



# Farabaugh Engineering and Testing Inc.

Project No. T139-19

Report Date: February 25, 2019

Total Pages: 26 pages (inclusive)

**FM 4474**  
SIMULATED WIND UPLIFT RESISTANCE OF ROOF ASSEMBLIES  
IN ACCORDANCE WITH FM STANDARD 4474, APPENDIX D

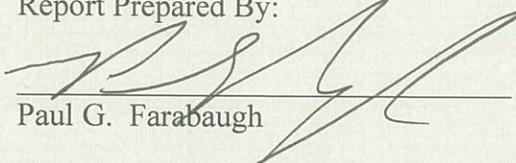
ON

**T-PANEL - METAL ROOF PANEL**  
**16" WIDE X 0.040" ALUMINUM**  
**WITH CONTINUOUS CLIPS AND INTERMITTENT CLIPS**  
**(5 SPANS @ 5'-0" O.C. & 12 SPANS @ 2'-0" O.C.)**

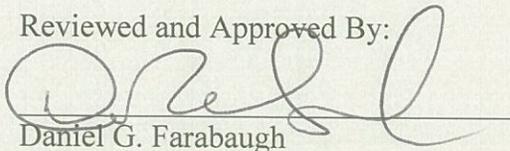
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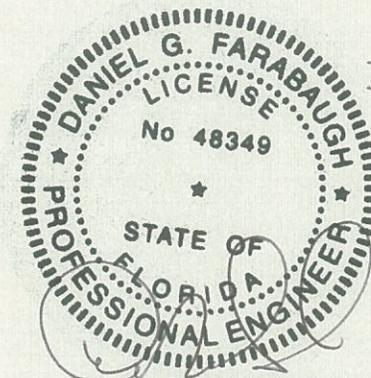
PETERSEN ALUMINUM CORP.  
10551 PAC ROAD  
TYLER, TX. 75707

Report Prepared By:

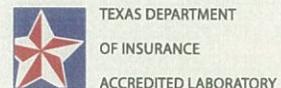
  
Paul G. Farabaugh

Reviewed and Approved By:

  
Daniel G. Farabaugh



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Project No. T139-19

**FM 4474-2004**  
AMERICAN NATIONAL STANDARD FOR EVALUATING THE SIMULATED WIND  
UPLIFT RESISTANCE OF ROOF ASSEMBLIES USING STATIC POSITIVE AND /OR  
NEGATIVE DIFFERENTIAL PRESSURES  
(APPENDIX D)

**Purpose**

This test method covers the evaluation of the simulated wind uplift resistance of roof assemblies by using static positive and /or negative differential pressures. The standard applies to all components as assembled in the roof system.

**Test Date**

1/29/19 Test #1 - 5 Spans @ 5'-0" o.c. with intermittent clips  
2/8/19 Test #2 - 5 Spans @ 5'-0" o.c. with continuous clips  
2/5/19 Test #3 - 12 Spans @ 2'-0" o.c. with intermittent clips  
1/30/19 Test #4 - 12 Spans @ 2'-0" o.c. with continuous clips

**Test Specimen**

Manufacturer: Petersen Aluminum  
10551 PAC Rd.  
Tyler, TX. 75707

Panel: T-PANEL - Metal Roof Panel, 16" wide x 0.040" aluminum with 0.040" alum. cap

Intermittent Clip: 6" wide x 16 ga. galvanized steel clip

Continuous Clip: 120" wide x 16 ga. galvanized steel clip

**Testing Apparatus**

The pressure test chamber measured 13' wide x 26' long x 8" deep. Air pressure was maintained from below the roof assembly. A controlled blower provided a pressure to uniformly load the specimen mock-up. Two static pressure taps located at diagonally opposite corners served as the manometer connection. Calibrated manometers were used to measure the pressure at each pressure tap. The uniform load pressure was performed in the negative direction to monitor wind uplift on the panel specimen mock-up. Calibrated deflectometers were attached to monitor panel deformation as shown.

### **Installation**

- The panels were installed on to 16 ga supports with using (2) #14-13 X 1-1/2" long, DP1, Concealor, self-drill fasteners per intermittent/continuous clip at supports. Test #1 & Test #3 used intermittent clips and Test #2 & #4 used continuous clips. Additional screw was used at each end of a continuous clip. The panel sidejoints used a 0.04" aluminum seam cap and were seamed with a mechanical seamer. The seam cap used 2 beads of factory sealant, one bead on each side of cap corners. The panel ends were fastened with (5) 1/4-14 x 1-1/2 long, self-drill, hex head fasteners with washer. The outer side panels were fastened with (2)1/4-14 x 1-1/2" long self- drill, hex head fasteners with washer at each support along each side of the mock-up.
- Plastic (4 mil thick) was employed loosely between the panels and subgirts and in the side joints to create a vacuum seal.

### **Procedure**

- The specimen was checked for proper adjustment and all vents closed in the pressure measuring lines.
- The required deflection measuring apparatus were installed at their specified locations.
- A nominal initial pressure was applied equal to at least four times but not more than ten times the dead weight of the specimen. This nominal pressure was used as the reference zero and initial deflection readings were recorded.
- At each load increment, pressure was maintained for a period of not less than 60 seconds and until the deflection gages indicated no further increase in deflections.
- Successive increments were achieved as above until failure or ultimate load was reached.

The test was conducted according to the procedure in FM 4474 (Appendix D) and as noted herein. In our opinion the tape and plastic had no influence on the results of the test.

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## TEST #1

Specimen: T-PANEL - Metal Roof Panel, 16" wide x 0.040" aluminum with intermittent Clip

Clip Spacing: 5 ft o/c

### NEGATIVE (UPLIFT) PRESSURE

PETERSEN ALUM. T-PANEL 16" WIDE X 0.040" ALUM. (5 SPANS @ 5' O.C.) INTERMITTENT CLIP

LOAD (PSF)	DEFLECTION DIAL READINGS (INCHES)					
	D-1	D-2	D-3	D-4	D-5	D-6
0.0	0.000	0.000	0.000	0.000	0.000	0.000
5.2	0.258	0.013	0.182	0.019	0.142	0.011
0.0	0.003	0.001	0.004	0.003	0.002	0.001
10.4	0.499	0.044	0.402	0.060	0.356	0.033
0.0	0.015	0.006	0.021	0.013	0.020	0.006
15.6	0.953	0.086	0.704	0.107	0.819	0.056
0.0	0.022	0.012	0.033	0.021	0.027	0.009
20.8	1.349	0.130	1.139	0.154	1.039	0.078
0.0	0.031	0.013	0.036	0.028	0.045	0.013
26.0	1.683	0.175	1.668	0.198	1.101	0.122
0.0	0.036	0.023	0.103	0.038	0.060	0.022
31.2	2.000	0.221	2.072	0.248	1.358	0.151
0.0	0.042	0.033	0.157	0.045	0.066	0.031
41.6	3.092	0.338	2.524	0.345	3.037	0.195
0.0	0.124	0.059	0.246	0.072	0.204	0.046
52.0	3.447	0.476	3.165	0.489	3.335	0.263
0.0	0.419	0.097	0.400	0.112	0.345	0.072
62.4	3.869	0.606	3.723	0.625	3.895	0.313
0.0	0.497	0.138	0.583	0.156	0.401	0.103

