

**REPORT ON HURRICANE ANCHOR TESTS
PRODUCT NUMBER: HA4**

PSI Report No: 748-50100-00415 (Page 1 of 13)

Report Date: October 20, 1998

Client: Alpine Engineered Products, Inc.
1950 Marley Drive
Haines City, FL 33844

Test Dates: November 24 and December 12, 1997, September 16, 23 and October 2, 1998

On the above test dates, representatives of Professional Service Industries, Inc. (PSI) witnessed hurricane (or seismic) anchor uplift load tests, thrust load tests and lateral load tests which were conducted at the Alpine Research and Development facility in Haines City, Florida. The tests were conducted in accordance with the requirements of ASTM D-1761 except that no torsional moment capacity tests were conducted because of the device's inability to resist torsion. Deviations in the test specimens are completely described in the drawing on page 12. Professional Service Industries, Inc., is recognized by the National Evaluation Service Committee as a Compliance Assurance and/or Inspection Agency (Report No. NER-QA231).

Specific gravity, G , of the test specimen's components were determined in accordance with the requirements of ASTM D-2395 and the moisture content, $M.C.$, of the components were measured in accordance with ASTM D-4444. The nails used to fabricate the test assemblies are described in PSI Reports Numbered 748-50100-00346 and 225-70012-002.

Testing was performed on a Tinius Olsen, 60,000 pound capacity universal testing machine that was calibrated in accordance with ASTM E-4 on June 13, 1997 and June 11, 1998. Displacement measurements were made with Lucas-Schaevitz displacement transducers (LVDT's) capable of measuring to 0.001 inch.

Test specimens were assembled and tested as shown in the drawing on page 12.

The load was applied at a uniform crosshead speed of 0.035 inch per minute. Deflections were measured at selected intervals until 1/8 inch displacements were registered by all transducers. The transducers were then removed from the specimen to avoid damage to the instruments while the test continued to termination. The maximum load reached during the test was recorded.

In conducting the lateral load test and the thrust load test, the load was applied to the specimen through a ¾ inch diameter cylinder located above a 4 inch wide by 8 inch long steel loading block which was centered on the joist. The headers were supported on steel channel sections. Four (4) HA4 Hurricane Anchors were used in each test specimen.

For the uplift test, the load was applied to the specimen through a friction type "jaw", while the plates were firmly attached to the movable crosshead with steel angles and bolts. The upright "studs" were attached to the plates with two (2) HA4 Hurricane Anchors on each side. The specimen was assembled as shown on page 12, in the middle illustration.

For the lateral load tests and the thrust load tests, the specimens were assembled as shown in the drawing on page 12. Two test series were conducted in both the lateral loading direction and in the thrust loading direction to evaluate the HA4 when none of the fasteners were subjected to withdrawal forces as well as when some of the fasteners were subjected to withdrawal forces. In each of the pair of lateral and thrust diagrams on page 12, the HA4 Hurricane Anchors are tested while attached to the top of the joist in one test and attached to the bottom of the joist for the other test.

A drawing of the product is shown on page 13.

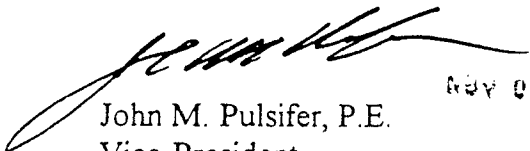
The test results are shown on pages 3 through 10.

The tests to determine the physical properties of the product are found on page 11.

Testing was conducted by Ed Murphy under the direction of A. Norris Breivik, P.E., from Alpine, and witnessed by Virgil Kilpatrick and Phill Sevcech from Professional Service Industries, Inc.

Respectfully Submitted,

PROFESSIONAL SERVICE INDUSTRIES, INC.



John M. Pulsifer, P.E.

Vice-President

Florida Registration Number: 36154

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**UPLIFT LOAD TEST
SPECIFIC GRAVITY (G) AND MOISTURE CONTENT (M.C.)**

Output files: 97045347.TOB, 97045348.TOB and 97045349.TOB.

Lumber is SOUTHERN PINE	TEST SPECIMEN 1		TEST SPECIMEN 2		TEST SPECIMEN 3	
	G	M.C.	G	M.C.	G	M.C.
Top Plate (2 x 6)	0.522	12%	0.484	9%	0.491	11%
Bottom Plate (2 x 6)	0.526	12%	0.491	10%	0.523	11%
Stud (Front) (2 x 6)	0.552	11%	0.518	11%	0.497	11%
Stud (Center) (2 x 6)	0.485	11%	0.515	11%	0.523	13%
Stud (Back) (2 x 6)	0.526	11%	0.560	12%	0.488	10%

