/EA 9394 EPOXY ADHERENDS,
INDIVIDUAL TENSILE LAP SHEAR SPECIMEN
STRENGTH FOR EA 9394 ADHESIVE BATCH NO. 0010

<u>Specimen Number</u>	<u>Tensile Lap Shear Strength psi</u>	<u>Failure Mode</u>
RB1B-A07-39-1	2776	In Laminate First Ply
RB1B-A07-39-4	2546	In Laminate First Ply
RB1B-A07-39-7	3115	In Laminate First Ply
RB1B-A07-39-10	2768	In Laminate First Ply
RB1B-A07-40-3	2690	In Laminate First Ply
RB1B-A07-40-6	3068	In Laminate First Ply
RB1B-A07-40-9	3099	In Laminate First Ply
Average	2866	
Std. Dev.	64	

TABLE R.6
TENSILE LAP SHEAR STRENGTH AT -65°F
USING W133 GRAPHITE/EA 9394 EPOXY ADHERENDS,
INDIVIDUAL TENSILE LAP SHEAR SPECIMEN
STRENGTH FOR EA 9394 ADHESIVE BATCH NO. 0010

<u>Specimen Number</u>	<u>Tensile Lap Shear Strength psi</u>	<u>Failure Mode</u>
RB1B-A07-39-2	3047	In Laminate First Ply
RB1B-A07-39-5	3059	In Laminate First Ply
RB1B-A07-39-8	3191	In Laminate First Ply
RB1B-A07-40-1	4231	In Laminate First Ply
RB1B-A07-40-4	4032	In Laminate First Ply
RB1B-A07-40-7	3795	In Laminate First Ply
RB1B-A07-40-10	3610	In Laminate First Ply
Average	3566	
Std. Dev.	133	

TABLE R.7
TENSILE LAP SHEAR STRENGTH AT 75°F
USING 6-4 TITANIUM ADHERENDS,
INDIVIDUAL TENSILE LAP SHEAR SPECIMEN
STRENGTH FOR EA 9394 ADHESIVE BATCH NO. 0010

<u>Specimen Number</u>	<u>Tensile Lap Shear Strength psi</u>	<u>Failure Mode</u>
RB1B-A07-41-1	3561	Cohesive-in Adhesive
RB1B-A07-41-4	3404	Cohesive-in Adhesive
RB1B-A07-42-2	3618	Cohesive-in Adhesive
RB1B-A07-42-5	3573	Cohesive-in Adhesive
RB1B-A07-43-3	3711	Cohesive-in Adhesive
RB1B-A07-44-1	3585	Cohesive-in Adhesive
RB1B-A07-44-4	3430	Cohesive-in Adhesive
RB1B-A07-45-2	3407	Cohesive-in Adhesive
RB1B-A07-45-5	3801	Cohesive-in Adhesive
RB1B-A07-46-3	3693	Cohesive-in Adhesive
Average	3578	
Std. Dev.	141	

TABLE R.8
TENSILE LAP SHEAR STRENGTH AT 200°F
USING 6-4 TITANIUM ADHERENDS,
INDIVIDUAL TENSILE LAP SHEAR SPECIMEN
STRENGTH FOR EA 9394 ADHESIVE BATCH NO. 0010

<u>Specimen Number</u>	<u>Tensile Lap Shear Strength psi</u>	<u>Failure Mode</u>
RB1B-A07-41-2	2399	Cohesive-in Adhesive
RB1B-A07-41-5	2335	Cohesive-in Adhesive
RB1B-A07-42-3	2291	Cohesive-in Adhesive
RB1B-A07-43-1	2269	Cohesive-in Adhesive
RB1B-A07-43-4	2499	Cohesive-in Adhesive
RB1B-A07-44-2	2364	Cohesive-in Adhesive
RB1B-A07-44-5	2225	Cohesive-in Adhesive
RB1B-A07-45-3	2252	Cohesive-in Adhesive
RB1B-A07-46-1	2248	Cohesive-in Adhesive
RB1B-A07-46-4	2299	Cohesive-in Adhesive
Average	2318	
Std. Dev.	59	

TABLE R.9
TENSILE LAP SHEAR STRENGTH AT -65°F
USING 6-4 TITANIUM ADHERENDS,
INDIVIDUAL TENSILE LAP SHEAR SPECIMEN
STRENGTH FOR EA 9394 ADHESIVE BATCH NO. 0010

