



*Progressive Engineering Inc.*

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**ALPHA SYSTEMS, INC.**

Adhesive Test per California CA 25-4  
Using P3100, P5101 & Alphaseal 5200 Adhesives

12/6/2004



This test report contains twelve (12) pages, including the cover sheet. Any additions to, alterations of, or unauthorized use of excerpts from this report are expressly forbidden.

2004-1817

**1. TITLE**

Evaluation of adhesives for structural use in the manufactured housing industry - California CA 25-4.

**2. OBJECTIVE**

To perform the requested tests as specified in the Fleetwood Memorandum date August 25, 2004 on P3100, P5101 and Alphaseal 5200 adhesives.

Alphaseal 5200 has an ICC-ES Legacy Report No. 21-48. This test result pertains only to the designated adhesive samples provided for testing of P3100 and P5101. Alpha Systems, Inc is responsible for any certification, quality control or random testing of production adhesive that may be required for these two products.

**3. TESTED FOR**

Alpha Systems, Inc.  
5120 Beck Drive  
Elkhart, IN 46516

**4. TESTING ORGANIZATION**

*Progressive Engineering, Inc.*

58640 State Road 15  
Goshen, IN 46528  
[www.p-e-i.com](http://www.p-e-i.com)

*See IAS Evaluation Report No. TL-178 for ISO 17025 Accreditation.*

**5. TESTING PERSONNEL**

Director of Testing	- Greg A. Weeden
Laboratory Manager	- Jason R. Holdeman
Technician	- Norm Amstutz

**6. ADHESIVE TESTED**

Alphaseal 5200 - Two-part polyurethane adhesive

Pemco P3100 - Water based, non-flammable, solvent free, zero V.O.C. adhesive (PVA)

Pemco P5101 - One-part polyurethane adhesive



Day 14 - Alphaseal 5200

## **7. GLUING AND CURING CONDITION**

- A. Moisture Content: All lumber was 10% to 15%
- B. Gluing: Both sides of lumber were glued using a tongue depressor to achieve 100% coverage on both pieces.
- C. Open time: The lumber was assembled 20 minutes after the adhesive was applied.
- D. Glue Preparation: The P3100, P5101, Alphaseal 5200 adhesives are a ready to use adhesive.
- E. Specimens Conditioned: As specified in tests 3, 4 & 5
- F. Clamping Pressure: 100 PSI for 24 hours for all test samples.
- G. Cure Time: 7 days for all test samples.

## **8. TEST RESULTS**

See data pages for results on Block shear - High heat and Humidity and Block Shear Moisture Resistance.

Alphaseal 5200<sup>1</sup>, P5101 and the P3100 adhesives passed the CA 25-4 Mold Test No. 5.

<sup>1</sup> - Sparse growth is noted on the Alphaseal 5200, but after a careful examination the growth was limited to glass fibers protruding from the adhesive . Due to the nature of the two-part polyurethane reaction, complete saturation of the disk could not be attained prior to the adhesive curing.

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CA 25-4 Block Shear

Test No. 3

Date: 10/19/04

Client: Alpha Systems

Adhesive: 3100

Wood Type: Maple to Maple

Prior Block Conditioning: 7 days at 100°F. +/- 2° and 85% +/- 2% relative humidity

Test Condition: 68.0°F and 44% R.H.

Load Rate: .200" per minute

Required Number: 1400 psi

	Sample No.	Height	Width	Sq. In.	Ultimate Load	PSI Reached	Percent %		
							Adhesion	Cohesion	Wood Pull
1	A1	1.505 "	2.014 "	3.031 sq.in.	4,199	1,385	80	20	
2	A2	1.506 "	2.000 "	3.012 sq.in.	4,087	1,357	40	60	
3	A3	1.507 "	1.998 "	3.011 sq.in.	3,567	1,185	80	20	
4	A4	1.509 "	1.991 "	3.004 sq.in.	4,018	1,337	80	20	
5	A5	1.507 "	1.995 "	3.006 sq.in.	3,991	1,327	70	30	
6	B1	1.503 "	2.008 "	3.018 sq.in.	4,260	1,412	70	30	
7	B2	1.501 "	1.992 "	2.990 sq.in.	4,043	1,352	70	30	
8	B3	1.512 "	1.992 "	3.012 sq.in.	4,126	1,370	60	40	
9	B4	1.501 "	1.990 "	2.987 sq.in.	3,739	1,252	80	20	
10	B5	1.502 "	1.993 "	2.993 sq.in.	4,038	1,349	80	20	
<b>Average</b>					<b>4,007</b>	<b>1,333</b>			

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CA 25-4 Block Shear

Test No. 3

Date: 10/19/2004

Test Condition: 68.0°F and 44% R.H.