UPLIFT LOAD TEST RESULTS

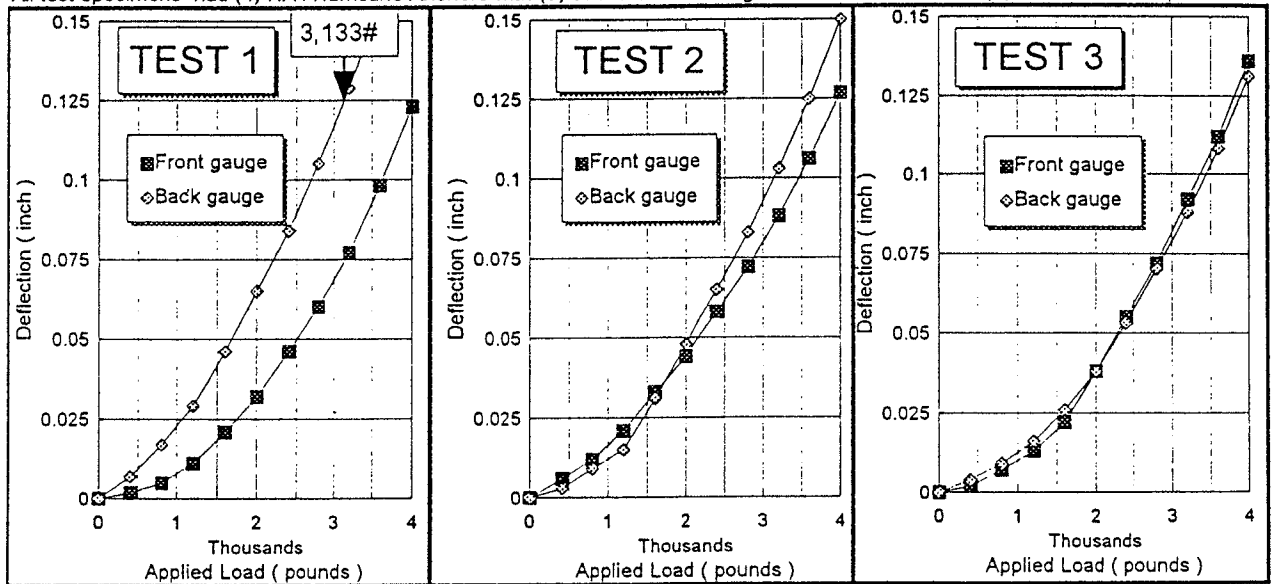
	TEST SPECIMEN 1	TEST SPECIMEN 2	TEST SPECIMEN 3
Load at 1/8 inch, Back Gauge	4,032	3,962	3,817
Load at 1/8 inch, Front Gauge	3,133	3,600	3,896
Maximum load recorded	8,220	8,520	7,970
Failure Mode	Steel tearing at corner	Steel tearing at corner	Wood "chunking" out at stud nails.

Each test specimen contains four (4), HA4's.

UPLIFT TEST DEFLECTIONS

Test 1			Test 2			Test 3		
APPLIED LOAD	FRONT (inch)	BACK (inch)	APPLIED LOAD	FRONT (inch)	BACK (inch)	APPLIED LOAD	FRONT (inch)	BACK (inch)
0	0	0	0	0	0	0	0	0
400	0.002	0.007	400	0.006	0.003	400	0.002	0.004
800	0.005	0.017	800	0.012	0.009	800	0.007	0.009
1200	0.011	0.029	1200	0.021	0.015	1200	0.013	0.016
1600	0.021	0.046	1600	0.033	0.031	1600	0.022	0.026
2000	0.032	0.065	2000	0.044	0.048	2000	0.038	0.038
2400	0.046	0.084	2400	0.058	0.065	2400	0.055	0.053
2800	0.060	0.105	2800	0.072	0.083	2800	0.072	0.070
3200	0.077	0.129	3200	0.088	0.103	3200	0.092	0.088
3600	0.098	0.155	3600	0.106	0.125	3600	0.112	0.108
4000	0.123	0.185	4000	0.127	0.150	4000	0.136	0.131

All test specimens had (4) HA4 Hurricane Anchors with (5) 8d x 1-1/2 inch long nails into the studs and (4) 8d nails into the plates



**LATERAL LOAD TEST (Connection at the joist is in compression)
SPECIFIC GRAVITY (G) AND MOISTURE CONTENT (M.C.)**

Output Files: 97045171.TOB, 97045174.TOB and 97045176.TOB.

Lumber is SOUTHERN PINE	TEST SPECIMEN 1		TEST SPECIMEN 2		TEST SPECIMEN 3	
	G	M.C.	G	M.C.	G	M.C.
Back Plate - No.1 (2 x 6)	0.557	16%	0.542	12%	0.502	13%
BackPlate - No.2 (2 x 6)	0.532	11%	0.484	14%	0.519	13%
Front Plate - No.1 (2 x 6)	0.515	11%	0.485	17%	0.536	22%
Front Plate - No.2 (2 x 6)	0.515	11%	0.495	15%	0.500	12%
Joist - No. 1 (2 x 12)	0.515	14%	0.534	11%	0.528	12%

LATERAL LOAD TEST RESULTS (Connection at joist is in compression)

	TEST SPECIMEN 1	TEST SPECIMEN 2	TEST SPECIMEN 3
Load at 1/8 inch, Back Gauge	1,075	1,005	1,224
Load at 1/8 inch, Front Gauge	944	1,027	1,128
Maximum load recorded	3,600	4,390	4,400
Failure Mode	Joist split in cross-grain bending	Joist split in cross-grain bending	Joist split in cross-grain bending

Each test specimen contains four (4), HA4's.

**LATERAL LOAD TEST (Connection at joist is in withdrawal)
SPECIFIC GRAVITY (G) AND MOISTURE CONTENT (M.C.)**

Output Files: 97045172.TOB, 97045173.TOB and 97045175.TOB.

