Evaluation of Double-Sided Wall Assemblies Under Racking Load 
Sheathed with 5/32” Lauan Paneling

Attached with:
“P5100” Adhesive, Front Panels
“P3100” Adhesive, Back Panels

Manufactured By:
Alpha Systems

Prepared For:
Alpha Systems
5120 Beck Drive
Elkhart, IN 46516

Test Report: NTA990060

Issued: September 27, 1999

Prepared By:
John Kirkwood
Director of Testing.

Reviewed By:
John W. Weldy, P.E.
Test Engineer

NTA, Inc. has issued this report for the exclusive use of the client to whom it is addressed. 
Any use or duplication of this report shall not be made without their consent.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>INTRODUCTION</td>
<td>3</td>
</tr>
<tr>
<td>2.0</td>
<td>TEST SPECIMEN DESCRIPTION</td>
<td>3</td>
</tr>
<tr>
<td>3.0</td>
<td>TEST SETUP AND PROCEDURE</td>
<td>4</td>
</tr>
<tr>
<td>4.0</td>
<td>TEST RESULTS</td>
<td>4</td>
</tr>
<tr>
<td>5.0</td>
<td>CONCLUSION</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>5.1 FOLLOW-UP TESTING</td>
<td>5</td>
</tr>
<tr>
<td>6.0</td>
<td>APPENDIX</td>
<td></td>
</tr>
<tr>
<td>6.1</td>
<td>TEST CHART AND TEST DATA</td>
<td>6</td>
</tr>
<tr>
<td>6.2</td>
<td>LOAD VS DEFLECTION GRAPH</td>
<td>9</td>
</tr>
<tr>
<td>6.3</td>
<td>TEST SAMPLE</td>
<td>10</td>
</tr>
<tr>
<td>6.4</td>
<td>TEST SETUP</td>
<td>11</td>
</tr>
</tbody>
</table>
1.0 INTRODUCTION

NTA, Inc. conducted racking load tests on wall assemblies at the NTA test facility in Nappanee, Indiana. The wall assemblies were tested in conformance to ASTM E 72-80; Standard Methods of Conducting Strength Tests of Panels for Building Construction, Section 14, Racking Load -- Evaluation of Luaun Materials on a Standard Wood Frame.

The Purpose of this evaluation is to determine what the allowable design shear load is for wall assemblies constructed as described in this report, using 5/32” luaun paneling attached with “P5100” and “P3100” adhesive as manufactured by Alpha Systems.

2.0 TEST SPECIMEN DESCRIPTION

A. Materials
1. Studs: 2 x 3, Stud Grade SPF at 16” o.c.
2. Top Plate: Single 1 x 3, Un-Graded SPF.
3. Bottom Plate: Single 1 x 3, Un-Graded SPF.

B. Fastening
- Top plate fastened to studs with (2) - 7/16” x 1-3/4” x 15 Ga. staples per stud.
- Bottom plate fastened to studs with (2) - 7/16” x 1-3/4” x 15 Ga. staples per stud.
- Luaun attached to 2 x 3 studs with (2) - 1/16” - 1/8” (average) beads of P5100 adhesive on the front. Back side with (1) 1/4” bead of P3100 per stud.
- Luaun attached to center 2 x 3 stud at seam with (2) - 1/16”-1/8” (average) bead of “P5100” adhesive. (Front side) Back side with (2) 1/4” P3100 beads.
- Luaun attached to top and bottom plates of front side with (2) 1/16”-1/8” beads of P5100 adhesive.
- Luaun attached to top and bottom plates of the back side with (1) 1/4” bead of P3100.
- Luaun fastened to framing with 3/16” x 3/4” x 19 Ga. staples at 6” o.c. around perimeter of Luaun, and none in the field for the interior studs. Front and back side fastening schedule identical.