Client: Alpha Systems

Load Rate: .200" per minute

Adhesive:

Required Number:

Wood Type: Maple to Maple

Prior Block Conditioning: 7 days at 100°F. +/- 2° and 85% +/- 2% relative humidity

	Sample No.	Height	Width	Sq. In.	Ultimate Load	PSI Reached	Percent %			
							Adhesion	Cohesion	Wood Pull	
1	A1	1.508 "	2.027 "	3.057 sq.in.	8,342	2,729	80		20	
2	A2	1.510 "	2.023 "	3.055 sq.in.	8,651	2,832	90		10	
3	A3	1.515 "	2.017 "	3.056 sq.in.	8,981	2,939	100			
4	A4	1.514 "	2.013 "	3.048 sq.in.	9,500	3,117	70		30	
5	A5	1.526 "	2.017 "	3.078 sq.in.	8,668	2,816	80		20	
6	B1	1.514 "	2.031 "	3.075 sq.in.	8,738	2,842			100	
7	B2	1.513 "	2.027 "	3.067 sq.in.	8,663	2,825	50		50	
8	B3	1.507 "	2.022 "	3.047 sq.in.	8,490	2,786	50		50	
9	B4	1.513 "	2.026 "	3.065 sq.in.	8,524	2,781	60		40	
10	B5	1.519 "	2.018 "	3.065 sq.in.	8,525	2,781	30		70	
					<b>Average</b>	<b>8,708</b>	<b>2,845</b>			

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CA 25-4 Block Shear

Test No. 4

Date: 10/14/04

Client: Alpha Systems

Adhesive: 3100

Wood Type: Plywood to Plywood

Test Condition: 68.0°F and 53% R.H.

Load Rate: .200" per minute

Required Number: 375 psi

Prior Block Conditioning: Placed in water at room temp. for 4 hrs. followed by 20 hrs. in air temp. of 140° - 145°F. (Three cycles were completed.)

	Sample No.	Height	Width	Sq. In.	Ultimate Load	PSI Reached	Percent %		
							Adhesion	Cohesion	Wood Pull
1	A1	1.515 "	2.004 "	3.036 sq.in.	1,877	618			100
2	A2	1.510 "	2.000 "	3.020 sq.in.	2,098	695			100
3	A3	1.516 "	2.005 "	3.040 sq.in.	2,374	781			100
4	A4	1.511 "	2.008 "	3.034 sq.in.	2,269	748		50	50
5	A5	1.515 "	2.007 "	3.041 sq.in.	2,098	690		50	50
6	B1	1.519 "	2.011 "	3.055 sq.in.	1,334	437		20	80
7	B2	1.520 "	2.007 "	3.051 sq.in.	1,620	531		20	80
8	B3	1.521 "	2.004 "	3.048 sq.in.	2,035	668		20	80
9	B4	1.512 "	2.020 "	3.054 sq.in.	1,633	535		10	90
10	B5	1.523 "	2.014 "	3.067 sq.in.	1,972	643		10	90
<b>Average</b>					1,931	634			

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CA 25-4 Block Shear

Test No. 4

Date: 10/14/04

Client: Alpha Systems

Adhesive: 3100

Wood Type: Plywood to Douglas Fir

Test Condition: 68.0°F and 53% R.H.

Load Rate: .200" per minute

Required Number: 375 psi

Prior Block Conditioning: Placed in water at room temp. for 4 hrs. followed by 20 hrs. in air temp. of 140° - 145°F. (Three cycles were completed.)

