CLAYTON HOMES

Progressive Engineering Inc.

DOW Chemical Company

Evaluation of Sheathing Materials
Racking Load - Single Sided Wall using
1 x 3 Plates, American Gypsum Horizontal and
Voramer® MB 3099/Voramer® ME 3044 Adhesive

6/23/2004

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2004-1084
(A)

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1. TITLE

Evaluation of sheathing materials on a modified wood frame as described in ASTM E 72-98, Section 14 Racking Load.

2. TESTED FOR

Dow Chemical
1881 West Oak Parkway
Marietta, GA 30062

3. TESTING ORGANIZATION

Progressive Engineering Inc.
58640 State Road 15
Goshen, IN 46528
www.p-e-i.com

See IAS Research Report No. TL-178

4. TESTING PERSONNEL

Test Engineer	- Timothy A. Baldridge, PE
Director of Testing	- Greg A. Weeden
Laboratory Manager	- Jason R. Holdeman
Technician	- Lonnie Camp

5. TEST SPECIMEN

A. Materials

I. Studs - 2 x 3 stud grade SPF at 16" o.c.

II. Plates - 1 x 3 ungraded SPF lumber.

III. 4 ft. x 8 ft. x 1/2" thick American Gypsum Eagle Roc board.

B. Fasteners

I. Plate to stud attachment with two (2) 7/16" c. x 2" lg. x 15 Ga. staples per stud end.

II. Adhesive used: Voramer® MB 3099/Voramer® ME 3044 adhesive.

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C. Construction Steps

I. Two (2) pieces of 1/2" American Gypsum board were laid on a flat wall jig.

II. The previously constructed framework was laid on the gypsum such that the center stud was perpendicular with the gypsum seam.

III. A wood spacer was placed between the top and bottom plate and the gypsum at the end of every stud. The wood spacers were approximately 3/4" x 1/2" and measured thickness ranged between .062" - .065".

IV. Three (3) clamps were used along each plate to pull the plates and gypsum tight to the wall jig.

V. The Voramer® MB 3099/Voramer® ME 3044 two-part polyurethane adhesive was applied by CCT, MFG. personnel according to the process described in its use and application procedure.

VI. The average contact area of the Voramer® MB 3099/Voramer® ME 3044 on the side of the studs was 15/16". The average contact area of the Voramer® MB 3099/Voramer® ME 3044 on the side of the plates was 1-1/8". The average contact area of the Voramer® MB 3099/Voramer® ME 3044 on the gypsum, along the studs, was 1-1/16". The average contact area of the Voramer® MB 3099/Voramer® ME 3044 on the gypsum, along the plates, was 1-1/2".

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 5 days until they were tested.

VIII. The horizontal seam was taped and mudded a minimum of 1 day prior to testing.

6. TEST SAMPLE SECUREMENT

A 4 x 4 was attached to the top plate of the wall sample with 2-1/2" long x #8 screws at 8" o.c. for load application. A second 4 x 4 was attached to the bottom plate of the wall sample with 2-1/2" long x #8 screws at 8" o.c. for sample securement. The 4 x 4 attached to the bottom plate was then secured to the test fixture with 3/8" lag screws.

7. PROCEDURE

A. Load was applied horizontally to the 4 x 4 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 near the bottom of the first stud. See attached drawing for details.

B. Load in 400 pound increments, up to 2,400 pounds, was 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 = 5373 lbs.

Test No. 2 = 4423 lbs.

Test No. 3 = 5263 lbs.

Average = 5019.6 lbs.

Ultimate Shear Load

5019.6 lbs./8 ft. = 627.4 PLF

TIMOTHY A. BALDRIDGE REGISTERED No. 19800097 STATE OF INDIANA PROFESSIONAL ENGINEER

Timothy A Baldridge

Date Signed: Jun 29,2024

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

627.4 PLF/2.5 safety factor = **250.9 PLF**

9. CONCLUSION

Based on the data obtained from this test; a design shear, per the Manufactured Home Construction and Safety Standards, of **250.9 PLF** can be obtained from a shear wall constructed as follows:

A. 2 x 3 studs at 16" o.c. with 1 x 3 plates as framing.

B. Two (2) pieces of 1/2" x 48" x 96" American Gypsum Eagle Roc board

C. Voramer® MB 3099/Voramer® ME 3044 two-part polyurethane adhesive applied as shown on attached drawing.

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WALL TEST -- RACKING LOAD

Test No.1

6/23/2004

Temperature 71 deg. F.

Humidity 43.8%

Average Moisture Content at Construction

Studs - 12.6 %

Plates - 10.0 %

1/2" American Gypsum/ Horizontal

Time	Load lbs.	Indicator No.1 reading	Indicator No.1 deflection	Indicator No.2 reading	Indicator No.2 deflection	Indicator No.3 reading	Indicator No.3 deflection	RESULTANT Deflection at indicator No.1
7:05	0	.164	----	.161	----	.306	----	----
7:06	400	.235	.071	.165	.004	.318	.012	.055
7:07	0	.170	.006	.162	.001	.306	.000	.005
7:09	800	.290	.126	.166	.005	.334	.028	.093
7:10	0	.182	.018	.165	.004	.306	.000	.014
7:13	1200	.345	.181	.167	.006	.352	.046	.129
7:14	0	.195	.031	.167	.006	.308	.002	.023
7:18	1600	.399	.235	.168	.007	.374	.068	.160
7:19	0	.210	.046	.168	.007	.309	.003	.036
7:24	2000	.445	.281	.172	.011	.395	.089	.181
7:25	0	.222	.058	.171	.010	.309	.003	.045
7:31	2400	.510	.346	.175	.014	.421	.115	.217
7:32	0	.235	.071	.173	.012	.309	.003	.056

max. load reached 5373 Lbs.

