

DRB1648.10.025

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION			DATE
STATEMENT OF COMPLIANCE WITH THE FEDERAL AVIATION REGULATIONS			8 April 2010
MAKE	MODEL NO.	TYPE (Airplane, Radio, Helicopter, etc.)	NAME OF APPLICANT
All	All	Material Allowables	DRB Aviation Consultants San Antonio, TX
LIST OF DATA			
IDENTIFICATION		TITLE	
DOCUMENT NUMBER		DOCUMENT TITLE	
1648R25T01 Rev D, dtd 03/31/10		Test Plan/Report for Composite Panels Inserts and Panel Pin Allowables Prepared for: Technical Composite Corporation AND DRB Aviation Consultants	
PURPOSE OF DATA			
In support of FAA Special Project Number SP7043SC-Q.			
APPLICABLE REQUIREMENTS (List specific sections)			
14 CFR Parts: 23.605(b), 23.613(a)(b), 25.605(b), and 25.613(a)(b).			
CERTIFICATION ~ Under authority vested by direction of the Administrator and in accordance with conditions and limitations of appointment under Part 183 of the Federal Aviation Regulations, data listed above and on attached sheets numbered <u>N/A</u> have been examined in accordance with established procedures and found to comply with applicable requirements of the Federal Aviation Regulations.			
I (XX) Therefore		Recommend approval of these data	
☒		Approve these data	
SIGNATURE(S) OF DESIGNATED ENGINEERING		DESIGNATION	CLASSIFICATION(S)
<i>Danny J. Engle</i> Danny J. Engle		DER7-710085-SW	Structural



Report No. 1648R25T01

Rev. D

**Test Plan/Report for Composite Panels
Inserts and Panel Pin Allowables**

Prepared For:

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Date: March 31, 2010

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Test Plan/Report

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Revision Log

Revision History				
Revision	Page(s) Affected	Description of Change(s)	Approval	Date
IR	All	Initial Release	PF	2009-07-02
A	1.00, 2.03 & 2.04 3.04 Sec 5.00 Appendix A Appendix B Appendix C	Added Panels 00-113M040-3, -9 & -12 Changed -55 link to -59 Added Short and Long Beam Results Added Conformity Data Added Calibration Data Added Test Data	PF	2009-10-13
B	Sec 1.00 & 2.05 Sec 5.00 Appendix A Appendix C	Added Aluminum Panels to Test Panel Definitions Added Pin and Insert Results Added Conformity Data Added Test Data	PF	2009-12-04
C	2.06	Updated Process Spec list	PF	2010-02-16
D	Sec 5.00 Appendix A Appendix C	Added Short and Long Beam Results Added Conformity Data Added Test Data	PF	2010-03-31

Released By: DRB Analyst: Candice Roemer (C.R.) On: 03/31/10

Introduction

The purpose of this test is to establish composite sandwich panel material properties and joint properties for potted panel pins and inserts. These properties will then be used in structural analyses to establish margins of safety for various interior assemblies. The results in this report are submitted to the FAA under FAA Project # SP7043SC-Q.

The following panels are used in the component testing:

Thickness/Panel #	Manufacturer	Face Sheets	Core
(0.25") 00-113M041-3	Tech Comp. Corp.	2 ply Fiberglass	1/8" cell 3.0 lb/ft ³ Nomex
(0.375") 00-113M041-5	Tech Comp. Corp.	2 ply Fiberglass	1/8" cell 3.0 lb/ft ³ Nomex
(0.50") 00-113M041-7	Tech Comp. Corp.	2 ply Fiberglass	1/8" cell 3.0 lb/ft ³ Nomex
(0.75") 00-113M041-9	Tech Comp. Corp.	2 ply Fiberglass	1/8" cell 3.0 lb/ft ³ Nomex
(1.00") 00-113M041-11	Tech Comp. Corp.	2 ply Fiberglass	1/8" cell 3.0 lb/ft ³ Nomex
(0.125") 00-113M040-13	Tech Comp. Corp.	2 ply/1 ply Fiberglass	Divinycel
(0.25") 00-113M040-15	Tech Comp. Corp.	2 ply/1 ply Fiberglass	Divinycel
(0.375") 00-113M040-17	Tech Comp. Corp.	2 ply/1 ply Fiberglass	Divinycel
(0.25") 00-113M040-3	Tech Comp. Corp.	2 ply Fiberglass	Divinycel
(0.375") 00-113M040-5	Tech Comp. Corp.	2 ply Fiberglass	Divinycel
(0.50") 00-113M040-7	Tech Comp. Corp.	2 ply Fiberglass	Divinycel
(0.75") 00-113M040-9	Tech Comp. Corp.	2 ply Fiberglass	Divinycel
(1.00") 00-113M040-11	Tech Comp. Corp.	2 ply Fiberglass	Divinycel
(0.25") 00-113M042-1	Tech Comp. Corp.	0.02" 2024-T3 AL	3/16" cell 5.7 lb/ft ³ 5052AL
(0.375") 00-113M042-3	Tech Comp. Corp.	0.02" 2024-T3 AL	3/16" cell 5.7 lb/ft ³ 5052AL
(0.50") 00-113M042-5	Tech Comp. Corp.	0.02" 2024-T3 AL	3/16" cell 5.7 lb/ft ³ 5052AL
(0.75") 00-113M042-7	Tech Comp. Corp.	0.02" 2024-T3 AL	3/16" cell 5.7 lb/ft ³ 5052AL
(1.00") 00-113M042-9	Tech Comp. Corp.	0.02" 2024-T3 AL	3/16" cell 5.7 lb/ft ³ 5052AL