C. Construction Steps
- “P 5100” applied to the assembled wall with a caulking gun (one side).
- “P 3100” applied to the assembled wall with a caulking gun (one side).
- The Luaun was placed on one side of the wall framing immediately after the adhesive was applied and then promptly fastened along all panel edges and framing members as described.

D. Cure Time
After construction, each of the wall assemblies were cured a minimum of seven (7) days before testing.
3.0 TEST SETUP AND PROCEDURE

The wall top plate was fastened to a steel load bar using four (4) - #10 wood screws into each stud bay adjacent to a panel edge for load application. The bottom plate was securely fastened to a structural tee with four (4) - #10 wood screws into each stud bay. The structural tee was then attached to the I-beam in order to secure the sample to the test rack.

Load was applied horizontally to the load bar attached to the top plate of the wall. Dial indicators were placed on the top plate (Indicator #1), and on the bottom plate (Indicator #2) opposite the loaded end of the wall. An additional dial indicator was placed on the load end of the wall at the base of the rack at the first stud location (Indicator #3). See Figure #2 for details.

Load was applied in 395 pound increments, up to 2360 pounds, at a rate of approximately 790 pounds per two minutes (not less than). When each load increment was reached, deflection readings were taken while maintaining the load. The load was then reduced back to zero at an approximate rate of 790 pounds per two minutes. Zero load readings were taken after each load increment up to 2360 pounds. Finally, load was applied at the same approximate rate until failure occurred.

To determine the horizontal deflection of the panel, subtract the deflection readings from Indicators #2 and #3 from Indicator #1. Indicator #3, which is attached to the stud, will measure any rotation of the panel. Indicator #2 measures any slippage of the panel in the test rack. Indicator #1 measures the total of displacement of Indicators #2 and #3, as well as the deformation of the panel.

4.0 TEST RESULTS

A total of three (3) test samples were tested. Each sample had 5/32” lauan attached to the front side using “P3100” adhesive. Each sample had 5/32” lauan attached to the back side using “P3100” adhesive. The ultimate loads achieved and the types of failures that occurred are described below.

<table>
<thead>
<tr>
<th>SAMPLE</th>
<th>ULTIMATE LOAD</th>
<th>FAILURE MODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>10675 pounds</td>
<td>Lauan shear.</td>
</tr>
<tr>
<td>#2</td>
<td>10555 pounds</td>
<td>Lauan shear.</td>
</tr>
<tr>
<td>#3</td>
<td>11500 pounds</td>
<td>Lauan shear.</td>
</tr>
</tbody>
</table>

Average Ultimate Load = 10,910 pounds

Allowable Design Load = (Average Ultimate Load) / [(Wall Length)*(Safety Factor)]

(10,910 pounds) / [(8 feet)*(2.5)] = 545.5 PLF
5.0 CONCLUSION

Based on the results of the tests conducted, the maximum allowable design load for a 96" tall shear wall built of 2 x 3 Stud Grade SPF studs at 16" o/c, 1 x 3, un-graded SPF top plates with 1 x 3 un-graded SPF bottom plates with Lauan attached to both sides as described in this report is:

For 5/32" Lauan Paneling
Attached to Both Sides with
Alpha Systems
P5100 Adhesive - Front panels
P3100 Adhesive - Back Panels
= 545.5 PLF

5.1 FOLLOW-UP TESTING

Follow-up testing will be in accordance with the NTA, Inc. follow-up testing procedures.