Mode of Failure: Foam shear along studs on top sheet of gypsum and shifted gypsum sheet along the seam.

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WALL TEST -- RACKING LOAD

Test No.2 Average Moisture Content at Construction

6/23/2004 Studs - 10.7 %

Temperature 71 deg. F. Plates - 10.0 %

Humidity 43% 1/2" American Gypsum/ Horizontal

Time	Load lbs.	Indicator No.1 reading	Indicator No.1 deflection	Indicator No.2 reading	Indicator No.2 deflection	Indicator No.3 reading	Indicator No.3 deflection	RESULTANT Deflection at indicator No.1
8:30	0	.352	----	.475	----	.319	----	----
8:31	400	.411	.059	.477	.002	.337	.018	.039
8:32	0	.357	.005	.476	.001	.320	.001	.003
8:34	800	.465	.113	.478	.003	.350	.031	.079
8:35	0	.361	.009	.477	.002	.321	.002	.005
8:38	1200	.502	.150	.479	.004	.375	.056	.090
8:39	0	.366	.014	.479	.004	.321	.002	.008
8:43	1600	.554	.202	.479	.004	.392	.073	.125
8:44	0	.370	.018	.479	.004	.322	.003	.011
8:49	2000	.608	.256	.480	.005	.420	.101	.150
8:50	0	.375	.023	.480	.005	.322	.003	.015
8:56	2400	.653	.301	.481	.006	.440	.121	.174
8:57	0	.380	.028	.480	.005	.323	.004	.019

max. load reached 4423 Lbs.

Mode of Failure: Foam shear along studs on top sheet of gypsum and shifted gypsum sheet along the seam.

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WALL TEST -- RACKING LOAD

Test No. 3 Average Moisture Content at Construction

6/23/2004 Studs - 13.5 %

Temperature 71 deg.F. Plates - 12.5 %

Humidity 43% 1/2 American Gypsum\ Horizontal

Time	Load lbs.	Indicator No.1 reading	Indicator No.1 deflection	Indicator No.2 reading	Indicator No.2 deflection	Indicator No.3 reading	Indicator No.3 deflection	RESULTANT Deflection at indicator No.1
10:25	0	.239	----	.397	----	.569	----	----
10:26	400	.280	.041	.403	.006	.578	.009	.026
10:27	0	.241	.002	.398	.001	.574	.005	-.004
10:29	800	.346	.107	.408	.011	.604	.035	.061
10:30	0	.244	.005	.400	.003	.575	.006	-.004
10:33	1200	.396	.157	.412	.015	.624	.055	.087
10:34	0	.248	.009	.401	.004	.575	.006	-.001
10:38	1600	.453	.214	.415	.018	.648	.079	.117
10:39	0	.252	.013	.402	.005	.575	.006	.002
10:44	2000	.514	.275	.419	.022	.675	.106	.147
10:45	0	.256	.017	.404	.007	.575	.006	.004
10:51	2400	.571	.332	.423	.026	.702	.133	.173
10:52	0	.263	.024	.406	.009	.576	.007	.008

max. load reached 5263 Lbs.

Mode of Failure: Foam shear along bottom plate and along studs.

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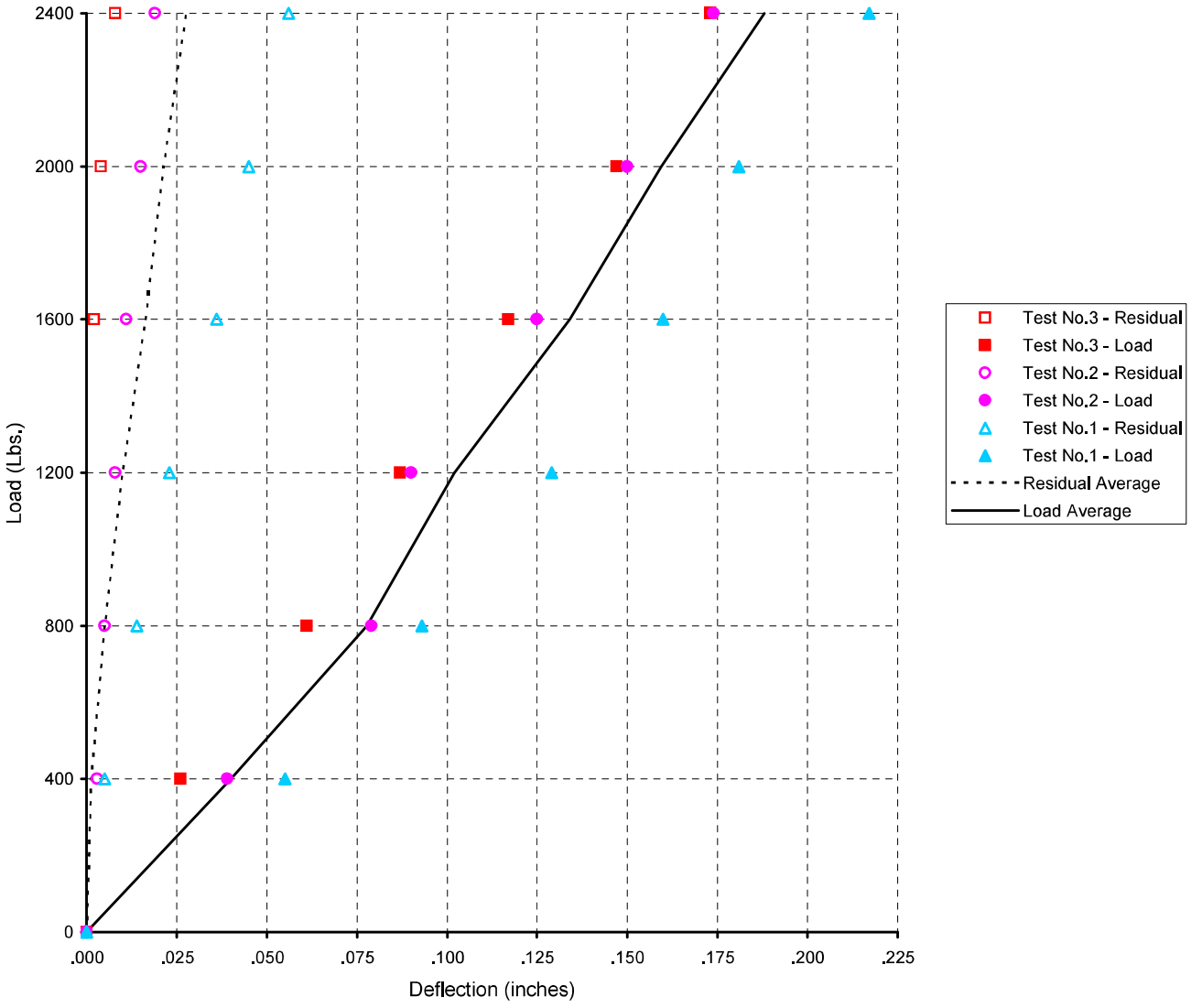
Horizontal Single Sided wall using 1/2" EagleRoc and MB 3099