	Sample No.	Height	Width	Sq. In.	Ultimate Load	PSI Reached	Percent %		
							Adhesion	Cohesion	Wood Pull
1	A1	1.515 "	1.972 "	2.988 sq.in.	1,811	606			100
2	A2	1.506 "	1.956 "	2.946 sq.in.	2,400	815		50	50
3	A3	1.512 "	1.957 "	2.959 sq.in.	1,157	391		50	50
4	A4	1.511 "	1.958 "	2.959 sq.in.	1,216	411		50	50
5	A5	1.524 "	1.965 "	2.995 sq.in.	2,238	747		20	80
6	B1	1.523 "	1.961 "	2.987 sq.in.	1,337	448		70	30
7	B2	1.523 "	1.954 "	2.976 sq.in.	1,346	452		70	30
8	B3	1.524 "	1.948 "	2.969 sq.in.	1,451	489		20	80
9	B4	1.513 "	1.961 "	2.967 sq.in.	1,735	585		50	50
10	B5	1.526 "	1.951 "	2.977 sq.in.	1,466	492		50	50
<b>Average</b>					1,616	<b>544</b>			



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CA 25-4 Block Shear

Test No. 4

Date: 10/15/04

Client: Alpha Systems

Adhesive: 5101

Wood Type: Plywood to Plywood

Test Condition: 65.0°F and 47% R.H.

Load Rate: .200" per minute

Required Number: 375 psi

Prior Block Conditioning: Placed in water at room temp. for 4 hrs. followed by 20 hrs. in air temp. of 140° - 145°F. (Three cycles were completed.)

	Sample No.	Height	Width	Sq. In.	Ultimate Load	PSI Reached	Percent %		
							Adhesion	Cohesion	Wood Pull
1	A1	1.514 "	2.014 "	3.049 sq.in.	2,214	726			100
2	A2	1.514 "	2.003 "	3.033 sq.in.	1,836	605			100
3	A3	1.518 "	2.004 "	3.042 sq.in.	1,964	646			100
4	A4	1.514 "	2.005 "	3.036 sq.in.	2,142	706			100
5	A5	1.513 "	2.007 "	3.037 sq.in.	2,456	809			100
6	B1	1.509 "	1.997 "	3.013 sq.in.	1,827	606			100
7	B2	1.513 "	2.000 "	3.026 sq.in.	2,229	737			100
8	B3	1.515 "	1.998 "	3.027 sq.in.	1,961	648			100
9	B4	1.517 "	2.003 "	3.039 sq.in.	1,992	656			100
10	B5	1.525 "	2.010 "	3.065 sq.in.	2,150	701			100
<b>Average</b>					<b>2,077</b>	<b>684</b>			

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CA 25-4 Block Shear

Test No. 4

Date: 10/15/04

Client: Alpha Systems

Adhesive: 5101

Wood Type: Plywood to Douglas Fir

Test Condition: 65.0°F and 47% R.H.

Load Rate: .200" per minute

Required Number: 375 psi

Prior Block Conditioning: Placed in water at room temp. for 4 hrs. followed by 20 hrs. in air temp. of 140° - 145°F. (Three cycles were completed.)

	Sample No.	Height	Width	Sq. In.	Ultimate Load	PSI Reached	Percent %		
							Adhesion	Cohesion	Wood Pull
1	A1	1.515 "	1.983 "	3.004 sq.in.	2,620	872			100
2	A2	1.517 "	1.966 "	2.982 sq.in.	2,851	956			100
3	A3	1.517 "	1.989 "	3.017 sq.in.	2,523	836			100
4	A4	1.518 "	1.997 "	3.031 sq.in.	3,059	1,009		20	80
5	A5	1.509 "	1.989 "	3.001 sq.in.	2,552	850			100
6	B1	1.522 "	1.970 "	2.998 sq.in.	2,554	852			100
7	B2	1.512 "	1.967 "	2.974 sq.in.	2,539	854			100
8	B3	1.511 "	1.960 "	2.962 sq.in.	2,779	938			100
9	B4	1.517 "	1.969 "	2.987 sq.in.	2,667	893			100
10	B5	1.519 "	1.985 "	3.015 sq.in.	3,263	1,082			100
<b>Average</b>					<b>2,741</b>	<b>914</b>			

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CA 25-4 Mold Test

Test No. 5

Date: 12/6/04

Client: Alpha Systems

Adhesive: P3100, P5101 & Alphaseal 5200

Standard: ASTM D 4300

Species of Fungi cultured: Aspergillus Niger

Type of media used: Potato Dextrose Agar

Fungi incubation time: 14 days

Test Performed: Testing with spore suspension of a pure culture of a single species for low viscosity adhesive.