Lumber is SOUTHERN PINE	TEST SPECIMEN 1		TEST SPECIMEN 2		TEST SPECIMEN 3	
	G	M.C.	G	M.C.	G	M.C.
Back Plate - No.1 (2 x 6)	0.537	20%	0.509	18%	0.522	15%
Back Plate - No.2 (2 x 6)	0.537	15%	0.554	18%	0.541	12%
Front Plate - No.1 (2 x 6)	0.486	19%	0.559	18%	0.533	11%
Front Plate - No.2 (2 x 6)	0.486	19%	0.520	13%	0.544	12%
Joist - No. 1 (2 x 12)	0.540	10%	0.492	13%	0.490	14%

LATERAL LOAD TEST RESULTS (Connection at joist is in withdrawal)

	TEST SPECIMEN 1	TEST SPECIMEN 2	TEST SPECIMEN 3
Load at 1/8 inch, Back Gauge	1,106	1,156	1,942
Load at 1/8 inch, Front Gauge	1,018	1,166	1,787
Maximum load recorded	2,570	2,160	3,060
Failure Mode	Nail withdrawal from joist	Nail withdrawal from joist	Nail withdrawal from joist

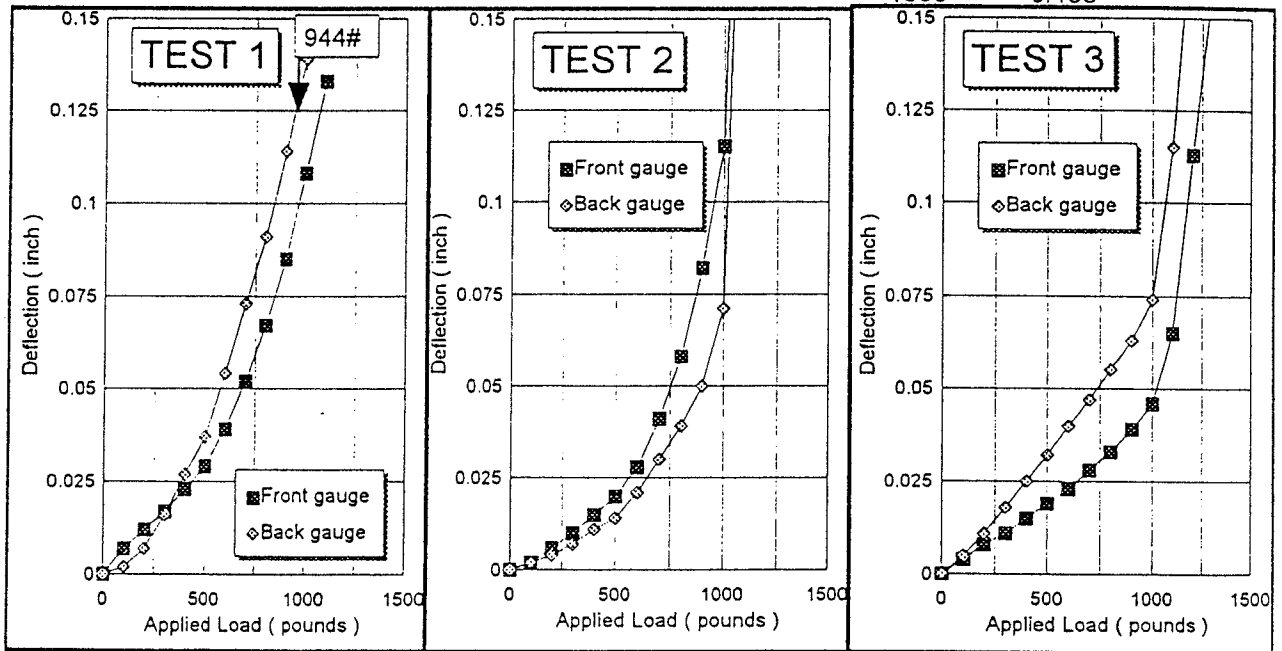


Each test specimen contains four (4), HA4's.

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LATERAL TEST DEFLECTIONS
Connection at the joist is in compression