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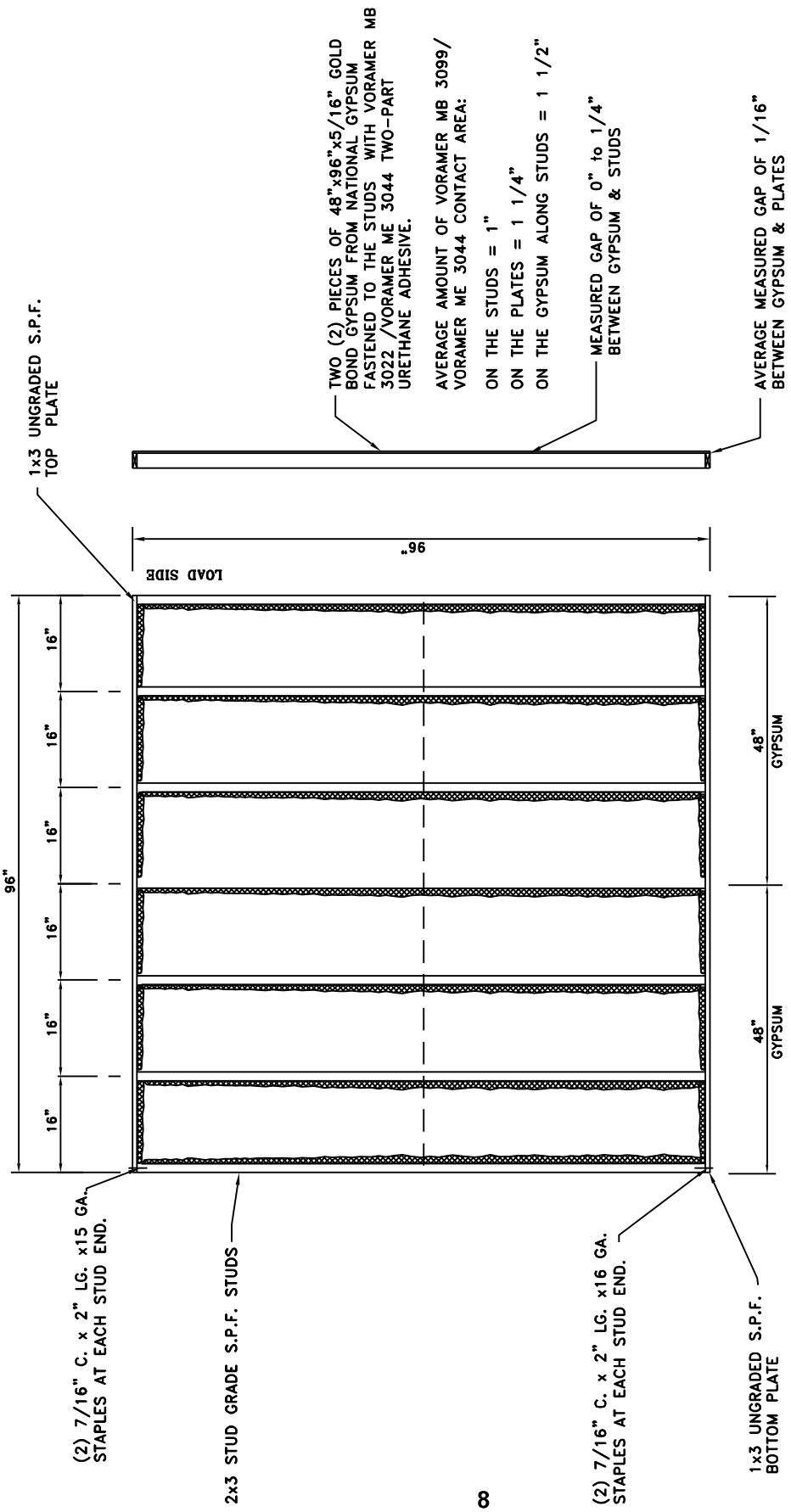

