ALPHA SYSTEMS

Ceiling Dead Load Tests
Using 5/16” USG Sheetrock MH

3/1/2002

This test report contains thirteen (13) pages, including the cover sheet. Any additions to, alterations of, or unauthorized use of excerpts from this report are expressly forbidden.

2002-358
(A)
1. **TITLE**

   Ceiling board dead load test per PEI Standard No. 93-8.

2. **OBJECTIVE**

   To apply load to a ceiling sample, representative of a dead load on ceiling board, until a failure is reached.

3. **TESTED FOR**

   Alpha Systems
   5120 Beck Dr
   Elkhart, IN 46516

4. **TESTING ORGANIZATION**

   Progressive Engineering, Inc.
   58640 State Road 15
   Goshen, IN 46528

5. **TESTING PERSONNEL**

   Test Engineer - Evor F. Johns, P.E.
   Director of Testing - Greg A. Weeden
   Laboratory Manager - Jason R. Holdeman
   Technician - Rodd Lehman
   Technician - Lonnie Camp
   Technician - Ben Kasa

6. **TEST SPECIMEN**

   **A. Materials**

      I. Gypsum - 48" x 96" x 5/16" USG Sheetrock MH Panel

      II. Joist - 2 x 6 No. 2 grade SPF

      III. Alpha Systems Alphaseal 5200 two-part polyurethane adhesive.

   **B. Construction Steps**

      I. One (1) piece of gypsum was laid flat.

      II. Three (3) 2 x 6s were laid on the gypsum at 24" o.c. Both ends of the 2 x 6 had 0" gap along the gypsum. #8 washer head screws, 1-1/2" lg were used along each 2 x 6, at a spacing of 12" o.c., to achieve a 0" gap.
III. The average bead size of the Alphaseal 5200 on the wood was 1/2", using a stitch pattern.

IV. The average bead size of the Alphaseal 5200 on the gypsum was 7/8", using a stitch pattern.

V. The samples remained flat for a minimum of 24 hours until they were tested. The temporary fasteners were removed prior to testing.

7. **PROCEDURE**

A. The samples were placed in a vacuum test fixture. Polyethylene film was applied over the samples, in a manner such that load was applied directly to the gypsum, then enclosed by taping the film to the fixture. See drawings for details.

B. Dial indicators were placed at the center line of the ceiling sample, one at each 2 x 6 and one on the gypsum between each 2 x 6.

C. A vacuum load was applied with a Shop Vac and measured with a water manometer. Load was applied in 2 PSF increments to the samples, with a residual deflection measurement taken between each increment. Deflection measurements were taken up to 14 PSF. The load was applied until a failure was reached.

8. **Test Results**

See the attached deflection charts for actual deflections measured.

Average ultimate load reached

Test No. 1 = 35.3 PSF

Test No. 2 = 30.1 PSF

Test No. 3 = 30.1 PSF

Average = 31.8 PSF

Allowable load under the Manufactured Home Construction and Safety Standards

\[
\frac{31.8}{2.5} \text{ safety factor } = 12.7 \text{ PSF}
\]
9. CONCLUSION

Based on the data obtained from this test; a ceiling dead load of 12.7 PSF can be obtained from a ceiling constructed as follows:

A. 5/16" USG Sheetrock MH brand gypsum. Gypsum was applied with the 8' edge parallel to the 2 x 6 framing.

B. Alpha Systems Alphaseal 5200 two-part urethane adhesive. (stitch pattern)

C. A gap of 0" between joist or truss and gypsum was used in this test. Zero gap is considered worst case.
**CEILING DEAD LOAD TEST**

**Gap Between Wood and Gypsum:** Zero

**Gypsum Brand Used:** USG Sheetrock MH

**Gypsum Thickness:** 5/16"

**Truss Spacing:** 2’ o.c.

**Date:** 3/1/2002

**Test Sample Size:** 49-1/2"x98

**Gypsum Clear Span:** 96"

**Temperature:** 71 degree F.

**Humidity:** 20%

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**Ultimate Load:** 35.3 PSF

**Failure:** Gypsum core truss #3
**CEILING DEAD LOAD TEST**

Gap Between Wood and Gypsum: **Zero**  
Gypsum Brand Used: USG Sheetrock MH  
Gypsum Thickness: 5/16"  
Truss Spacing: 2' o.c.  
Date: 3/1/2002  