Test Results

The results are summarized in this section along with any items of note that occurred during the tests. Data reduction for these results can be found in section 6.00 of this report. The following tables summarize the allowables calculated for the panel pin/insert shear and tension test and panel material short beam and long beam tests.

Pin Shear and Tension Tests

Panel	Pin	Adhesive	Loading	"A" Basis	"B" Basis
00-113M041-3	ATR-150-1875F	DP100	L-Joint, Trans. Shear	161.88	336.01
00-113M041-3	ATR-150-1875F	DP100	L-Joint, Tension	93.68	131.16
00-113M041-3	ATR-150-1875F	DP100	L-Joint, Long. Shear	197.33	361.58
00-113M041-5	ATR-200-3125F	DP100	L-Joint, Trans. Shear	216.88	396.94
00-113M041-5	ATR-200-3125F	DP100	L-Joint, Tension	221.36	283.67
00-113M041-5	ATR-200-3125F	DP100	L-Joint, Long. Shear	428.55	509.43
00-113M041-7	ATR-200-3125F	DP100	L-Joint, Trans. Shear	343.36	605.68
00-113M041-7	ATR-200-3125F	DP100	L-Joint, Tension	162.01	217.23
00-113M041-7	ATR-200-3125F	DP100	L-Joint, Long. Shear	436.19	576.84
00-113M041-9	ATR-250-4375F	DP100	L-Joint, Trans. Shear	219.97	434.26
00-113M041-9	ATR-250-4375F	DP100	L-Joint, Tension	185.54	242.38
00-113M041-9	ATR-250-4375F	DP100	L-Joint, Long. Shear	202.12	400.10
00-113M041-11	ATR-250-4375F	DP100	L-Joint, Trans. Shear	205.39	302.55
00-113M041-11	ATR-250-4375F	DP100	L-Joint, Tension	208.24	286.40
00-113M041-11	ATR-250-4375F	DP100	L-Joint, Long. Shear	277.40	398.76
00-113M040-7	ATR-250-4375F	DP100	L-Joint, Trans. Shear	176.76	255.59
00-113M040-7	ATR-250-4375F	DP100	L-Joint, Tension	Not Tested	Not Tested
00-113M040-7	ATR-250-4375F	DP100	L-Joint, Long. Shear	Not Tested	Not Tested
00-113M040-9	ATR-250-4375F	DP100	L-Joint, Trans. Shear	Not Tested	Not Tested
00-113M040-9	ATR-250-4375F	DP100	L-Joint, Tension	Not Tested	Not Tested
00-113M040-9	ATR-250-4375F	DP100	L-Joint, Long. Shear	Not Tested	Not Tested

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Test Results

Insert Shear and Tension Tests

Panel	Insert	Adhesive	Loading	"A" Basis	"B" Basis
00-113M041-3	NAS1836-3-07	DP100	Blind Insert Shear	363.93	505.59
00-113M041-3	NAS1834-3-250	DP100	Thru Insert Shear	795.14	965.84
00-113M041-3	NAS1836-3-07	DP100	Blind Insert Tension	192.93	239.62
00-113M041-3	NAS1834-3-250	DP100	Thru Insert Tension	334.52	418.24
00-113M041-5	NAS1836-3-11	DP100	Blind Insert Shear	588.45	635.44
00-113M041-5	NAS1834-3-375	DP100	Thru Insert Shear	530.45	741.11
00-113M041-5	NAS1836-3-11	DP100	Blind Insert Tension	292.17	338.62
00-113M041-5	NAS1834-3-375	DP100	Thru Insert Tension	544.24	598.00
00-113M041-7	NAS1836-3-14	DP100	Blind Insert Shear	420.81	515.18
00-113M041-7	NAS1834-3-500	DP100	Thru Insert Shear	613.72	708.29
00-113M041-7	NAS1836-3-14	DP100	Blind Insert Tension	360.15	400.19
00-113M041-7	NAS1834-3-500	DP100	Thru Insert Tension	629.69	661.37
00-113M041-9	NAS1836-3-22	DP100	Blind Insert Shear	372.61	480.37
00-113M041-9	NAS1834-3-750	DP100	Thru Insert Shear	495.31	627.45
00-113M041-9	NAS1836-3-22	DP100	Blind Insert Tension	528.22	599.06
00-113M041-9	NAS1834-3-750	DP100	Thru Insert Tension	665.35	713.79
00-113M041-11	NAS1836-3-28	DP100	Blind Insert Shear	404.78	504.36
00-113M041-11	NAS1834-3-1000	DP100	Thru Insert Shear	562.23	665.78
00-113M041-11	NAS1836-3-28	DP100	Blind Insert Tension	466.86	553.17
00-113M041-11	NAS1834-3-1000	DP100	Thru Insert Tension	691.43	752.63