TEST REPORT BY: John Kirkwood, NTA Inc.
Director of Testing

REPORT REVIEWED BY: John W. Weldy
Test Engineer
### WALL RACKING TEST

**Test Procedure:** ASTM E 72-80  
**Type of Sheathing:** 5/32" Lauan  
**Gypsum Lot Number:**  

**Adhesive Manufacturer:** Alpha Systems  
**Type of Adhesive:** P 5100 Front/ P 3100 Back  
**FASTENERS:** 3/16" x 3/4" x 19 Ga. Senco Staple  
**Field Spacing:** None  
**Top Plate Spacing:** 6" o.c.  
**Bottom Plate Spacing:** 6" o.c.  
**Vertical Edge Spacing:** 6" o.c.  
**Adhesive Bead Size:** (2) 1/16" - 1/8" P 5100 Front  
(1) 1/4" - P 3100 Back

### AVERAGE MOISTURE CONTENT

<table>
<thead>
<tr>
<th>Plates</th>
<th>11.50%</th>
<th>1 x 3 SPF Ungraded</th>
<th>Studs</th>
<th>12.00%</th>
<th>2 x 3 SPF Stud Grade</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>LOAD (pounds)</th>
<th>INDICATOR #1 (in.)</th>
<th>INDICATOR #2 (in.)</th>
<th>INDICATOR #3 (in.)</th>
<th>RESULTANT DEFLECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>READING</td>
<td>DEF.</td>
<td>READING</td>
<td>DEF.</td>
</tr>
<tr>
<td>0</td>
<td>0.125</td>
<td>0</td>
<td>0.450</td>
<td>0</td>
</tr>
<tr>
<td>395</td>
<td>0.132</td>
<td>0.007</td>
<td>0.451</td>
<td>0.001</td>
</tr>
<tr>
<td>790</td>
<td>0.157</td>
<td>0.032</td>
<td>0.450</td>
<td>0.000</td>
</tr>
<tr>
<td>1185</td>
<td>0.194</td>
<td>0.069</td>
<td>0.452</td>
<td>0.002</td>
</tr>
<tr>
<td>1570</td>
<td>0.226</td>
<td>0.101</td>
<td>0.453</td>
<td>0.003</td>
</tr>
<tr>
<td>1965</td>
<td>0.256</td>
<td>0.131</td>
<td>0.454</td>
<td>0.004</td>
</tr>
<tr>
<td>2360</td>
<td>0.267</td>
<td>0.142</td>
<td>0.454</td>
<td>0.004</td>
</tr>
<tr>
<td>0</td>
<td>0.153</td>
<td>0.028</td>
<td>0.452</td>
<td>0.002</td>
</tr>
</tbody>
</table>

**LOAD AT FAILURE:** 10675  
**DATE FABRICATED:** 9/20/99  
**MODE OF FAILURE:** Shear failure in between stud bays. Both sides.

**8' x 8' SAMPLE:** LAUAN ATTACHED TO BOTH SIDES.

---

**Location of Failure and Dial Indicator Placement**

---

**TESTED BY:** John Kirkwood  
**WITNESSED BY:** Shawn Weldy
WALL RACKING TEST

Test Procedure: ASTM E 72-80
Type of Sheathing: 5/32" Lauan
Gypsum Lot Number: 

Adhesive Manufacturer: Alpha Systems
Type of Adhesive: P 5100 Front/ P3100 Back

FASTENERS: 3/16" x 3/4" x 19 Ga. Senco Staple
Field Spacing: None
Top Plate Spacing: 6" o.c.
Bottom Plate Spacing: 6" o.c.
Vertical Edge Spacing: 6" o.c.
Adhesive Bead Size: (2) 1/16" - 1/8" P 5100 Front
(1) 1/4" - P 3100 Back

SAMPLE 2
Test Number: 990060
Test Date: 9/27/99
Temperature: 70 F
Relative Humidity: 36%

AVERAGE MOISTURE CONTENT
Plates: 11.50% 1 x 3 SPF Ungraded
Studs: 12.00% 2 x 3 SPF Stud Grade