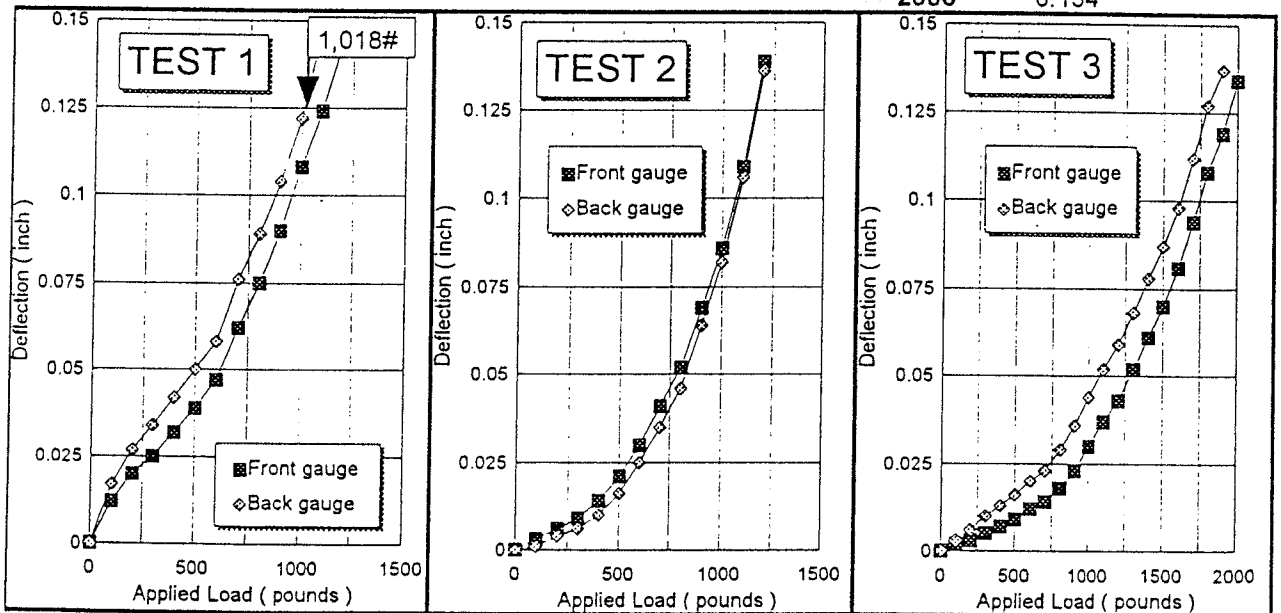
Test 1			Test 2			Test 3		
APPLIED LOAD	FRONT (inch)	BACK (inch)	APPLIED LOAD	FRONT (inch)	BACK (inch)	APPLIED LOAD	FRONT (inch)	BACK (inch)
0	0	0	0	0	0	0	0	0
100	0.007	0.002	100	0.002	0.002	100	0.004	0.005
200	0.012	0.007	200	0.006	0.004	200	0.008	0.011
300	0.017	0.016	300	0.010	0.007	300	0.011	0.018
400	0.023	0.027	400	0.015	0.011	400	0.015	0.025
500	0.029	0.037	500	0.020	0.014	500	0.019	0.032
600	0.039	0.054	600	0.028	0.021	600	0.023	0.040
700	0.052	0.073	700	0.041	0.030	700	0.028	0.047
800	0.067	0.091	800	0.058	0.039	800	0.033	0.055
900	0.085	0.114	900	0.082	0.050	900	0.039	0.063
1000	0.108	0.139	1000	0.115	0.071	1000	0.046	0.074
1100	0.133		1100	0.316	0.274	1100	0.065	0.115
1200			1200			1200	0.113	0.185
						1300	0.158	



All tests had (4) HA4 Hurricane Anchors with (5) 8d x 1-1/2 inch nails into the joist and (4) 8d nails into the plates.

LATERAL LOAD TEST DEFLECTIONS
Connection at joist is in withdrawal

Test 1			Test 2			Test 3		
APPLIED LOAD	FRONT (inch)	BACK (inch)	APPLIED LOAD	FRONT (inch)	BACK (inch)	APPLIED LOAD	FRONT (inch)	BACK (inch)
0	0	0	0	0	0	0	0	0
100	0.012	0.017	100	0.003	0.001	100	0.002	0.003
200	0.020	0.027	200	0.006	0.004	200	0.003	0.006
300	0.025	0.034	300	0.009	0.006	300	0.005	0.010
400	0.032	0.042	400	0.014	0.010	400	0.007	0.013
500	0.039	0.050	500	0.021	0.016	500	0.009	0.016
600	0.047	0.058	600	0.030	0.025	600	0.012	0.020
700	0.062	0.076	700	0.041	0.035	700	0.014	0.023
800	0.075	0.089	800	0.052	0.046	800	0.018	0.029
900	0.090	0.104	900	0.069	0.064	900	0.023	0.036
1000	0.108	0.122	1000	0.086	0.082	1000	0.030	0.044
1100	0.124	0.149	1100	0.109	0.106	1100	0.037	0.052
1200	0.144		1200	0.139	0.136	1200	0.043	0.059
1300			1300			1300	0.052	0.068
1400			1400			1400	0.061	0.078
1500			1500			1500	0.070	0.087
1600			1600			1600	0.081	0.098
1700			1700			1700	0.094	0.112
1800			1800			1800	0.108	0.127
						1900	0.119	0.137
						2000	0.134	



All tests had (4) HA4 Hurricane Anchors with (5) 8d x 1-1/2 inch nails into the joist and (4) 8d nails into the plates.

**THRUST LOAD TEST (Connection at plate is loaded in compression)
SPECIFIC GRAVITY (G) AND MOISTURE CONTENT (M.C.)**

Output Files 97045159.TOB, 97045160.TOB and 97045162.TOB.