Prepared by: DRB Adhesion Consultants, LLC, PCOW-7M027-00-10-06119

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Test Results

Insert Shear and Tension Tests

Panel	Insert	Adhesive	Loading	"A" Basis	"B" Basis
00-113M040-15	NAS1836-3-07	DP100	Blind Insert Shear	267.30	361.17
00-113M040-15	NAS1834-3-250	DP100	Thru Insert Shear	710.45	796.70
00-113M040-15	NAS1836-3-07	DP100	Blind Insert Tension	142.81	173.06
00-113M040-15	NAS1834-3-250	DP100	Thru Insert Tension	175.65	231.11
00-113M040-17	NAS1836-3-11	DP100	Blind Insert Shear	446.52	557.55
00-113M040-17	NAS1834-3-375	DP100	Thru Insert Shear	681.69	557.55
00-113M040-17	NAS1836-3-11	DP100	Blind Insert Tension	243.30	290.21
00-113M040-17	NAS1834-3-375	DP100	Thru Insert Tension	300.72	342.87
00-113M040-7	NAS1836-3-14	DP100	Blind Insert Shear	408.88	523.73
00-113M040-7	NAS1834-3-500	DP100	Thru Insert Shear	671.52	768.28
00-113M040-7	NAS1836-3-14	DP100	Blind Insert Tension	316.95	391.29
00-113M040-7	NAS1834-3-500	DP100	Thru Insert Tension	118.27	336.82
00-113M040-9	NAS1836-3-22	DP100	Blind Insert Shear	368.59	483.36
00-113M040-9	NAS1834-3-750	DP100	Thru Insert Shear	639.12	683.19
00-113M040-9	NAS1836-3-22	DP100	Blind Insert Tension	330.10	413.83
00-113M040-9	NAS1834-3-750	DP100	Thru Insert Tension	474.40	508.69

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Test Results (Cont'd.)

Short Beam Shear Test

In the short beam shear test, core compression failures were observed in the first samples. Load plates were added to the loading fixture and holding fixture to prevent this type of failure. The following table summarizes the allowables calculated for the short beam shear test.

The following equation converts the load from the test results to the core shear stress:

$$\sigma = V / hb, \text{ Where } V = P/2$$

where σ is the core shear stress, V is the shear load on the panel, h is the height of the panel, and b is the width of the panel. The shear load is half the applied because the load is applied at the center between the two supports.

Short Beam Shear Allowable Summary (Glass Skins):

Panel	Direction	H	F _s (PSI)	
			"A" Basis	"B" Basis
00-113M041-3	L	0.25"	198.94	208.93
00-113M041-3	W	0.25"	140.26	147.73
00-113M041-5	L	0.375"	112.73	117.31
00-113M041-5	W	0.375"	112.73	117.66
00-113M041-7	L	0.50"	156.15	165.07
00-113M041-7	W	0.50"	114.81	118.71
00-113M041-9	L	0.75"	115.22	123.77
00-113M041-9	W	0.75"	66.86	74.16
00-113M041-11	L	1.00"	109.93	120.45
00-113M041-11	W	1.00"	87.12	91.74
00-113M040-3	NA	0.25"	152.26	165.57
00-113M040-5	NA	0.375"	80.41	188.49
00-113M040-7	NA	0.50"	136.79	143.01
00-113M040-9	NA	0.75"	100.87	105.84
00-113M040-11	NA	1.00"	85.83	93.71

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Test Results (Cont'd.)