<table>
<thead>
<tr>
<th>LOAD (pounds)</th>
<th>INDICATOR #1 (in.)</th>
<th>INDICATOR #2 (in.)</th>
<th>INDICATOR #3 (in.)</th>
<th>RESULTANT DEFLECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>READING</td>
<td>DEF.</td>
<td>READING</td>
<td>DEF.</td>
</tr>
<tr>
<td>0</td>
<td>0.125</td>
<td></td>
<td>0.503</td>
<td></td>
</tr>
<tr>
<td>385</td>
<td>0.135</td>
<td>0.010</td>
<td>0.504</td>
<td>0.001</td>
</tr>
<tr>
<td>0</td>
<td>0.129</td>
<td>0.004</td>
<td>0.503</td>
<td>0.000</td>
</tr>
<tr>
<td>790</td>
<td>0.169</td>
<td>0.044</td>
<td>0.504</td>
<td>0.001</td>
</tr>
<tr>
<td>0</td>
<td>0.138</td>
<td>0.013</td>
<td>0.503</td>
<td>0.000</td>
</tr>
<tr>
<td>1185</td>
<td>0.202</td>
<td>0.077</td>
<td>0.506</td>
<td>0.003</td>
</tr>
<tr>
<td>0</td>
<td>0.143</td>
<td>0.018</td>
<td>0.503</td>
<td>0.000</td>
</tr>
<tr>
<td>1570</td>
<td>0.238</td>
<td>0.113</td>
<td>0.507</td>
<td>0.004</td>
</tr>
<tr>
<td>0</td>
<td>0.151</td>
<td>0.026</td>
<td>0.504</td>
<td>0.001</td>
</tr>
<tr>
<td>1965</td>
<td>0.267</td>
<td>0.142</td>
<td>0.508</td>
<td>0.005</td>
</tr>
<tr>
<td>0</td>
<td>0.156</td>
<td>0.031</td>
<td>0.505</td>
<td>0.002</td>
</tr>
<tr>
<td>2360</td>
<td>0.303</td>
<td>0.176</td>
<td>0.510</td>
<td>0.007</td>
</tr>
<tr>
<td>0</td>
<td>0.158</td>
<td>0.033</td>
<td>0.505</td>
<td>0.002</td>
</tr>
</tbody>
</table>

LOAD AT FAILURE: 10555
DATE FABRICATED: 9/20/99

MODE OF FAILURE: Shear failure in between stud bays. Both sides.

8' x 8' SAMPLE: LAUAN ATTACHED TO BOTH SIDES.

Location of Failure and Dial Indicator Placement

TESTED BY: John Kirkwood
WITNESSED BY: Shawn Weldy

NTA980060 S2.XLS Page 7 of 11
**WALL RACKING TEST**

Test Procedure: ASTM E 72-80

Type of Sheathing: 5/32" Lauan

Gypsum Lot Number: 

Adhesive Manufacturer: Alpha Systems

Type of Adhesive: P 5100 Front/ P3100 Back

FASTENERS: 3/16" x 3/4" x 19 Ga. Senco Staple

Field Spacing: None

Top Plate Spacing: 6" o.c.

Bottom Plate Spacing: 6" o.c.

Vertical Edge Spacing: 6" o.c.

Adhesive Bead Size: (2) 1/16" - 1/8" P 5100 Front

(1) 1/4" - P 3100 Back

---

**SAMPLE 3**

<table>
<thead>
<tr>
<th>Test Number</th>
<th>990060</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Date</td>
<td>9/27/99</td>
</tr>
<tr>
<td>Temperature</td>
<td>70 F</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>36%</td>
</tr>
</tbody>
</table>