<u>Specimen Number</u>	<u>Tensile Lap Shear Strength psi</u>	<u>Failure Mode</u>
RB1B-A07-41-3	2929	Cohesive-in Adhesive
RB1B-A07-42-1	2896	Cohesive-in Adhesive
RB1B-A07-42-4	3067	Cohesive-in Adhesive
RB1B-A07-43-2	2867	Cohesive-in Adhesive
RB1B-A07-43-5	3224	Cohesive-in Adhesive
RB1B-A07-44-3	2940	Cohesive-in Adhesive
RB1B-A07-45-1	2791	Cohesive-in Adhesive
RB1B-A07-45-4	3040	Cohesive-in Adhesive
RB1B-A07-46-2	2715	Cohesive-in Adhesive
RB1B-A07-46-5	3342	Cohesive-in Adhesive
Average	2981	
Std. Dev.	95	

TABLE R.10
TENSILE LAP SHEAR STRENGTH AT 75°F
USING 2024-T3 ALUMINUM ADHERENDS,
INDIVIDUAL TENSILE LAP SHEAR SPECIMEN
STRENGTH FOR EA 9394 ADHESIVE BATCH NO. 0010

<u>Specimen Number</u>	<u>Tensile Lap Shear Strength psi</u>	<u>Failure Mode</u>
RB1B-A23-14-2	4063	Adhesive-primer to metal
RB1B-A23-14-7	4016	Adhesive-primer to metal
RB1B-A23-15-4	4208	Adhesive-primer to metal
RB1B-A23-16-1	3845	Cohesive-in Adhesive
RB1B-A23-16-5	4568	Adhesive-primer to metal
RB1B-A23-17-6	4462	Adhesive-primer to metal
RB1B-A23-20-3	4899	Adhesive-primer to metal
RB1B-A23-29-4	4213	Adhesive-primer to metal
RB1B-A23-33-3	4379	Adhesive-primer to metal
RB1B-A23-33-7	4289	Adhesive-primer to metal
Average	4294	
Std. Dev.	138	

TABLE R.11
TENSILE LAP SHEAR STRENGTH AT 200°F
USING 2024-T3 ALUMINUM ADHERENDS,
INDIVIDUAL TENSILE LAP SHEAR SPECIMEN
STRENGTH FOR EA 9394 ADHESIVE BATCH NO. 0010

Specimen Number	Tensile Lap Shear Strength psi	Failure Mode
RB1B-A23-14-1	2966	Cohesive-in Adhesive
RB1B-A23-15-6	2988	Cohesive-in Adhesive
RB1B-A23-16-7	3019	Cohesive-in Adhesive
RB1B-A23-17-1	2946	Cohesive-in Adhesive
RB1B-A23-17-4	3090	Cohesive-in Adhesive
RB1B-A23-20-2	3061	Cohesive-in Adhesive
RB1B-A23-20-7	3112	Cohesive-in Adhesive
RB1B-A23-29-6	3222	Cohesive-in Adhesive
RB1B-A23-33-2	3254	Cohesive-in Adhesive
RB1B-A23-33-6	3146	Cohesive-in Adhesive
Average	3081	
Std. Dev.	72	

TABLE R.12
TENSILE LAP SHEAR STRENGTH AT -65°F
USING 2024-T3 ALUMINUM ADHERENDS,
INDIVIDUAL TENSILE LAP SHEAR SPECIMEN
STRENGTH FOR EA 9394 ADHESIVE BATCH NO. 0010

<u>Specimen Number</u>	<u>Tensile Lap Shear Strength psi</u>	<u>Failure Mode</u>
RB1B-A23-14-4	4273	Adhesive-primer to metal
RB1B-A23-15-2	4207	Adhesive-primer to metal
RB1B-A23-15-7	4257	Adhesive-primer to metal
RB1B-A23-16-4	4330	Adhesive-primer to metal
RB1B-A23-17-2	3953	Cohesive-in Adhesive
RB1B-A23-20-4	4419	Adhesive-primer to metal
RB1B-A23-20-6	3883	Cohesive-in Adhesive
RB1B-A23-29-1	4188	Adhesive-primer to metal
RB1B-A23-29-3	4281	Adhesive-primer to metal
RB1B-A23-33-5	4233	Adhesive-primer to metal
Average	4203	
Std. Dev.	102	

APPENDIX S

**RESULTS OF INDIVIDUAL TEST SPECIMENS
TO DETERMINE THE EFFECT OF SURFACE
PREPARATION ON TENSILE LAP SHEAR AND
FLOATING ROLLER PEEL STRENGTHS**

TABLE S.1
EFFECT OF PANTA SURFACE PREPARATION ON UNPRIMED
ALUMINUM ADHERENDS, INDIVIDUAL TENSILE LAP
SHEAR SPECIMEN STRENGTH AT 75°F FOR
EA 9394 ADHESIVE, BATCH NO. 0010