### RESULTS:

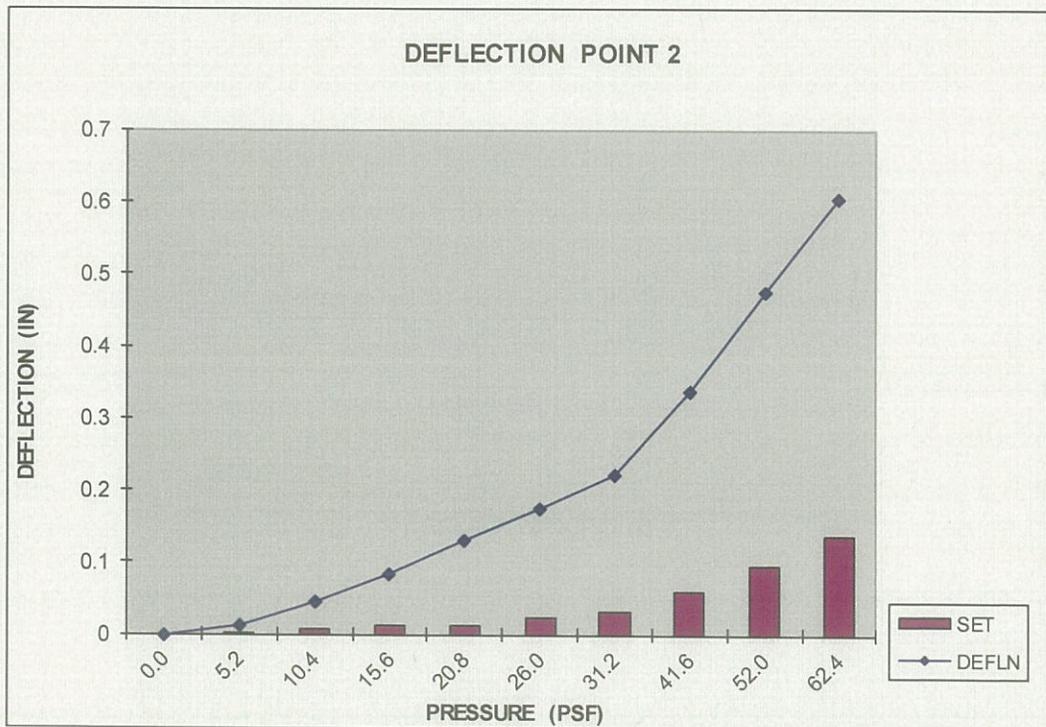
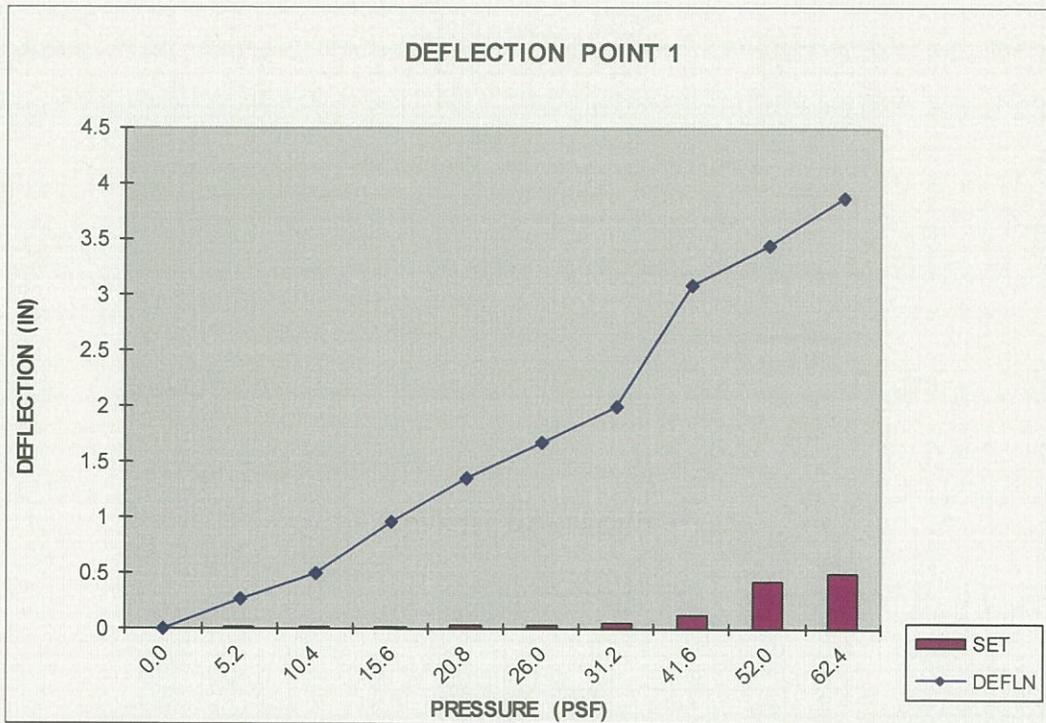
*Based on FM 4474 Test Method Appendix D*