Lumber is SOUTHERN PINE	TEST SPECIMEN 1		TEST SPECIMEN 2		TEST SPECIMEN 3	
	G	M.C.	G	M.C.	G	M.C.
Back Plate - No.1 (2 x 4)	0.551	11%	0.530	17%	0.525	10%
Back Plate - No.2 (2 x 4)	0.547	21%	0.556	19%	0.513	20%
Front Plate - No.1 (2 x 4)	0.510	20%	0.555	11%	0.520	19%
Front Plate - No.2 (2 x 4)	0.510	20%	0.535	11%	0.510	20%
Joist - No. 1 (2 x 6)	0.553	12%	0.512	10%	0.524	14%

THRUST LOAD TEST RESULTS (Connection at plate is in compression)

	TEST SPECIMEN 1	TEST SPECIMEN 2	TEST SPECIMEN 3
Load at 1/8 inch, Front	735	790	1,344
Load at 1/8 inch, Back	710	660	1,125
Maximum load recorded	2,757	2,780	3,100
Failure Mode	Steel tearing at bend	Steel tearing at bend	Steel tearing at bend

Each test specimen contains four (4), HA4's.

**THRUST LOAD TEST (Connection at plate is in withdrawal)
SPECIFIC GRAVITY (G) AND MOISTURE CONTENT (M.C.)**

Output Files: 97045163.TOB, 97045164.TOB and 97045165.TOB.

Lumber is SOUTHERN PINE	TEST SPECIMEN 1		TEST SPECIMEN 2		TEST SPECIMEN 3	
	G	M.C.	G	M.C.	G	M.C.
Back Plate - No.1 (2 x 4)	0.520	10%	0.557	10%	0.540	11%
Back Plate - No.2 (2 x 4)	0.508	16%	0.541	20%	0.545	11%
Front Plate - No.1 (2 x 4)	0.523	10%	0.547	11%	0.521	18%
Front Plate - No.2 (2 x 4)	0.516	17%	0.555	11%	0.557	10%
Joist - No. 1 (2 x 6)	0.530	10%	0.517	14%	0.487	11%

THRUST LOAD TEST RESULTS (Connection at plate is in withdrawal)

	TEST SPECIMEN 1	TEST SPECIMEN 2	TEST SPECIMEN 3
Load at 1/8 inch, Front Gauge	553	527	479
Load at 1/8 inch, Back Gauge	602	530	479
Maximum load recorded	2,100	1,950	1,690
Failure mode	Nail withdrawal from plates	Nail withdrawal from plates	Nail withdrawal from plates

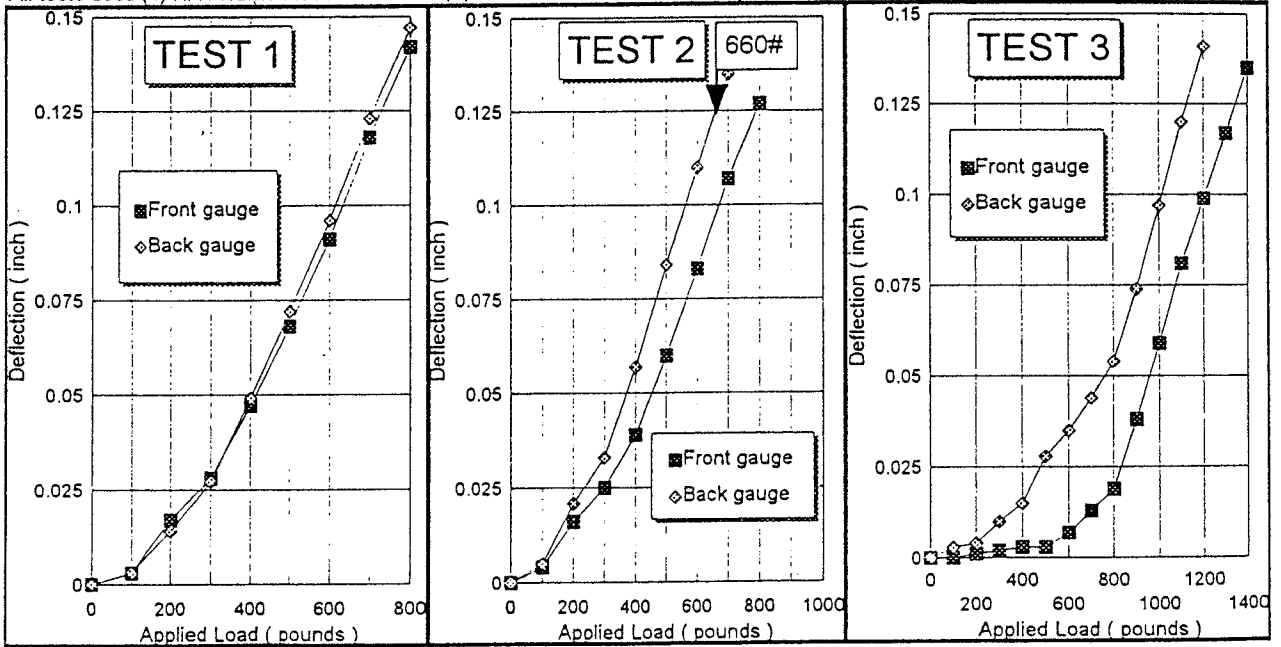


Each test specimen contained four (4), HA4's.