		Alphaseal		
		P5101	5200	Control
	Date	Plate	Plate	Plate
		grading	grading	grading
Start	11/15/04			
	11/18/04	NG	NG	LG
	11/22/04	NG	SG	MG
	11/29/04	NG	SG	HG

		P3100
	Date	Plate
		grading
Start	11/22/04	
	11/25/04	NG
	11/29/04	NG
	12/6/04	NG

NG = No Growth

SG = Sparse Growth

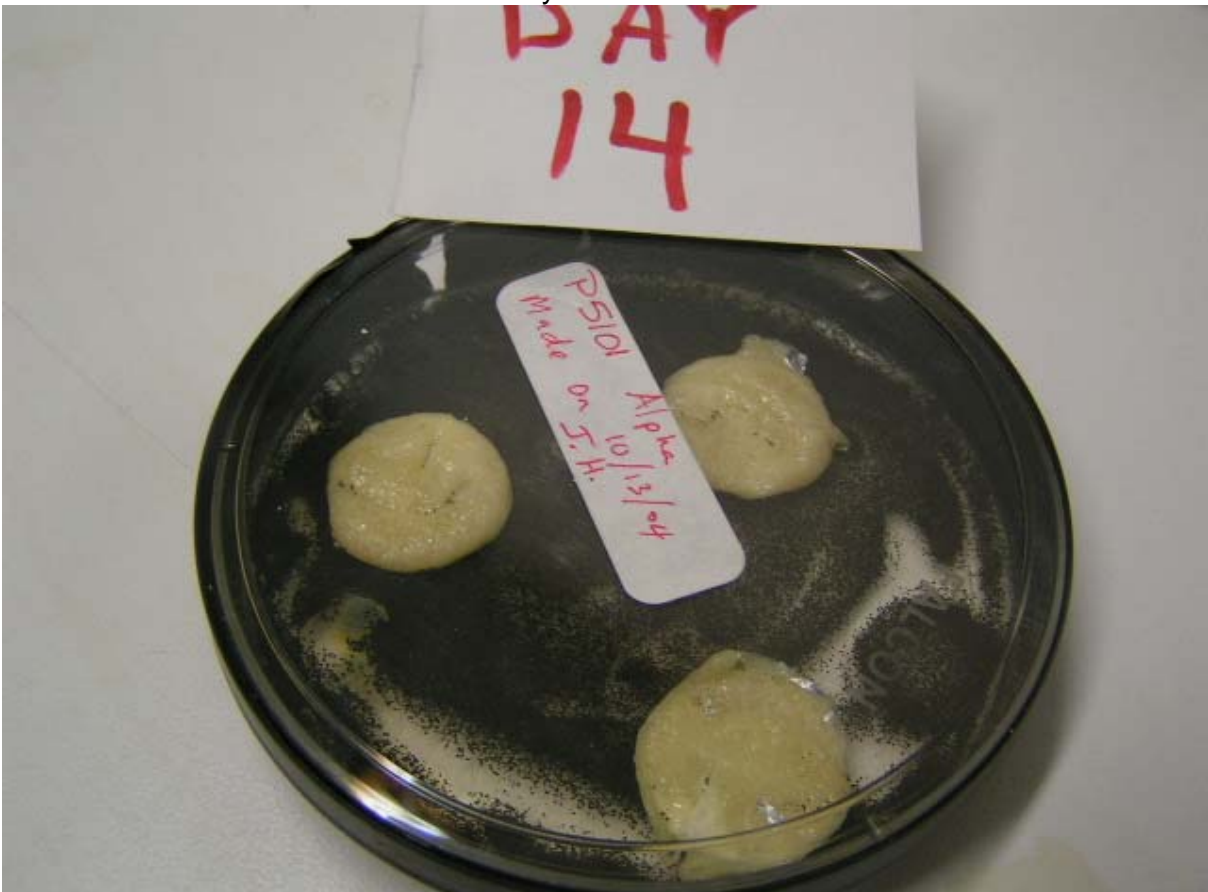
LG = Light Growth

MG = Moderate Growth

HG = Heavy Growth



Day 14 - P3100



Day 14 - P5101