ALPHA SYSTEMS, INC.

Evaluation of Sheathing Materials - Racking Load
Alphaseal 5200 & USG Gypsum

10/22/98

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98-3236

(A)
WALL TEST - RACKING LOAD

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.
   3120 Beck Drive
   Elkhart, IN 46516

3. TESTING ORGANIZATION

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

4. TESTING PERSONNEL

   Test Engineer – Evor F. Johns, P.E.
   Director of Testing – Greg A. Weeden
   Technician – Scott Gruver
   Joe Merryman of Alpha Systems, Inc.
   Dave Young of Alpha Systems, Inc.

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.
      III. 4 ft. x 8 ft. x 1/2" thick USG gypsum board.
      IV. Alphaseal 5200 two-part urethane adhesive. joint compound.
      V. USG sheetrock Durabond 45 setting type joint compound.
      VI. Fiberglass mesh joint tape.
      VII. 3/4" masking tape.

   B. Fasteners

      I. Plate to studs with two (2) 7/16" c. x 2" 19 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 studs were perpendicular to 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. A 3/4" piece of masking tape was used across the seam.

V. Three (3) 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.

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

VII. The average contact area of the Alphaseal 5200 on the side of the studs was 1/2".
The average contact area of the Alphaseal 5200 on the side of the plates was 1/2".
The average contact area of the Alphaseal 5200 on the gypsum was 3/4".

VIII. 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.

IX. A fiberglass mesh tape was applied to the horizontal seam. One coat of USG sheetrock Durabond 45 setting type joint compound was mixed and applied to the wall panel per the instructions on the bag.

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 to the steel angle at center and at 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 = 6015 lbs.
Test No. 2 = 6532 lbs.
Test No. 3 = 5475 lbs.
Average = 6007.3 lbs.

Ultimate shear load

6007.3 lbs./8 ft. = 750.9 PLF

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

750.9 PLF/2.5 safety factor = 300.3 PLF

9. CONCLUSION

Based on the data obtained from this test; a design shear, per the Manufactured Home Construction and Safety Standards, of 300.3 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. 1/2" (or thicker) x 48" x 96" USG gypsum board with seams horizontal.
C. Alphaseal 5200 urethane adhesive applied as shown on attached drawing.
D. Fiberglass mesh tape and joint compound at gypsum seam.
PROGRESSIVE ENGINEERING, Inc.
WALL TEST -- RACKING LOAD

Test No. 1
10/22/98

Temperature 70 deg.F.
Humidity 39%

Average Moisture Content at Construction
Studs - 11.0 %
Plates - 9.0 %

USG board and Alphaseal 5200 on ONE side

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<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 6015 Lbs.

Mode of Failure: Foam shear along first bay.
### Test No.2

10/22/98

Temperature 70 deg.F.

Humidity 39%

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**Average Moisture Content at Construction**

- **Studs**: 12.4 %
- **Plates**: 9.5 %

**USG board and Alphaseal 5200 on ONE side**

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<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 6532 Lbs.

**Mode of Failure**: Foam from wood along top plate.
PROGRESSIVE ENGINEERING, Inc.
WALL TEST -- RACKING LOAD

Test No. 3

10/23/98

Temperature 66 deg.F.

Humidity 42%

Average Moisture Content at Construction

Studs - 10.6 %

Plates - 9.3 %

USG board and Alphaseal 5200 on ONE side

<table>
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<tr>
<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 5475 Lbs.

Mode of Failure: Foam from wood on first bay. Mud cracked at seam.
Single Sided Wall using USG

Load (Lbs.)

Deflection (inches)

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

ALPHA SYSTEMS
(2) 7/16" C. x 2" LG. x16 GA.
STAPLES AT EACH STUD END.

2x3 STUD GRADE S.P.F. STUDS

U.S.G. SHEETROCK DURABOND 45
SETTING-TYPE JOINT COMPOUND
WITH FIBERGLASS MESH ON FRONT
SIDE OF WALL.

3/4" MASKING TAPE @ GYPSUM
SEAM ON BACK SIDE.

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

TWO (2) PIECES OF 48"x96"x1/2"
SHEETROCK FROM UNITED STATES
GYPSUM CORP. GYPSUM WAS
FASTENED WITH ALPHASEAL 5200
TWO PART URETHANE ADHESIVE.

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

AVERAGE MEASURED GAP OF 1/16"
BETWEEN GYPSUM & PLATES
Test Set-up

Test No. 3 at Failed Area