ALPHA SYSTEMS, INC.

Evaluation of Sheathing Materials - Racking Load
Alphaseal 5200 & Georgia-Pacific Gypsum

9/30/98

This test report contains fourteen (14) pages, including the cover sheet. Any additions to, alterations of, or unauthorized use of excerpts from this test are expressly forbidden.

98-2966
(A)
1. **TITLE**

   Evaluation of sheathing materials on a modified wood frame as described in ASTM E 72-80, Section 14 Racking Load.

2. **TESTED FOR**

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

3. **TESTING ORGANIZATION**

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

4. **TESTING PERSONNEL**

   Dave Young of Alpha Systems, Inc.
   Joe Merryman of Alpha Systems, Inc.
   Test Engineer - Evor F. Johns, P.E.
   Director of Testing - Greg A. Weeden
   Technician - Jason Holdeman

5. **TEST SPECIMEN CONSTRUCTION**

   A. **Materials**

      I. Studs - 2 x 3 stud grade SPF at 16" o.c.
      II. Plates - 1 x 3 ungraded SPF plates.
      III. 4 ft. x 8 ft. x 5/16" thick Georgia-Pacific gypsum board. (bundle labeled)
      IV. Alphaseal 5200 two-part urethane adhesive.

   B. **Fasteners**

      I. Plate to studs with two (2) 7/16" c. x 2" lg. x 16 Ga. staples per stud end.
C. Construction Steps

I. Two (2) pieces of gypsum were laid on a flat wall jig.

II. The previously constructed framework was laid on the gypsum such that the center 2 x 3 stud was parallel with and directly over the gypsum seam.

III. A 1/16" wood spacer was placed between the top plate and the gypsum at the center location and both ends. The wood spacers were approximately 3/4" x 1/2" and the measured thickness ranged between .062" to .065".

IV. Four (4) clamps were used along each plate to pull the plates and gypsum tight to the wall jig. No direct attempt was made to gap the studs.

V. The Alphaseal 5200 two-part urethane adhesive was applied by Dave Holdread of Alpha Systems, Inc. according to the process described in its use and application procedure.

VI. The average contact area of the Alphaseal 5200 on the side of the field studs was 7/16". The average contact area of the Alphaseal 5200 on the side of the plates, center stud and outside studs was 1/2". The average contact area of the Alphaseal 5200 on the gypsum for field studs was 11/16". The average contact area of the Alphaseal 5200 on the gypsum for the plates, center studs and outside studs was 1".

VII. The walls remained clamped in the jig for 5 minutes. After the 5 minutes, the clamps were taken off and the walls were raised up to the vertical position where they remained for a minimum of 24 hours until they were tested.

6. TEST SAMPLE SECUREMENT

A steel beam, with a steel plate welded to the ends, was screwed to the top plate using 2" lg. hex head screws. A t-shaped beam was fastened to the bottom plate using 2" hex head screws. The screws were used in a pattern of 6" - 6" - 4", with a stagger of 1". The bottom I-beam of the fixture has a 2" x 2" x 96" lg. steel angle welded to it. There are three (3) steel pegs 3/4" diameter welded the steel angle at center and a 42½" in either direction. The bottom beam has three (3) 3/4" diameter holes that fit the pegs. C-clamps were used at each end of the bottom beam to restrict the wall from falling off the pegs. See attached drawings for further details.
7. PROCEDURE

A. Load was applied horizontally to the steel beam which was fastened to the top plate of the wall. Dial indicators were placed at the end of the top and bottom plates opposite the load side of the wall. A dial indicator was also placed on the load side of the wall at the bottom of the first stud. See attached drawing for details.

B. Loads in 400 pound increments, up to 2,400 pounds, were applied at 400 lbs./minute and released while taking load deflections and residual deflections. Load was then applied at 400 lbs./minute until a failure was reached.

8. TEST RESULTS

Test No. 1 = 6104 lbs.
Test No. 2 = 5561 lbs.
Test No. 3 = 6036 lbs.
Average = 5900.3 lbs.

Ultimate shear load
5900.3 lbs./8 ft. = 737.5 PLF

Allowable shear loads under the Manufactured Home Construction and Safety Standards.