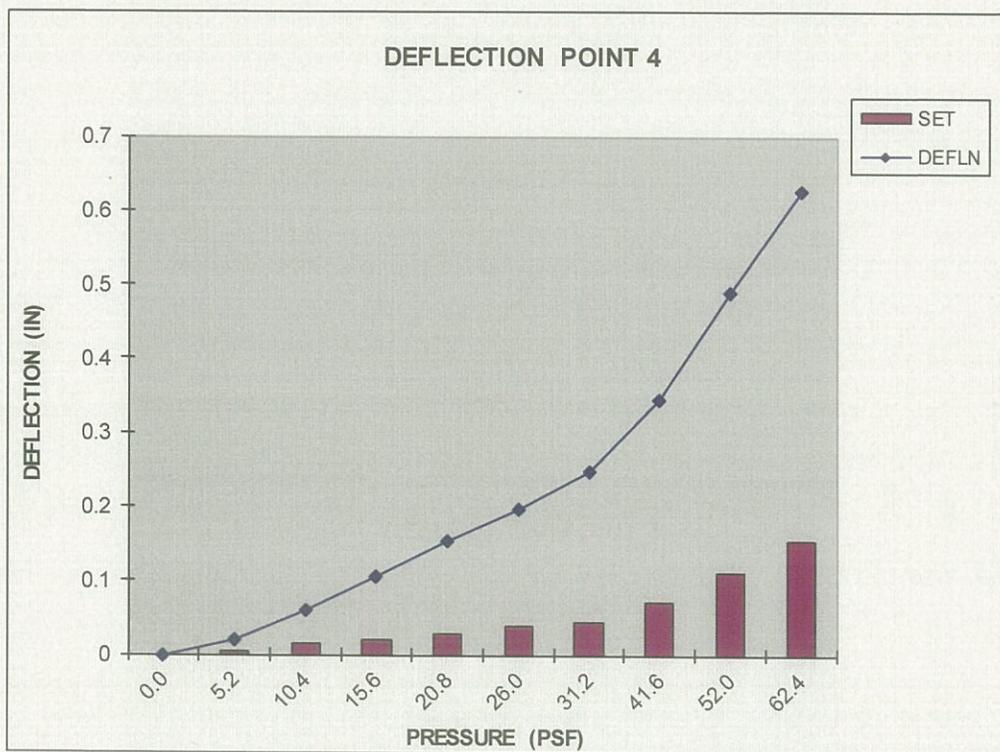
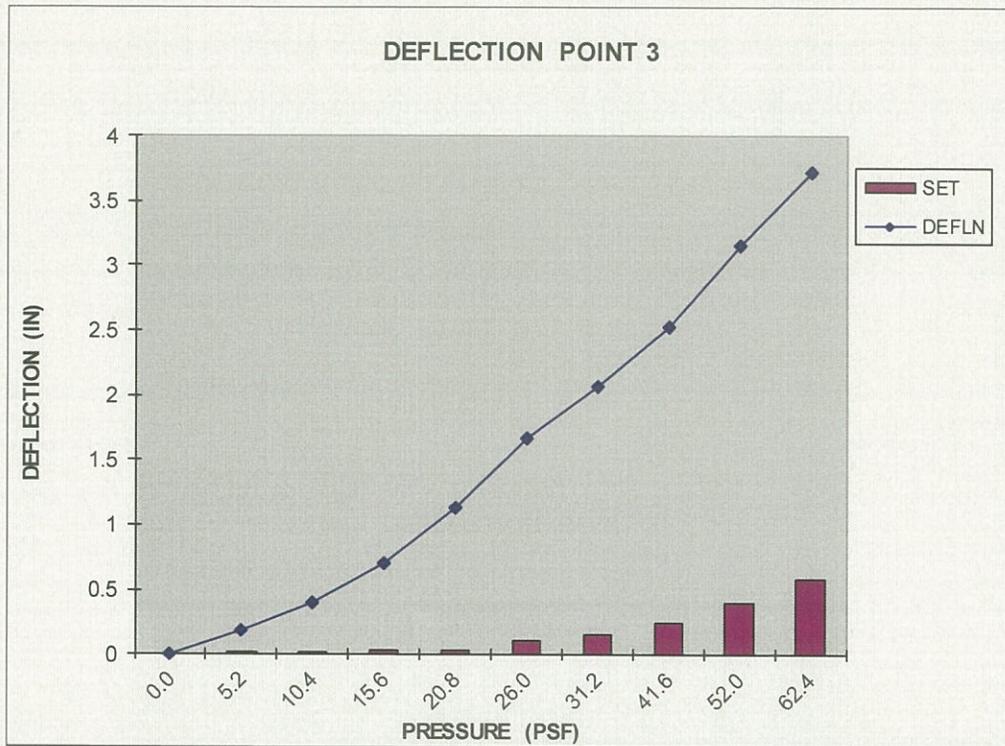
*Maximum Test Load Rating (held for 1 min.) = 75.0 psf*

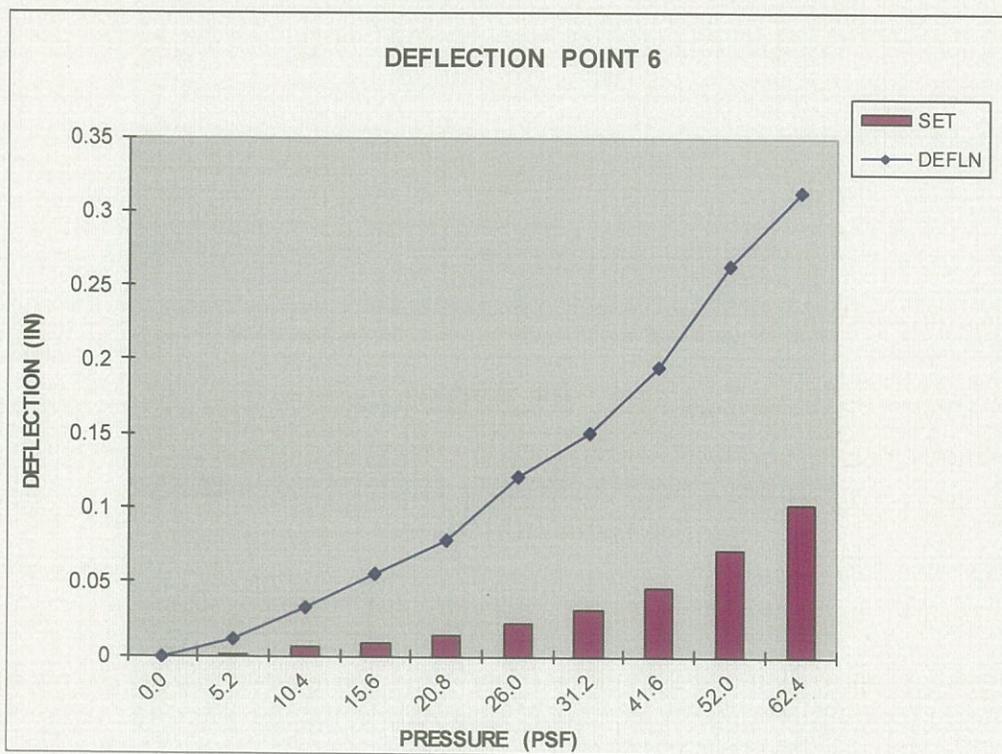
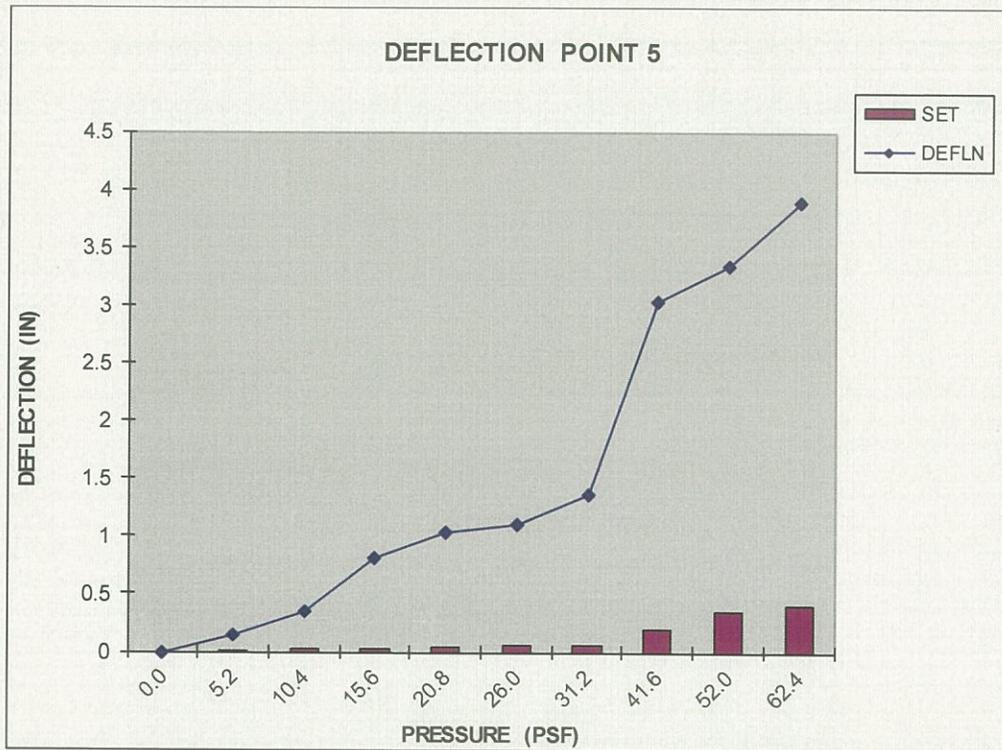
Buckling at end span = 77.5 psf