<u>Specimen Number</u>	<u>Tensile Lap Shear Strength psi</u>	<u>Failure Mode</u>
RB1B-A10-193-1	5042	Adhesive-Metal to Adhesive
RB1B-A10-193-2	4939	Adhesive-Metal to Adhesive
RB1B-A10-193-3	4380	Adhesive-Metal to Adhesive
Average	4787	
Std. Dev.	236	

TABLE S.2
EFFECT OF PANTA SURFACE PREPARATION ON UNPRIMED
ALUMINUM ADHERENDS, INDIVIDUAL TENSILE LAP
SHEAR SPECIMEN STRENGTH AT 75°F
AFTER 30 DAYS AT 140°F AND 95-100% R.H.
FOR EA 9394 ADHESIVE, BATCH NO. 0010

<u>Specimen Number</u>	<u>Tensile Lap Shear Strength psi</u>	<u>Failure Mode</u>
RB1B-A10-193-4	4519	Adhesive-Metal to Adhesive
RB1B-A10-193-5	4321	Adhesive-Metal to Adhesive
RB1B-A10-193-6	4628	Adhesive-Metal to Adhesive
Average	4489	
Std. Dev.	129	

TABLE S.3
EFFECT OF SANDED SURFACE PREPARATION ON UNPRIMED
ALUMINUM ADHERENDS, INDIVIDUAL TENSILE LAP
SHEAR SPECIMEN STRENGTH AT 75°F
FOR EA 9394 ADHESIVE, BATCH NO. 0010

<u>Specimen Number</u>	<u>Tensile Lap Shear Strength psi</u>	<u>Failure Mode</u>
RB1B-A10-146-1	1462	Adhesive-Metal to Adhesive
RB1B-A10-146-3	1397	Adhesive-Metal to Adhesive
RB1B-A10-146-5	1712	Adhesive-Metal to Adhesive
Average	1524	
Std. Dev.	148	

TABLE S.4
EFFECT OF SANDED SURFACE PREPARATION ON UNPRIMED
ALUMINUM ADHERENDS, INDIVIDUAL TENSILE LAP
SHEAR SPECIMEN STRENGTH AT 75°F
AFTER 30 DAYS AT 140°F AND 95-100% R.H.
FOR EA 9394 ADHESIVE, BATCH NO. 0010

<u>Specimen Number</u>	<u>Tensile Lap Shear Strength psi</u>	<u>Failure Mode</u>
RB1B-A10-146-2	1434	Adhesive-Metal to Adhesive
RB1B-A10-146-4	1395	Adhesive-Metal to Adhesive
RB1B-A10-146-6	1532	Adhesive-Metal to Adhesive
Average	1454	
Std. Dev.	61	

TABLE S.5
EFFECT OF SANDED SURFACE PREPARATION ON BR 127 PRIMED
ALUMINUM ADHERENDS, INDIVIDUAL TENSILE LAP
SHEAR SPECIMEN STRENGTH AT 75°F
FOR EA 9394 ADHESIVE, BATCH NO. 0010

<u>Specimen Number</u>	<u>Tensile Lap Shear Strength psi</u>	<u>Failure Mode</u>
RB1B-A10-147-1	2914	Adhesive-Primer to Metal
RB1B-A10-147-3	2852	Adhesive-Primer to Metal
RB1B-A10-147-5	2818	Adhesive-Primer to Metal
Average	2861	
Std. Dev.	52	

TABLE S.6
EFFECT OF SANDED SURFACE PREPARATION ON BR 127 PRIMED
ALUMINUM ADHERENDS, INDIVIDUAL TENSILE LAP
SHEAR SPECIMEN STRENGTH AT 75°F
AFTER 30 DAYS AT 140°F AND 95-100% R.H.
FOR EA 9394 ADHESIVE, BATCH NO. 0010

<u>Specimen Number</u>	<u>Tensile Lap Shear Strength psi</u>	<u>Failure Mode</u>
RB1B-A10-147-2	2340	Adhesive-Primer to Metal
RB1B-A10-147-4	2042	Adhesive-Primer to Metal
RB1B-A10-147-6	2207	Adhesive-Primer to Metal
Average	2196	
Std. Dev.	94	

TABLE S.7
EFFECT OF WET AGING AND SANDED SURFACE PREPARATION
ON UNPRIMED GRAPHITE/EA 9396 EPOXY ADHERENDS,
INDIVIDUAL TENSILE LAP SHEAR SPECIMEN
STRENGTH AT 75°F FOR EA 9394 ADHESIVE, BATCH NO. 0010