THIS DRAWING IS A PART OF TEST REPORT NO. 2004

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DWN. BY:	D.TYSON
DATE:	6/28/04
SCALE:	
JOB NO.	2004-1084
DWG. NO.	B1
REVISED ON:	
CLIENT:	DOW CHEMICAL
TITLE:	WALL PANEL

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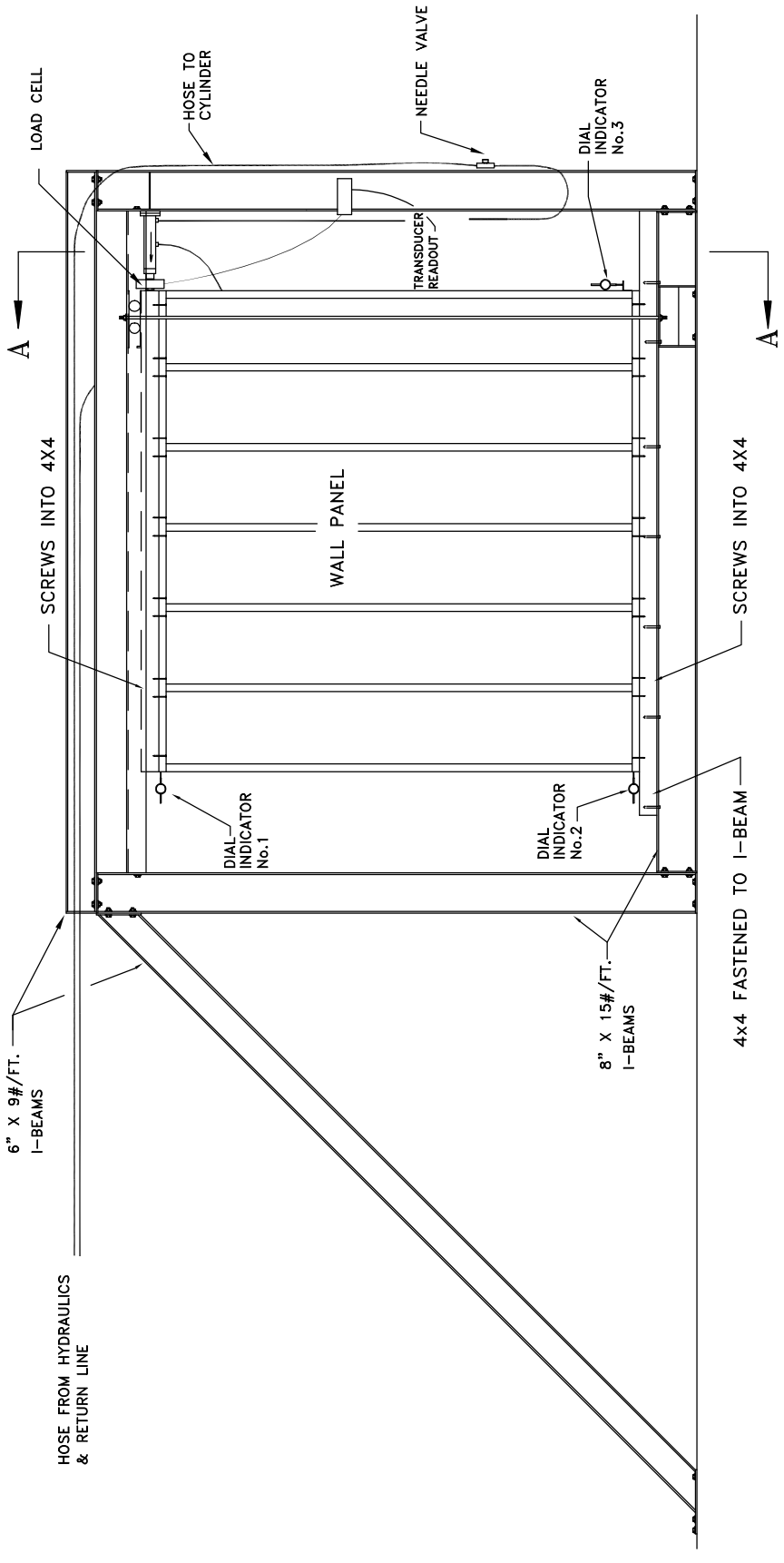

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DWN. BY:	A.BENDER
DATE:	6/30/04
SCALE:	
DRAWING NUMBER	F645
TITLE:	TEST SET-UP