Additional Test Pressure that was held for a minute was 78 psf

Maximum Test Load = 80.6 psf (Panel disengaged from clip)







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## TEST #2

Specimen: T-PANEL - Metal Roof Panel, 16" wide x 0.040" aluminum with continuous Clip

Clip Spacing: 5 ft o/c

### NEGATIVE (UPLIFT) PRESSURE

PETERSEN ALUM. T-PANEL 16" WIDE X 0.040" ALUM. (5 SPANS @ 5' O.C.) CONT. CLIP

LOAD (PSF)	DEFLECTION DIAL READINGS (INCHES)					
	D-1	D-2	D-3	D-4	D-5	D-6
0.0	0.000	0.000	0.000	0.000	0.000	0.000
10.4	0.312	0.009	0.302	0.011	0.362	0.007
0.0	0.006	0.003	0.006	0.003	0.003	0.001
20.8	0.771	0.045	0.754	0.050	0.820	0.014
0.0	0.025	0.010	0.026	0.010	0.028	0.000
31.2	1.238	0.091	1.206	0.098	1.274	0.024
0.0	0.046	0.015	0.046	0.018	0.059	0.002
41.6	1.617	0.135	1.577	0.144	1.642	0.037
0.0	0.074	0.018	0.069	0.021	0.095	0.005
52.0	1.920	0.182	1.886	0.187	1.945	0.050
0.0	0.087	0.017	0.080	0.021	0.120	0.007
62.4	2.180	0.241	2.157	0.232	2.193	0.064
0.0	0.109	0.021	0.096	0.025	0.150	0.008
78.1	2.555	0.321	2.520	0.310	2.556	0.078
0.0	0.174	0.033	0.130	0.039	0.218	0.013
93.7	2.945	0.406	2.864	0.393	2.927	0.087
0.0	0.294	0.050	0.176	0.064	0.342	0.018
109.3	3.369	0.491	3.196	0.476	3.344	0.090
0.0	0.705	0.073	0.174	0.095	0.780	0.024

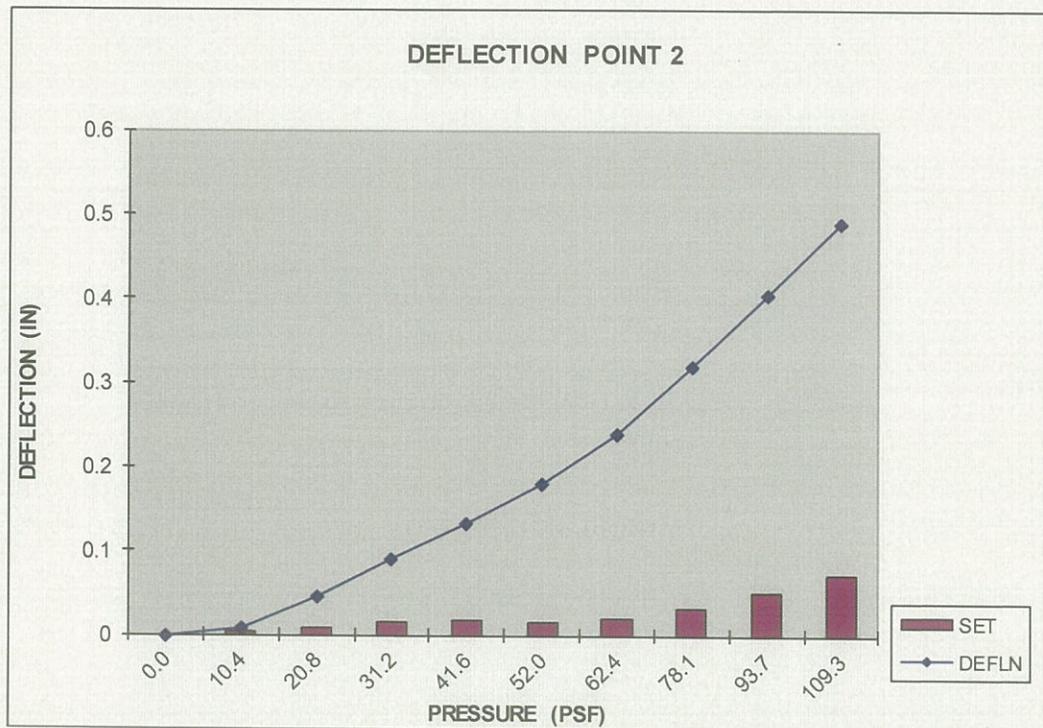
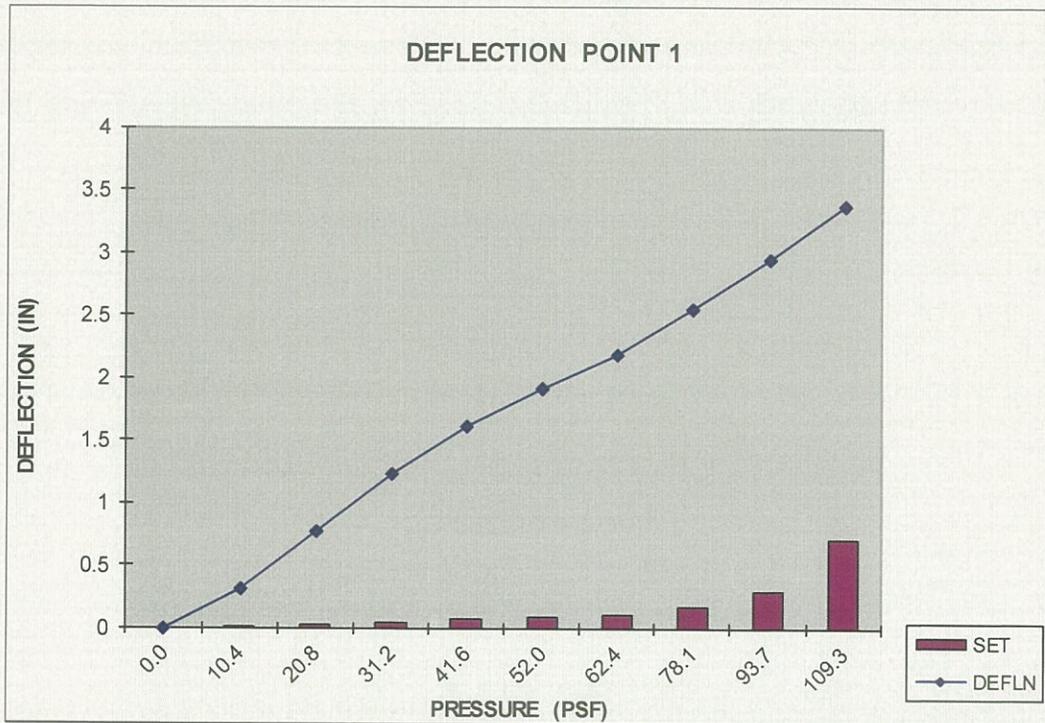
### RESULTS:

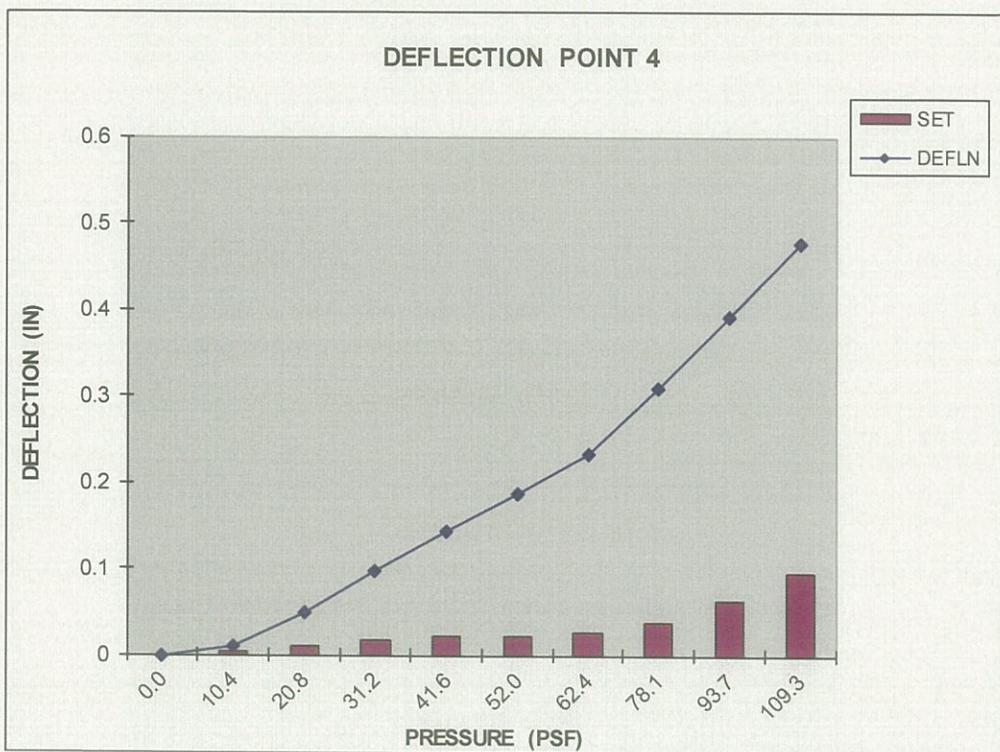
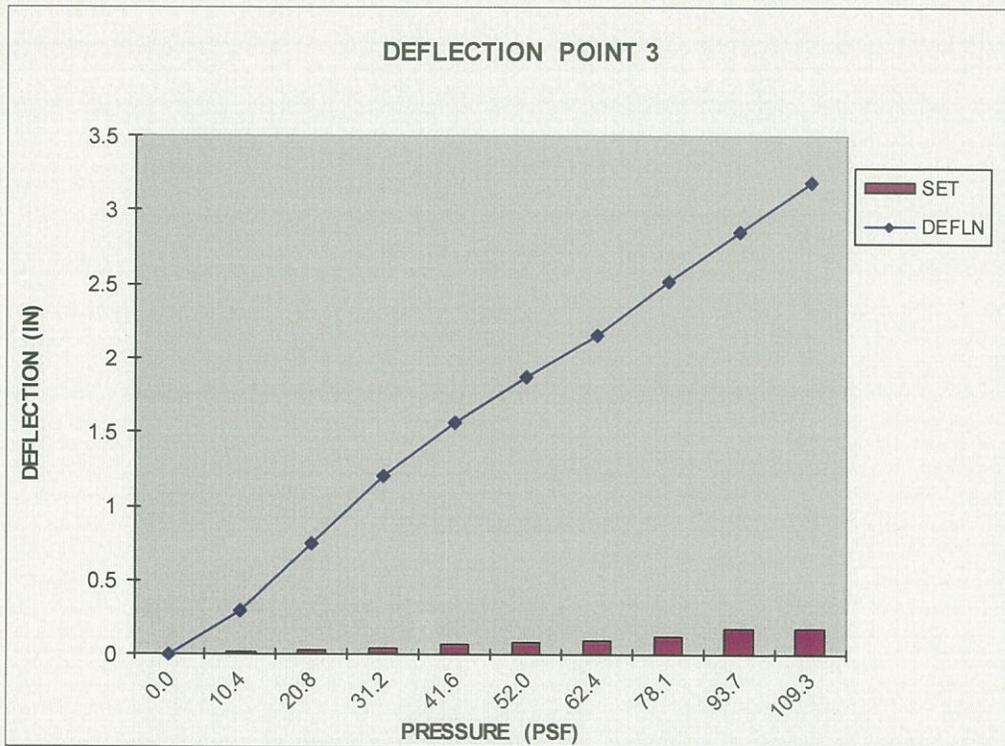
*Based on FM 4474 Test Method Appendix D*