THRUST TEST DEFLECTIONS
Connection at plate is loaded in compression

Test 1			Test 2			Test 3		
APPLIED LOAD	FRONT (inch)	BACK (inch)	APPLIED LOAD	FRONT (inch)	BACK (inch)	APPLIED LOAD	FRONT (inch)	BACK (inch)
0	0	0	0	0	0	0	0	0
100	0.003	0.003	100	0.004	0.005	100	0.000	0.003
200	0.017	0.014	200	0.016	0.021	200	0.001	0.004
300	0.028	0.027	300	0.025	0.033	300	0.002	0.010
400	0.047	0.049	400	0.039	0.057	400	0.003	0.015
500	0.068	0.072	500	0.060	0.084	500	0.003	0.028
600	0.091	0.096	600	0.083	0.110	600	0.007	0.035
700	0.118	0.123	700	0.107	0.135	700	0.013	0.044
800	0.142	0.147	800	0.127		800	0.019	0.054
900			900			900	0.038	0.074
1000			1000			1000	0.059	0.097
						1100	0.081	0.120
						1200	0.099	0.141
						1300	0.117	
						1400	0.135	

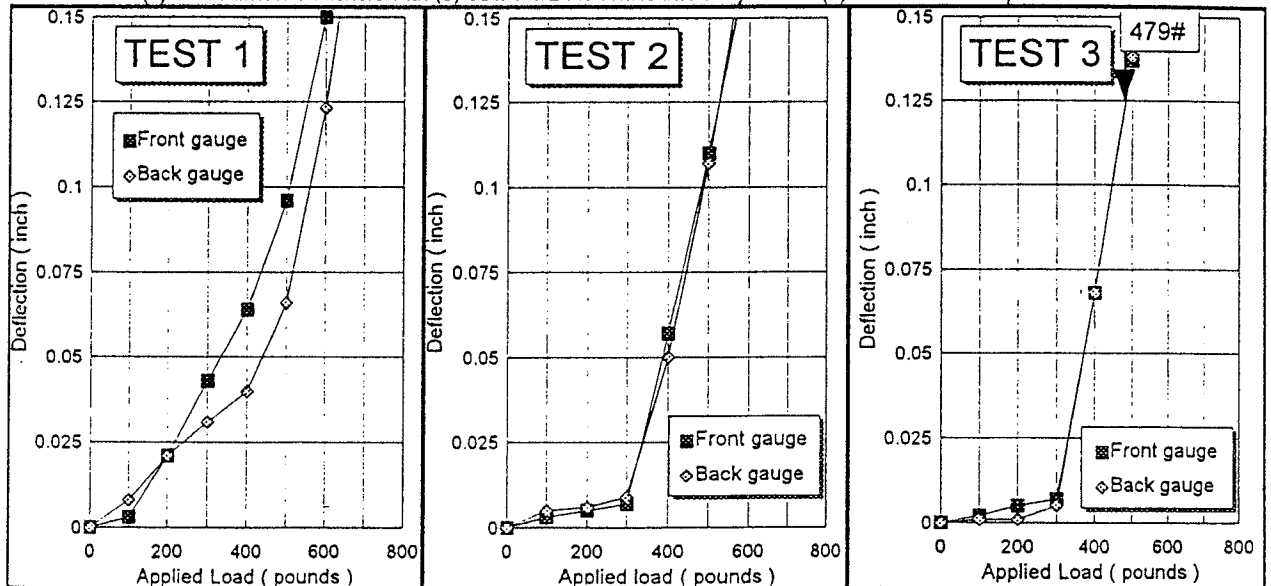
All tests used (4) HA4 Hurricane Anchors with (5) 8d x 1-1/2 inch nails into the joist and (4) 8d nails into the plates



THRUST TEST DEFLECTIONS
Plate connection is loaded in withdrawal

Test 1			Test 2			Test 3		
APPLIED LOAD	FRONT (inch)	BACK (inch)	APPLIED LOAD	FRONT (inch)	BACK (inch)	APPLIED LOAD	FRONT (inch)	BACK (inch)
0	0	0	0	0	0	0	0	0
100	0.003	0.008	100	0.003	0.005	100	0.002	0.001
200	0.021	0.021	200	0.005	0.006	200	0.005	0.001
300	0.043	0.031	300	0.007	0.009	300	0.007	0.005
400	0.064	0.040	400	0.057	0.050	400	0.068	0.068
500	0.096	0.066	500	0.110	0.107	500	0.137	0.138
600	0.150	0.123	600	0.170	0.180	600		
700		0.205	700			700		
800			800			800		

All tests used (4) HA4 hurricane anchors with (5) 8d x 1-1/2 inch nails into the joist and (4) 8d nails into the plates.



Steel Properties Data

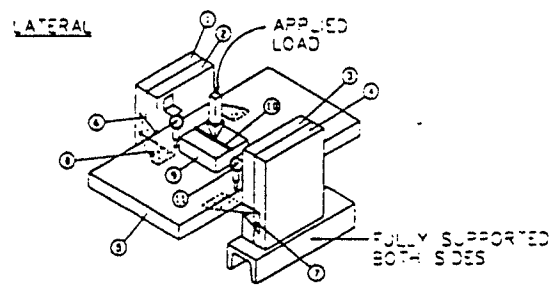
Test Date 16 SEPTEMBER 1998

Sample: HA 4 Hurricane Anchor

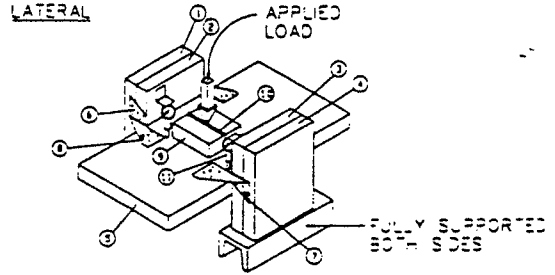
Sample	Width	Thickness (in.)		Yield (lbs., psi)		Ultimate (lbs., psi)		Elongation (in.)		%
		Gross	Net	Load	Stress	Load	Stress	Length 1	Length 2	
A	0.476	0.0473	0.0463	1420	64432	1620	73507	1.995	2.565	29
B	0.503	0.0474	0.0464	1490	63841	1700	72839	1.987	2.575	30
Average		0.0474			64136		73173			29