Specimen Number	Tensile Lap Shear Strength psi	<u>Failure Mode</u>
RB1B-A10-176-1	2020	In Laminate First Ply
RB1B-A10-176-2	1580	In Laminate First Ply
RB1B-A10-176-3	1870	In Laminate First Ply
Average	1823	
Std. Dev.	102	

TABLE S.8
EFFECT OF WET AGING AND SANDED SURFACE PREPARATION
ON UNPRIMED GRAPHITE/EA 9396 EPOXY ADHERENDS,
INDIVIDUAL TENSILE LAP SHEAR SPECIMEN
STRENGTH AT 75°F AFTER 30 DAYS AT 140°F AND 95-100% R.H.
FOR EA 9394 ADHESIVE, BATCH NO. 0010

<u>Specimen</u> <u>Number</u>	<u>Tensile</u> <u>Lap Shear Strength</u> <u>psi</u>	<u>Failure Mode</u>
RB1B-A10-176-4	1666	In Laminate First Ply
RB1B-A10-176-5	1883	In Laminate First Ply
RB1B-A10-176-6	1631	In Laminate First Ply
Average	1727	
Std. Dev.	28	

TABLE S.9
EFFECT OF PASA JELL 105 SURFACE PREPARATION
ON UNPRIMED ALUMINUM ADHERENDS,
INDIVIDUAL TENSILE LAP SHEAR SPECIMEN
STRENGTH AT 75°F FOR EA 9394 ADHESIVE, BATCH NO. 0010

<u>Specimen Number</u>	<u>Tensile Lap Shear Strength psi</u>	<u>Failure Mode</u>
RB1B-A10-192-1	4539	Adhesive-Primer to Metal
RB1B-A10-192-2	4717	Adhesive-Primer to Metal
RB1B-A10-192-3	5059	Adhesive-Primer to Metal
Average	4772	
Std. Dev.	132	

TABLE S.10
EFFECT OF PASA JELL 105 SURFACE PREPARATION
ON UNPRIMED ALUMINUM ADHERENDS,
INDIVIDUAL TENSILE LAP SHEAR SPECIMEN
STRENGTH AT 75°F AFTER 30 DAYS AT 140°F AND 95-100% R.H.
FOR EA 9394 ADHESIVE, BATCH NO. 0010

<u>Specimen Number</u>	<u>Tensile Lap Shear Strength psi</u>	<u>Failure Mode</u>
RB1B-A10-192-4	3786	Adhesive-Primer to Metal
RB1B-A10-192-5	3772	Adhesive-Primer to Metal
RB1B-A10-192-6	3624	Adhesive-Primer to Metal
Average	3727	
Std. Dev.	64	

TABLE S.11
EFFECT OF PANTA SURFACE PREPARATION ON
ALUMINUM AND SANDED SURFACE PREPARATION
ON GRAPHITE/EA 9396 EPOXY UNPRIMED ADHERENDS,
INDIVIDUAL FLOATING ROLLER PEEL SPECIMEN
STRENGTH AT 75°F FOR EA 9394 ADHESIVE, BATCH NO. 0010

Specimen Number	Floating Roller Peel Strength PLI	Failure Mode
RB1B-B10-194-1	16.2	Cohesive-in Adhesive
RB1B-B10-194-2	13.9	Cohesive-in Adhesive
RB1B-B10-194-3	14.3	Cohesive-in Adhesive
RB1B-B10-194-4	25.8	Cohesive-in Adhesive
RB1B-B10-194-5	15.8	Cohesive-in Adhesive
Average	15.2	
Std. Dev.	1.0	

TABLE S.12
EFFECT OF PANTA SURFACE PREPARATION ON
ALUMINUM AND SANDED SURFACE PREPARATION
ON GRAPHITE/EA 9396 EPOXY UNPRIMED ADHERENDS,
INDIVIDUAL FLOATING ROLLER PEEL SPECIMEN STRENGTH
AT 75°F AFTER 30 DAYS AT 140°F AND 95-100% R.H.
FOR EA 9394 ADHESIVE, BATCH NO. 0010

<u>Specimen Number</u>	<u>Floating Roller Peel Strength PLI</u>	<u>Failure Mode</u>
RB1B-B10-195-1	13.5	Cohesive-in Adhesive
RB1B-B10-195-2	12.8	Cohesive-in Adhesive
RB1B-B10-195-3	12.2	Cohesive-in Adhesive
RB1B-B10-195-4	13.8	Cohesive-in Adhesive
RB1B-B10-195-5	13.2	Cohesive-in Adhesive
Average	13.1	
Std. Dev.	0.6	