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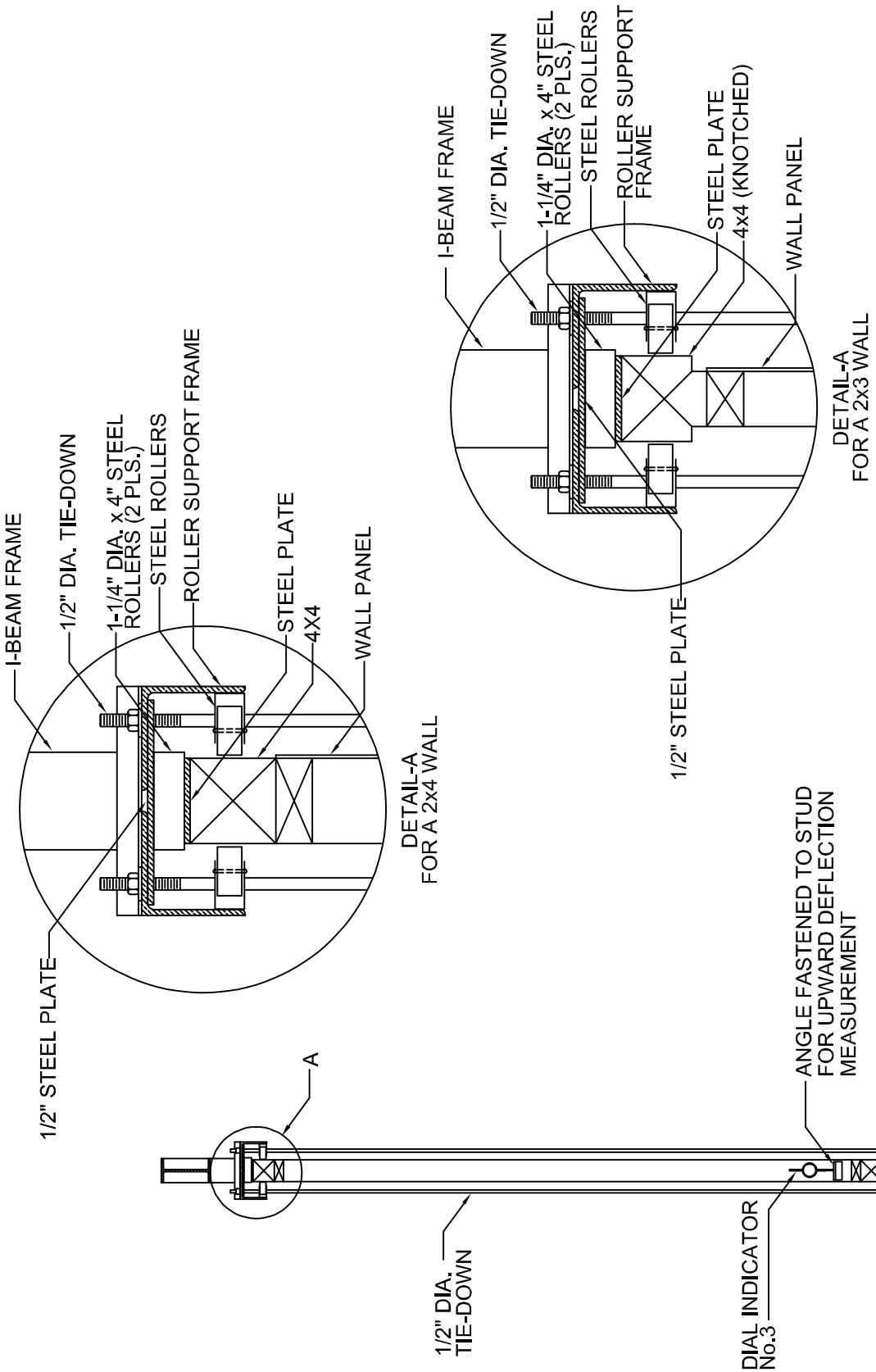