**AVERAGE MOISTURE CONTENT**

Plates: 11.50% 1 x 3 SPF Ungraded

Studs: 12.00% 2 x 3 SPF Stud Grade

<table>
<thead>
<tr>
<th>LOAD (pounds)</th>
<th>INDICATOR #1 (in.)</th>
<th>INDICATOR #2 (in.)</th>
<th>INDICATOR #3 (in.)</th>
<th>RESULTANT DEFLECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>READING</td>
<td>DEF.</td>
<td>READING</td>
<td>DEF.</td>
</tr>
<tr>
<td>0</td>
<td>0.430</td>
<td>0.500</td>
<td>0.988</td>
<td></td>
</tr>
<tr>
<td>395</td>
<td>0.438</td>
<td>0.008</td>
<td>0.501</td>
<td>0.01</td>
</tr>
<tr>
<td>0</td>
<td>0.420</td>
<td>0.010</td>
<td>0.500</td>
<td>0.00</td>
</tr>
<tr>
<td>790</td>
<td>0.488</td>
<td>0.038</td>
<td>0.502</td>
<td>0.002</td>
</tr>
<tr>
<td>0</td>
<td>0.425</td>
<td>0.005</td>
<td>0.501</td>
<td>0.001</td>
</tr>
<tr>
<td>1185</td>
<td>0.491</td>
<td>0.061</td>
<td>0.503</td>
<td>0.003</td>
</tr>
<tr>
<td>0</td>
<td>0.433</td>
<td>0.003</td>
<td>0.501</td>
<td>0.001</td>
</tr>
<tr>
<td>1570</td>
<td>0.534</td>
<td>0.104</td>
<td>0.504</td>
<td>0.004</td>
</tr>
<tr>
<td>0</td>
<td>0.444</td>
<td>0.014</td>
<td>0.502</td>
<td>0.002</td>
</tr>
<tr>
<td>1965</td>
<td>0.541</td>
<td>0.111</td>
<td>0.506</td>
<td>0.006</td>
</tr>
<tr>
<td>0</td>
<td>0.451</td>
<td>0.021</td>
<td>0.503</td>
<td>0.003</td>
</tr>
<tr>
<td>2360</td>
<td>0.631</td>
<td>0.201</td>
<td>0.508</td>
<td>0.008</td>
</tr>
<tr>
<td>0</td>
<td>0.460</td>
<td>0.030</td>
<td>0.503</td>
<td>0.003</td>
</tr>
</tbody>
</table>

LOAD AT FAILURE: 11500

DATE FABRICATED: 9/20/99

MODE OF FAILURE: Shear failure in between stud bays. Both sides.

8' x 8' SAMPLE: LAUAN ATTACHED TO BOTH SIDES.

**Location of Failure and Dial Indicator Placement**

TESTED BY: John Kirkwood

WITNESSED BY: Shawn Weldy

NTA980060  S3.XLS
For exact construction procedure see the attached test report.

Design Shear = 54.5 PSI

NOTE:

Perimeter no field fasteners

3/16" x 1/2 gauge staples

Attached to both sides with

(2) 48" x 96" x 5/32" lauan panels

Lauan panel at each end and bottom plate

(2) 7/16" x 1-3/4" x 15 ga. staples

Top Plate:

1 x 3 un-graded SPF

Front Side:

Average Bead Size

Per Center Stud

1/16 - 1/8"

Back Side

Average Bead Size

2 X 3

3000

2 Per Stud

1/16" x 1-3/4" x 15 ga.
2x4 WALL

SCREWS INTO TOP PLATE

1" BEAM FASTENED TO FLOOR

DIAL INDICATOR #4 WHEN APPLICABLE

HYDRAULIC PUMP

DIAL INDICATOR #3

WALL SAME AS 8" X 8"

DIAL INDICATOR #2 AND PRESSURE TRANSDUCER

BRAEDED TO BLOCK WALL TOP OF RACK LATERALLY

FRAMING WITH WOOD SCREWS SECURELY FASTENED TO METAL TOP PLATE AND BOTTOM PLATE

2x3 WALL

STEEL ROD

WALL SAME

STEEL ROLLERS (2 PLACES) 1/4" DIAMETER X 4"

ROLLER SUPPORT FRAME (BEGINNING OF TEST)

1/2" DIAMETER TE-DOWN OF WALL FRAME CONNECT TO TOP PLATE METAL FRAMING USED TO