Short Beam Shear Test

Glass Skins

Panel	Direction	H	F _s (PSI)	
			"A" Basis	"B" Basis
00-113M040-13	NA	0.125"	75.35	90.67
00-113M040-13	NA	0.125"	79.99	81.92
00-113M040-15	NA	0.25"	109.41	113.15
00-113M040-15	NA	0.25"	132.41	140.00
00-113M040-17	NA	0.375"	87.48	92.70
00-113M040-17	NA	0.375"	94.46	108.81

Aluminum Skins

Panel	Direction	H	F _s (PSI)	
			"A" Basis	"B" Basis
00-113M042-1	L	0.25"	365.78	400.48
00-113M042-1	W	0.25"	405.77	423.13
00-113M042-3	L	0.375"	545.62	562.81
00-113M042-3	W	0.375"	352.76	363.48
00-113M042-5	L	0.50"	500.41	511.77
00-113M042-5	W	0.50"	304.57	317.72
00-113M042-7	L	0.75"	425.34	438.25
00-113M042-7	W	0.75"	276.07	285.15
00-113M042-9	L	1.00"	300.39	339.30
00-113M042-9	W	1.00"	259.59	267.81

Test Results (Cont'd.)

Long Beam Bending Test

The bending moment allowable is quoted in both inch pounds per inch and pounds per square inch. A nominal thickness value of 0.020" for two ply and 0.010" for one ply skins was used because this lowers the apparent skin stress value and makes any analysis conservative where a lower value for skin thickness is used to determine the applied stress. The following equation translates the moment in inch pounds per inch into pounds per square inch.

$$M = PL/8b$$

$$\sigma_b = M / t_f h$$

The following table summarizes the bending allowables from the long beam bending test.

Long Beam Bending Allowable Summary (Glass Skins)

Panel	Direction	M (in-lb/in)		σ_b (PSI)		Loading
		"A" Basis	"B" Basis	"A" Basis	"B" Basis	
00-113M041-3	L	112.25	133.65	24,402	29,054	Quarter point loading
00-113M041-3	W	40.47	47.70	8,797	10,369	Quarter point loading
00-113M041-5	L	196.13	214.32	27,623	30,185	Quarter point loading
00-113M041-5	W	193.61	201.78	27,269	28,419	Quarter point loading
00-113M041-7	L	276.92	295.42	28,845	30,772	Quarter point loading
00-113M041-7	W	236.09	257.48	24,592	26,820	Quarter point loading
00-113M041-9	L	321.96	338.90	22,052	23,212	Quarter point loading
00-113M041-9	W	264.98	313.07	18,149	21,443	Quarter point loading
00-113M041-11	L	437.33	469.44	22,312	23,951	Quarter point loading
00-113M041-11	W	354.20	376.93	18,071	19,231	Quarter point loading
00-113M040-3	NA	101.61	108.50	22,089	23,586	Quarter point loading
00-113M040-5	NA	104.49	124.93	14,716	17,595	Quarter point loading
00-113M040-7	NA	194.82	210.67	20,293	21,944	Quarter point loading
00-113M040-9	NA	199.90	242.75	13,691	16,626	Quarter point loading
00-113M040-11	NA	278.35	284.95	14,201	14,538	Quarter point loading

Test Results (Cont'd.)

Long Beam Bending Test

Glass Skins

Panel	Direction	M (in-lb/in)		σ_b (PSI)		Loading
		"A" Basis	"B" Basis	"A" Basis	"B" Basis	
00-113M040-13	NA	24.49	61.34	11,131	27,881	Quarter point loading
00-113M040-13	NA	12.58	20.63	5,718	9,377	Quarter point loading
00-113M040-15	NA	57.24	61.34	12,178	13,051	Quarter point loading
00-113M040-15	NA	79.23	89.56	16,857	19,055	Quarter point loading
00-113M040-17	NA	65.28	75.58	9,066	10,497	Quarter point loading
00-113M040-17	NA	107.93	121.08	14,990	16,816	Quarter point loading

Aluminum Skins

Panel	Direction	M (in-lb/in)		σ_b (PSI)		Loading
		"A" Basis	"B" Basis	"A" Basis	"B" Basis	
00-113M042-1	L	237.75	257.79	51,683	56,041	Quarter point loading
00-113M042-1	W	206.57	228.25	44,906	49,618	Quarter point loading
00-113M042-3	L	377.93	399.96	53,230	56,332	Quarter point loading
00-113M042-3	W	373.36	386.28	52,585	54,406	Quarter point loading
00-113M042-5	L	563.05	576.03	58,650	60,002	Quarter point loading
00-113M042-5	W	501.92	523.33	52,283	54,513	Quarter point loading
00-113M042-7	L	711.50	777.33	48,732	53,242	Quarter point loading
00-113M042-7	W	764.52	798.16	52,364	54,668	Quarter point loading
00-113M042-9	L	938.11	1,006.91	47,862	51,373	Quarter point loading
00-113M042-9	W	937.54	992.01	47,833	50,612	Quarter point loading