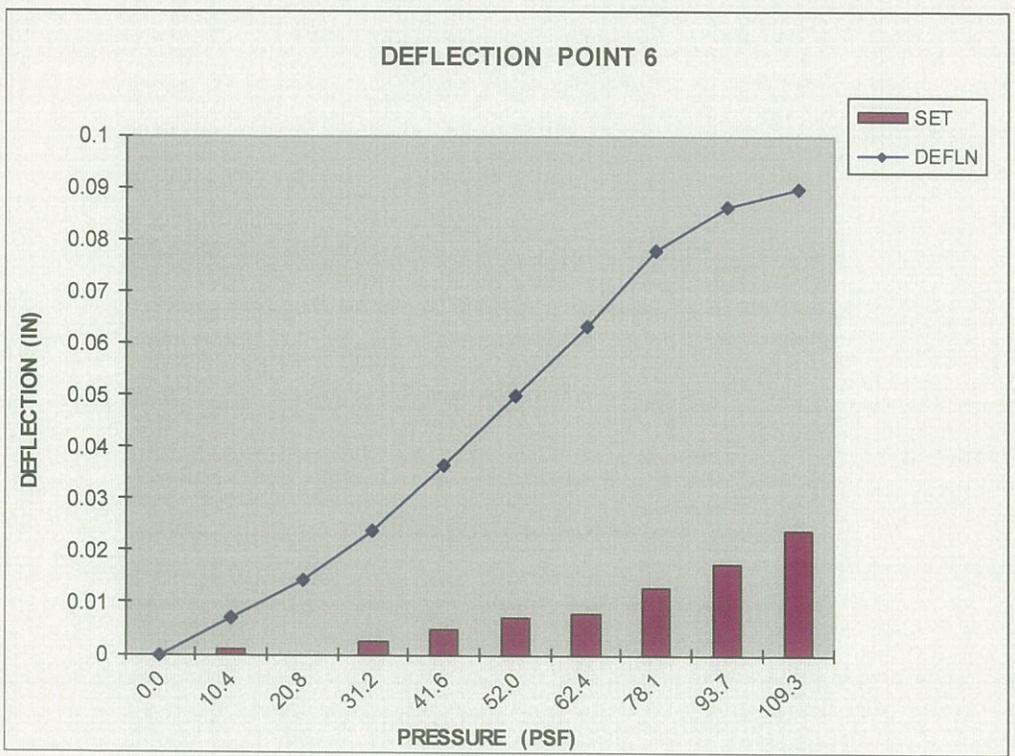
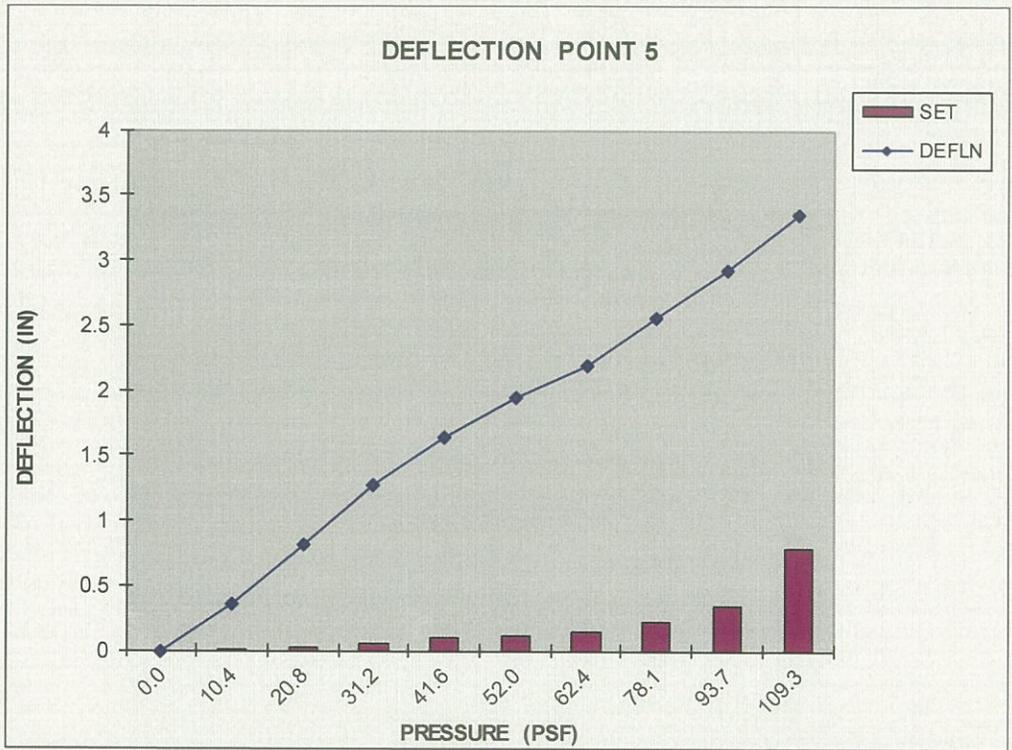
*Maximum Test Load Rating (held for 1 min.) = 180.0 psf*

Additional Test Pressure that was held for a minute was 182 psf

Maximum Test Load = 187.2 psf (clip fastener pulled thru clip)







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## TEST #3

Specimen: T-PANEL - Metal Roof Panel, 16" wide x 0.040" aluminum with intermittent Clip