DWN BY: M.MORRIS
DATE: 12/6/94
SCALE:
DRAWING NUMBER F384

TITLE: TEST SET-UP

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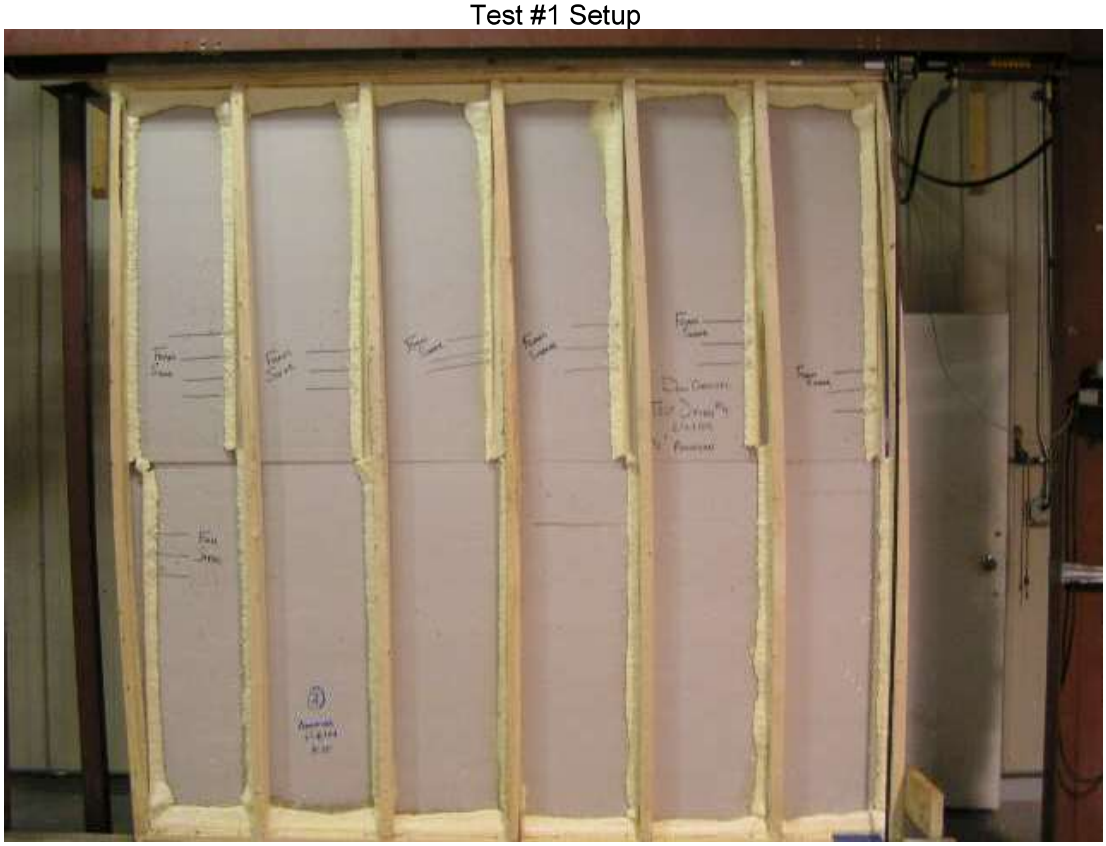
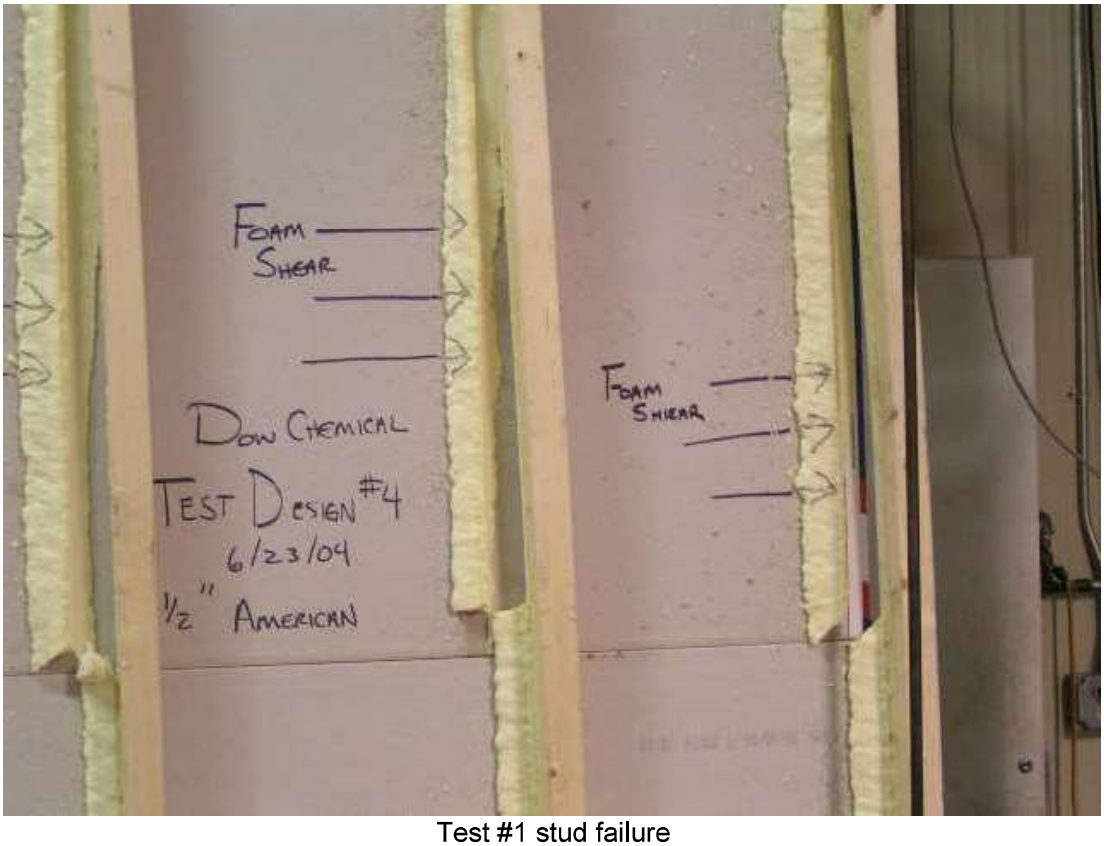
Test #1 Setup