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Ultimate Load: 30.1 PSF  
Failure: Truss #1 gypsum core failure
**PROGRESSIVE ENGINEERING, Inc.**

**CEILING DEAD LOAD TEST**

Gap Between Wood and Gypsum: **Zero**

Gypsum Brand Used: USG Sheetrock MH

Gypsum Thickness: 5/16"

Truss Spacing: 2' o.c.

Date: 3/1/2002

**Test No. 3**

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<td>1.768</td>
<td>.124</td>
<td>1.524</td>
<td>.292</td>
<td>1.853</td>
<td>.064</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4:10</td>
<td>No Load</td>
<td>1.924</td>
<td>.006</td>
<td>1.888</td>
<td>.027</td>
<td>1.885</td>
<td>.007</td>
<td>1.789</td>
<td>.027</td>
<td>1.912</td>
<td>.005</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Ultimate Load: **30.1 PSF**

Failure: Gypsum core failure at truss #3 at every adhesive location
PROGRESSIVE ENGINEERING, Inc.

Dead Load Test
With 0" Gap

Load in P.S.F.

Deflection in inches

Load-Average
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

-.000 -.015 -.030 -.045 -.060 -.075 -.090 -.105 -.120 -.135 -.150 -.165 -.180 -.195 -.210

-.000 -.005 -.010 -.015 -.020 -.025 -.030 -.035 -.040 -.045 -.050 -.055 -.060 -.065 -.070 -.075 -.080 -.085 -.090 -.095 -.100 -.105 -.110 -.115 -.120 -.125 -.130 -.135 -.140 -.145 -.150 -.155 -.160 -.165 -.170 -.175 -.180 -.185 -.190 -.195 -.200 -.205 -.210

-.000 -.015 -.030 -.045 -.060 -.075 -.090 -.105 -.120 -.135 -.150 -.165 -.180 -.195 -.210

-.000 -.005 -.010 -.015 -.020 -.025 -.030 -.035 -.040 -.045 -.050 -.055 -.060 -.065 -.070 -.075 -.080 -.085 -.090 -.095 -.100 -.105 -.110 -.115 -.120 -.125 -.130 -.135 -.140 -.145 -.150 -.155 -.160 -.165 -.170 -.175 -.180 -.185 -.190 -.195 -.200 -.205 -.210

-.000 -.015 -.030 -.045 -.060 -.075 -.090 -.105 -.120 -.135 -.150 -.165 -.180 -.195 -.210

-.000 -.015 -.030 -.045 -.060 -.075 -.090 -.105 -.120 -.135 -.150 -.165 -.180 -.195 -.210

-.000 -.015 -.030 -.045 -.060 -.075 -.090 -.105 -.120 -.135 -.150 -.165 -.180 -.195 -.210
ALPHASEAL 5200 TWO-PART URETHANE ADHESIVE IN A "STITCH PATTERN" BEAD WIDTH WAS 7/8"

48" x 96" x 5/16" USG SHEETROCK MH

2 x 6 #2 GRADE S.P.F.

'0' GAP BETWEEN GYPSUM & 2 x 6

* - TEMPORARY FASTENERS
NF - NO FOAM

THIS DRAWING IS A PART OF TEST REPORT NO. 2002-358(A)
SECTION A-A

- VACUUM
- VACUUM HOLES
- 4x12 STEEL TUBING FRAME
- DIAL INDICATORS
- I-BEAM TO SUPPORT DIAL INDICATORS
- WALL SAMPLE
- 2X4 BEARING
- I-BEAM SUPPORT
- POLYETHYLENE SHEETING TAPED TO TUBE
Test Set-Up

Test #1 at Failure