Clip Spacing: 2 ft o/c

### NEGATIVE (UPLIFT) PRESSURE

PETERSEN ALUM. T-PANEL 16" WIDE X 0.040" ALUM. (12 SPANS @ 2' O.C.) INTERMITTENT CLIP

LOAD (PSF)	DEFLECTION DIAL READINGS (INCHES)					
	D-1	D-2	D-3	D-4	D-5	D-6
0.0	0.000	0.000	0.000	0.000	0.000	0.000
15.6	0.540	0.013	0.556	0.017	0.747	0.014
0.0	0.012	0.006	0.017	0.009	0.009	0.002
31.2	1.025	0.060	1.538	0.048	1.367	0.037
0.0	-0.023	0.009	0.052	0.014	0.231	0.000
46.8	2.875	0.110	2.682	0.095	2.856	0.064
0.0	0.234	0.015	0.171	0.025	0.346	0.006
62.4	3.409	0.161	3.171	0.132	3.357	0.081
0.0	0.288	0.018	0.200	0.028	0.397	0.016
78.1	3.859	0.221	3.646	0.184	3.749	0.088
0.0	0.328	0.028	0.233	0.038	0.438	0.032
93.7	4.304	0.291	4.072	0.244	4.201	0.094
0.0	0.386	0.033	0.283	0.044	0.495	0.030
109.3	4.726	0.364	4.457	0.301	4.640	0.123
0.0	0.467	0.044	0.324	0.054	0.574	0.020
124.9	5.105	0.440	4.800	0.362	5.013	0.155
0.0	0.599	0.059	0.300	0.064	0.701	0.025
140.5	5.576	0.544	5.187	0.445	5.436	0.187
0.0	3.112	0.108	0.274	0.087	3.212	0.025

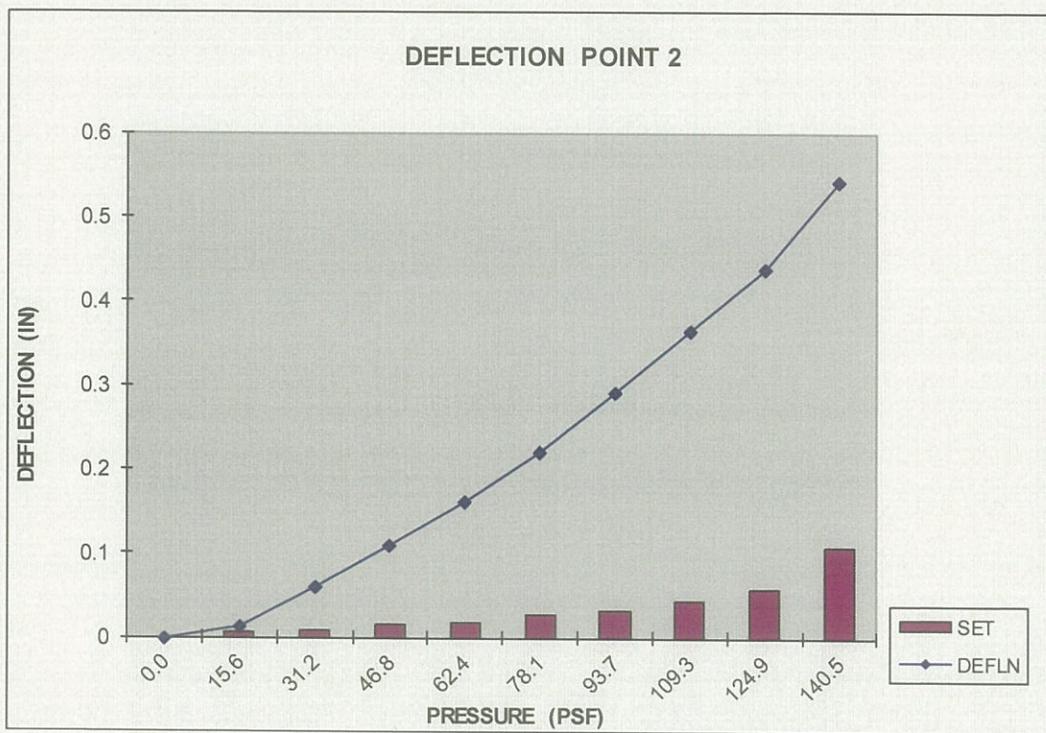
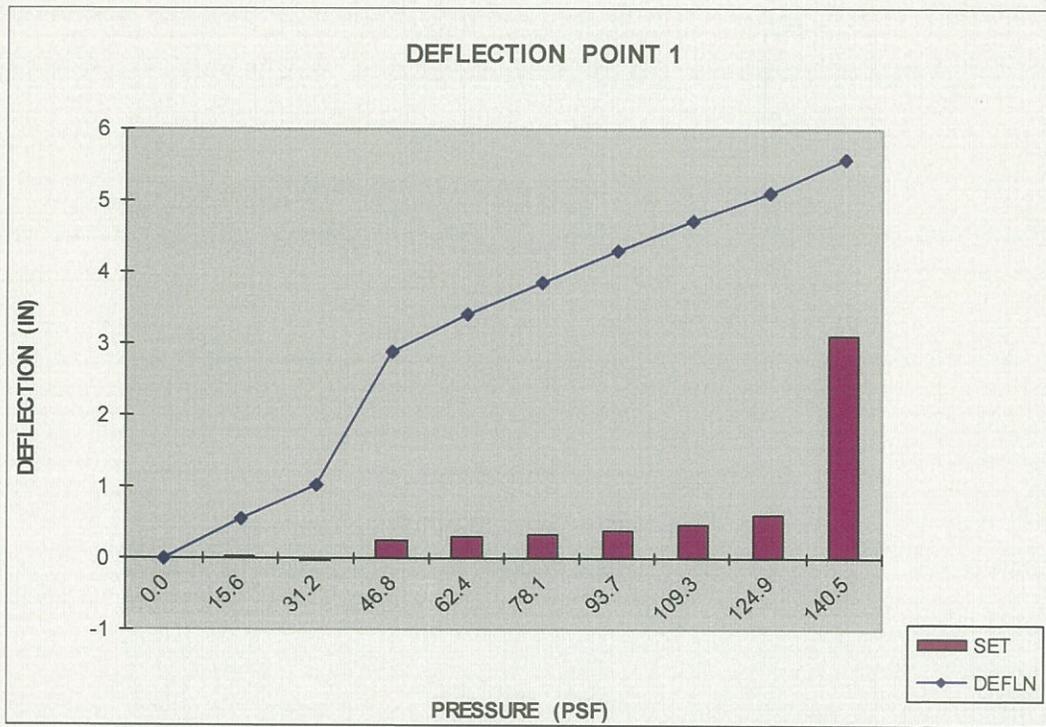
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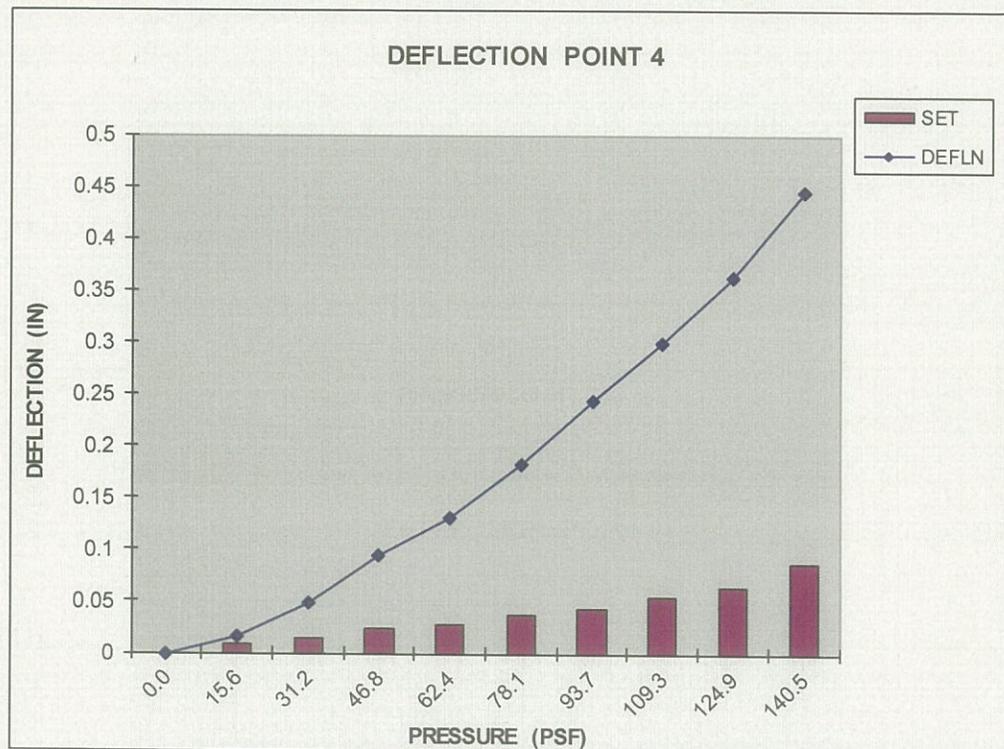
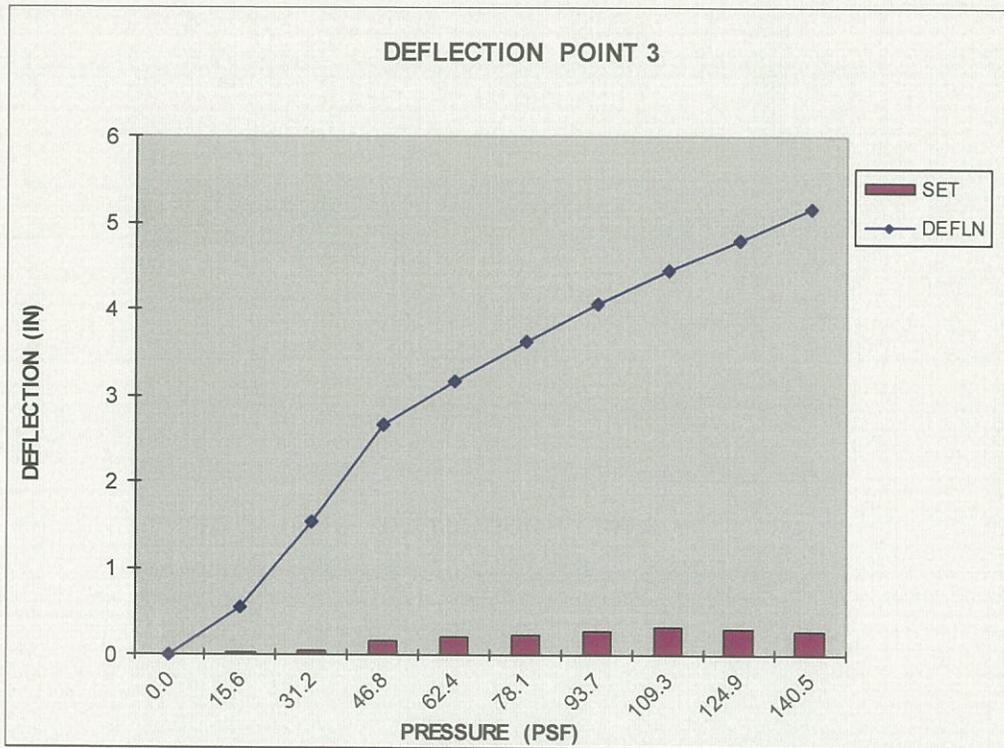
*Based on FM 4474 Test Method Appendix D*