Test #1 Stud Failure

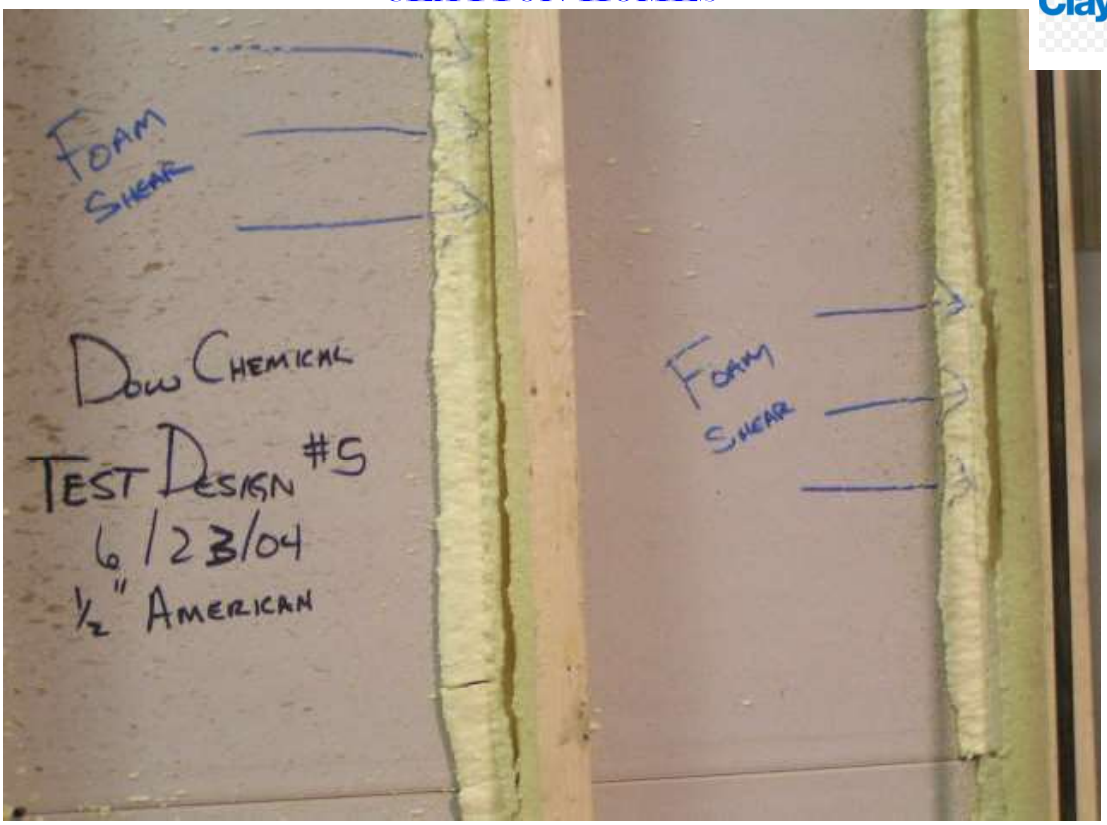
Test #1 stud failure



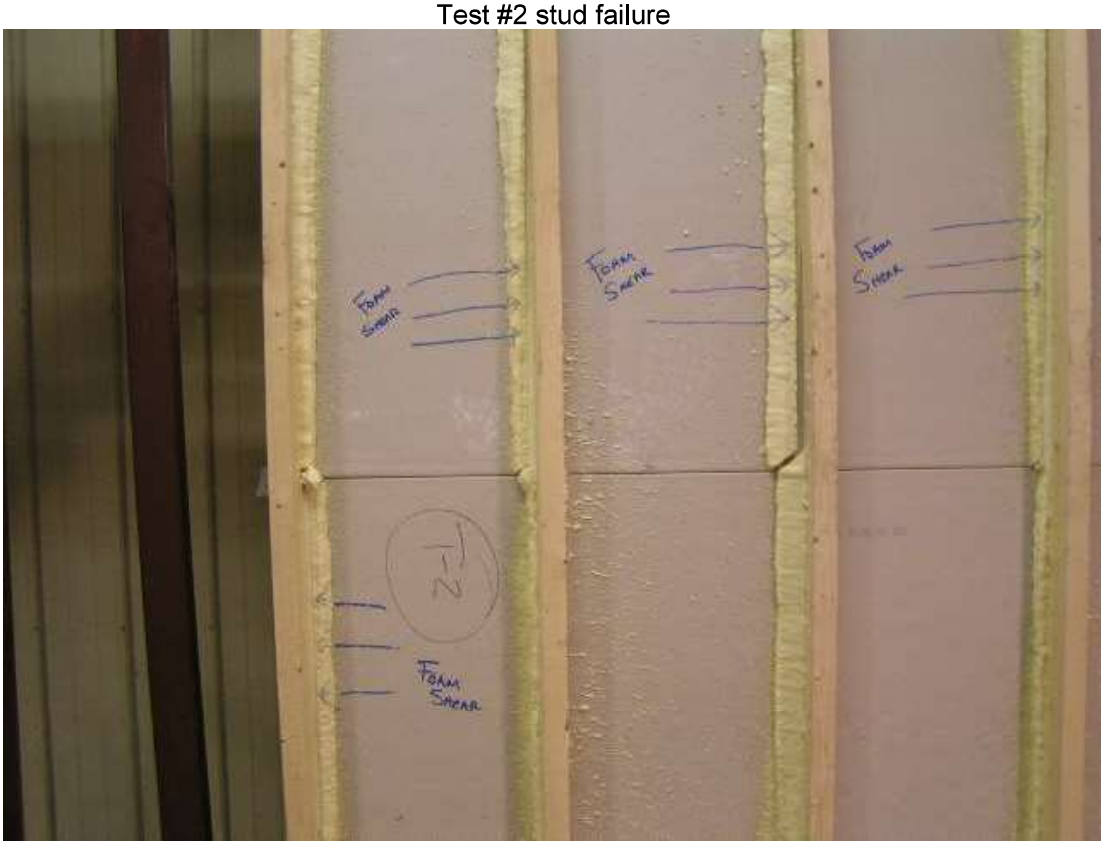
Test #1 stud failure

Test #2 Setup

Test #2 stud failure



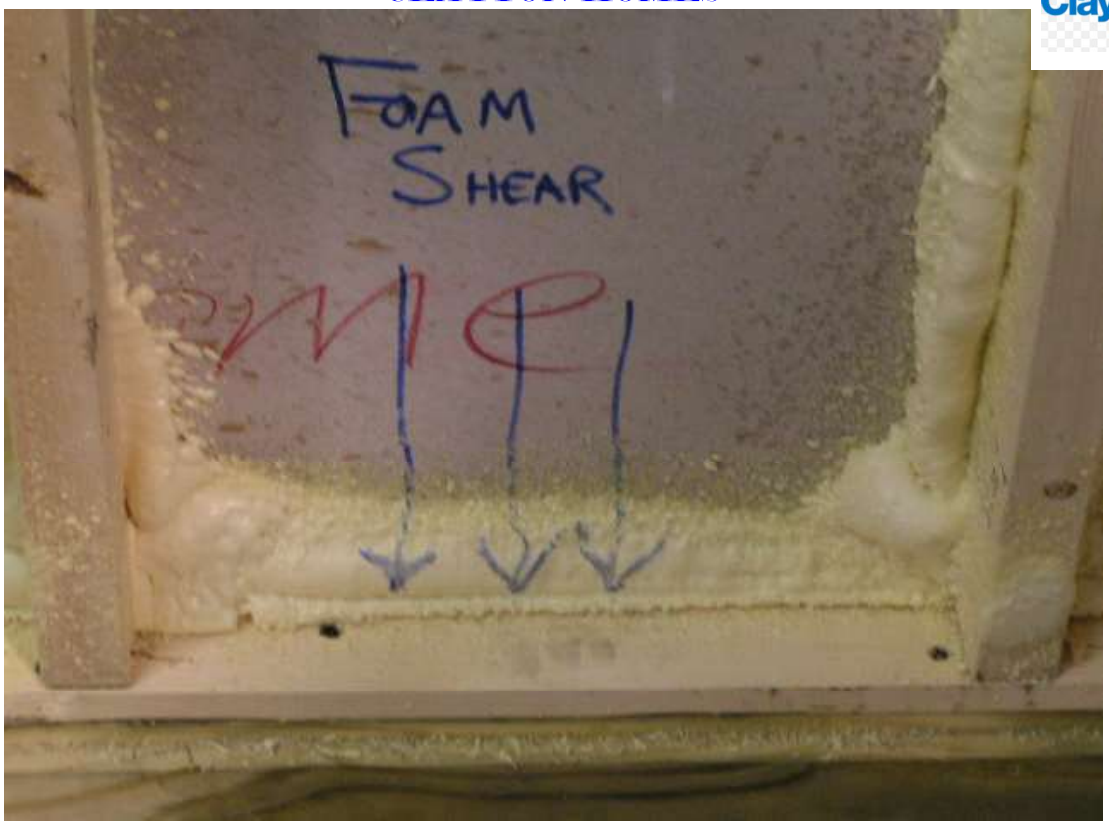