Steel Fy: 64136
Steel Fu: 73173

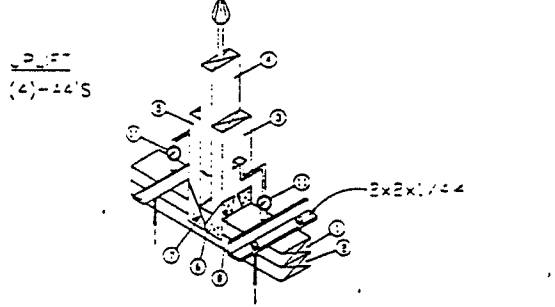
Yield Point Determined by Halt-of-the-Load Method (ASTM E8, 7.4.1.1)



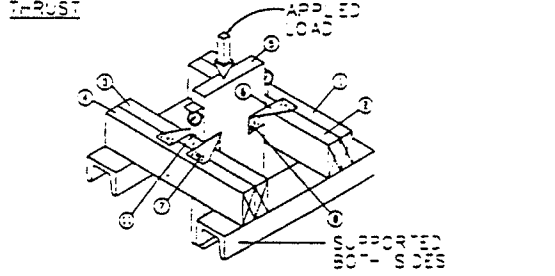
- ① 2x6x1'-6" SO. PINE
- ② 2x6x1'-6" SO. PINE
- ③ 2x6x1'-6" SO. PINE
- ④ 2x6x1'-6" SO. PINE
- ⑤ 2x12x2'-0" SO. PINE
- ⑥ -AC - HURRICANE ANCHOR (4) BELOW 2x12
- ⑦ (5) 8d x 1 1/2 NAILS
- ⑧ (4) 8d COMMON NAILS
- ⑨ 4 x 8 x 2 STEEL LOADING BLOCK
- ⑩ 3/4" DIAMETER STEEL CYLINDER
- ⑪ DISPLACEMENT TRANSDUCER



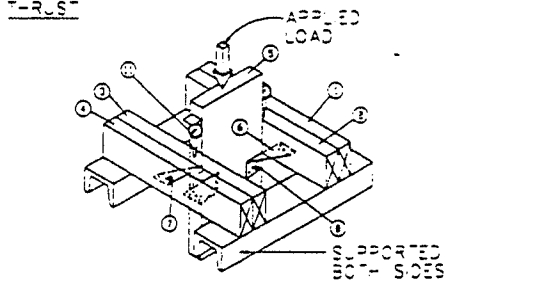
- ① 2x6x1'-6" SO. PINE
- ② 2x6x1'-6" SO. PINE
- ③ 2x6x1'-6" SO. PINE
- ④ 2x6x1'-6" SO. PINE
- ⑤ 2x12x2'-0" SO. PINE
- ⑥ -AC - HURRICANE ANCHOR (4) ABOVE 2x12
- ⑦ (5) 8d x 1 1/2 NAILS
- ⑧ (4) 8d COMMON NAILS
- ⑨ 4 x 8 x 2 STEEL LOADING BLOCK
- ⑩ 3/4" DIAMETER STEEL CYLINDER
- ⑪ DISPLACEMENT TRANSDUCER



- ① 2x6x1'-6" SO. PINE
- ② 2x6x1'-6" SO. PINE
- ③ 2x6x2'-0" SO. PINE
- ④ 2x6x2'-0" SO. PINE
- ⑤ 2x6x2'-0" SO. PINE
- ⑥ -AC - HURRICANE ANCHOR
- ⑦ (4) 8d COMMON NAILS
- ⑧ (5) 8d x 1 1/2 NAILS
- ⑨
- ⑩
- ⑪ DISPLACEMENT TRANSDUCER