737.5 PLF/2.5 safety factor = 295.0 PLF

9. CONCLUSION

Based on the data obtained from this test; a design shear, per the Manufactured Home Construction and Safety Standards, of 295.0 PLF can be obtained from a shear wall constructed as follows:

A. 2 x 3 studs at 16" o.c. with 1 x 3 top and bottom plates as framing.
B. 5/16" (or thicker) x 48" x 96" Georgia-Pacific gypsum board with seams vertical.
C. Alphaseal 5200 two-part urethane adhesive applied as shown on attached drawing.
Test No.1
9/29/1998

Temperature  75 deg.F.
Humidity  45%

Average Moisture Content at Construction
Studs -  13.8 %
Plates -  11.0 %
GP board on ONE side

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<th>Time</th>
<th>Load lbs.</th>
<th>Indicator No.1 reading</th>
<th>Indicator No.1 deflection</th>
<th>Indicator No.2 reading</th>
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<th>Indicator No.3 reading</th>
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max. load reached  6104 Lbs.

Mode of Failure: Foam shear from bottom plate load side of center stud.
Test No.2

Average Moisture Content at Construction

9/30/1998

Studs - 13.4 %

Plates - 9.3 %

Temperature 73 deg.F.

Humidity 52%

GP board on ONE side

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<th>Time</th>
<th>Load lbs.</th>
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max. load reached 5561 Lbs.

Mode of Failure: Foam shear from the top plate on the load side of the center stud.
Test No. 3

9/30/1998

Studs - 14.0 %

Plates - 9.0 %

GP board on ONE side

<table>
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<th>Time</th>
<th>Load lbs.</th>
<th>Indicator No.1 reading</th>
<th>Indicator No.1 deflection</th>
<th>Indicator No.2 reading</th>
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max. load reached 6036 Lbs.

Mode of Failure: Foam shear from the top plate on the load side of the center stud
Single Sided Wall

Load (Lbs.) vs. Deflection (inches)

- Test No.1 - Residual
- Test No.1 - Load
- Test No.2 - Residual
- Test No.2 - Load
- Test No.3 - Residual
- Test No.3 - Load

Residual Average
Load Average
(2) 7/16" C. x 2" LG. x16 GA. STAPLES AT EACH STUD END.

2x3 STUD GRADE S.P.F. STUDS

1x3 UNGRADED S.P.F. TOP & BOTTOM PLATES

3/4" WIDE MASKING TAPE ON GYPSUM SEAM

48" GYPSUM

96"

16" 16" 16" 16" 16" 16"

LOAD SIDE

TWO (2) PIECES OF 48"x96"x5/16" GEORGIA PACIFIC GYPSUM—GYPSUM WAS FASTENED WITH ALPHA SEAL 5200 TWO-PART URETHANE ADHESIVE.

AVERAGE AMOUNT OF 5200 CONTACT AREA:
ON THE STUDS = 1/2"
ON THE PLATES = 1/2"
ON THE GYPSUM = 3/4"

MEASURED GAP OF 0" to 3/16"
BETWEEN GYPSUM & STUDS

AVERAGE MEASURED GAP OF 1/16"
BETWEEN GYPSUM & PLATES

THIS DRAWING IS A PART OF TEST REPORT NO. 98-2966

CLIENT:

D. LEHMAN

DATE: 10/2/98

SHEET: 5/4"=12"

JOB NO. 98-2966

SMALL NO. B1

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PE
PROGRESSIVE ENGINEERING, INC.
TESTING LABORATORY

58640 State Road 15
COSHOEN, INDIANA 46518
Telephone (219) 653-0337
6" x 9#/ft.
I-BEAMS

8" x 15#/ft.
I-BEAMS

2x2 STEEL ANGLE WELDED TO I-BEAM

SCREWS INTO 1x3
WELDED STEEL SHAPE

WINCH BOTH SIDES
TRANSDUCER READOUT
HYDRAULIC PUMP

DIAL INDICATOR No.1
DIAL INDICATOR No.2
DIAL INDICATOR No.3

(3) 3/4" STEEL PINS

STEEL "T" SHAPE PINNED TO STEEL ANGLE

TEST SET-UP

F641

PROGRESSIVE ENGINEERING, INC.
Testing Laboratory

50640 State Road 15
GOSHEN, INDIANA 46528
Telephone (219) 533-0337
Test Set-Up

Test No. 1 at Failed Area
Test Set-up

Test No. 3 at Failed Area