Test #2 stud failure



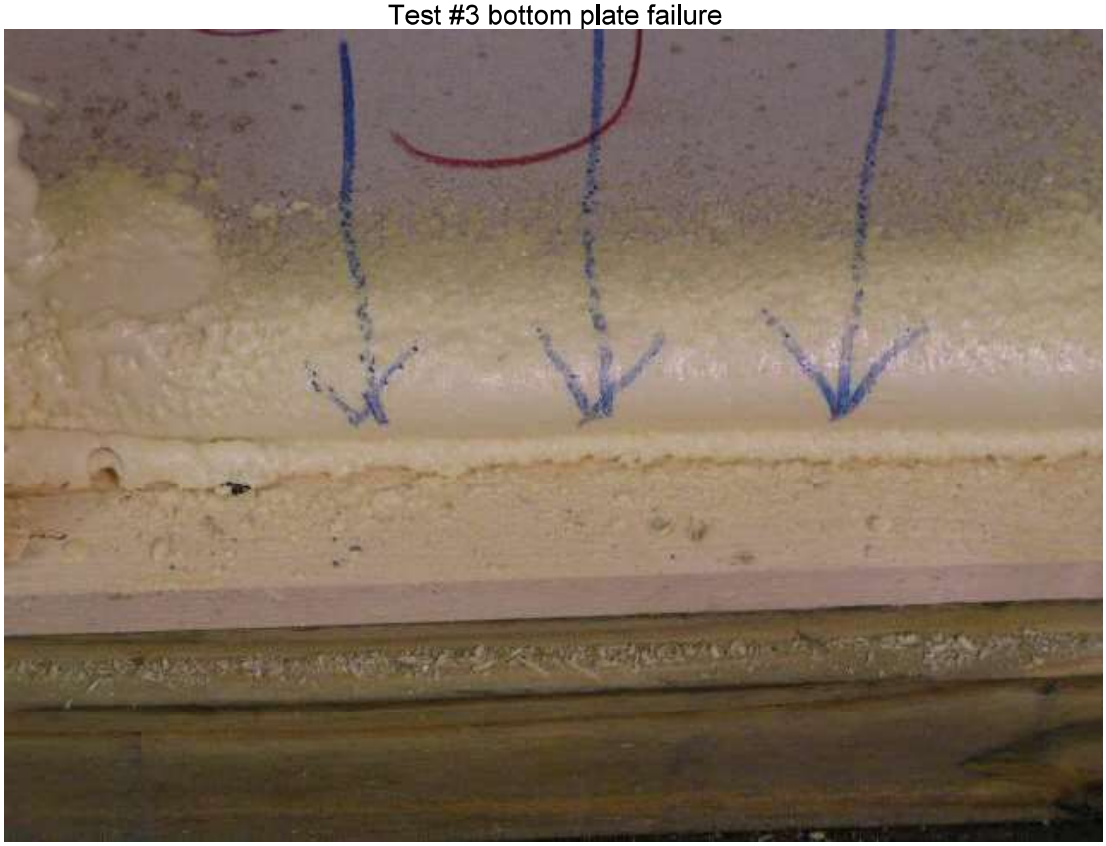
Test #2 stud failure

Test #3 Setup

Test #3 bottom plate failure



Test #3 bottom plate failure



Test #3 bottom plate failure