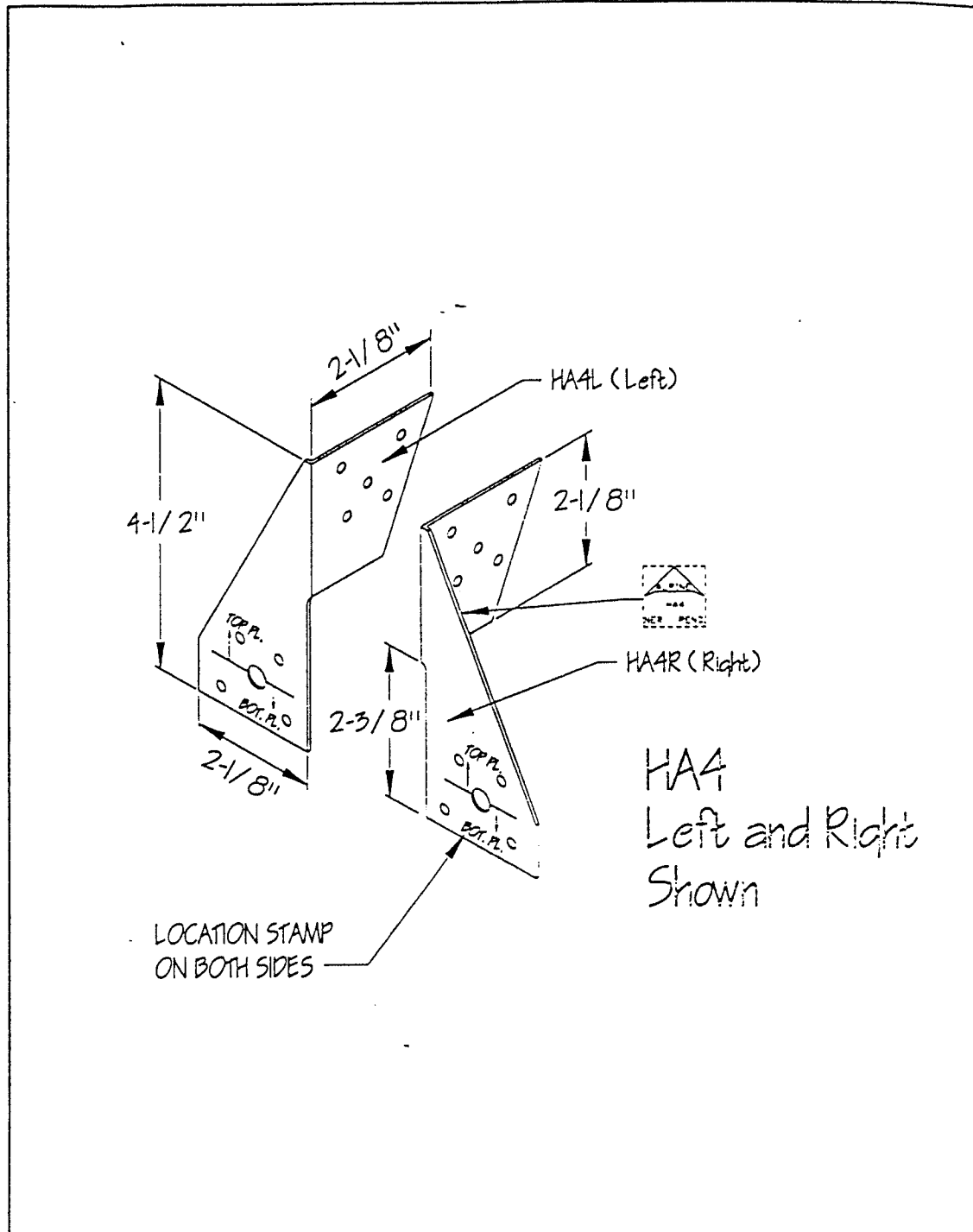



- ① 2x4x1'-6" SO. PINE
- ② 2x4x1'-6" SO. PINE
- ③ 2x4x1'-6" SO. PINE
- ④ 2x4x1'-6" SO. PINE
- ⑤ 2x6x2'-0" SO. PINE
- ⑥ -AC - HURRICANE ANCHOR (4) ABOVE 2x4's
- ⑦ (4) 8d COMMON NAILS
- ⑧ (5) 8d x 1 1/2 NAILS
- ⑨ 4 x 8 x 2 STEEL LOADING BLOCK
- ⑩ 3/4" DIAMETER STEEL CYLINDER
- ⑪ DISPLACEMENT TRANSDUCER



- ① 2x4x1'-6" SO. PINE
- ② 2x4x1'-6" SO. PINE
- ③ 2x6x1'-6" SO. PINE
- ④ 2x4x1'-6" SO. PINE
- ⑤ 2x6x2'-0" SO. PINE
- ⑥ -AC - HURRICANE ANCHOR (4) BELOW 2x4's
- ⑦ (4) 8d COMMON NAILS
- ⑧ (5) 8d x 1 1/2 NAILS
- ⑨ 4 x 8 x 2 STEEL LOADING BLOCK
- ⑩ 3/4" DIAMETER STEEL CYLINDER
- ⑪ DISPLACEMENT TRANSDUCER

NO:	MODIFICATIONS:	DATE APP:	A PINE		CONSTRUCTION HARDWARE		
MATERIAL:		F _y =	PRODUCT NAME	D/E NO:	DR:	CK:	
THICKNESS:		F _u =	-HURRICANE ANCHOR		K.F.		
COATING:	PROGRESSION:		PRODUCT NO:	SCALE:	APP:	DATE:	
			HA4			8-5-98	



NO:	MODIFICATIONS:	DATE:	APP:	 CONSTRUCTION HARDWARE			
MATERIAL: ASTM A653 SQ		Fy = 50ksi		PRODUCT NAME:	DIE NO:	DR:	CK:
THICKNESS: 18 ga		Fu = 70ksi		HURRICANE ANCHOR		K.F.	<i>One</i>
COATING: G-60		PROGRESSION:		PRODUCT NO:	SCALE:	APP:	DATE:
				HA4	NONE	1/16/98	10-15-