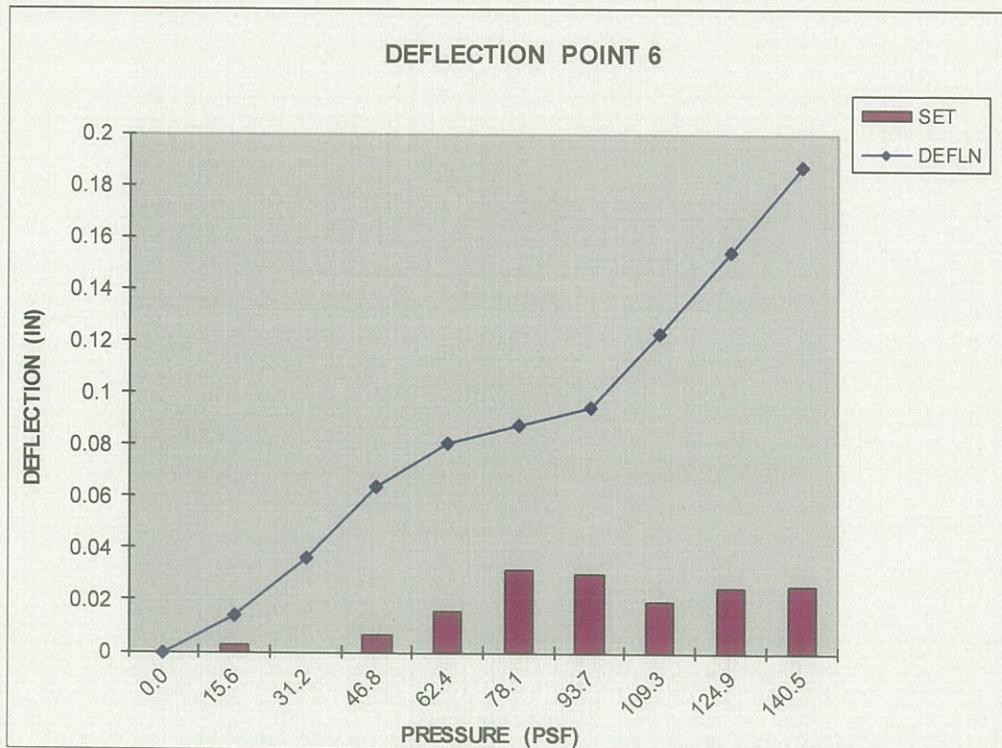
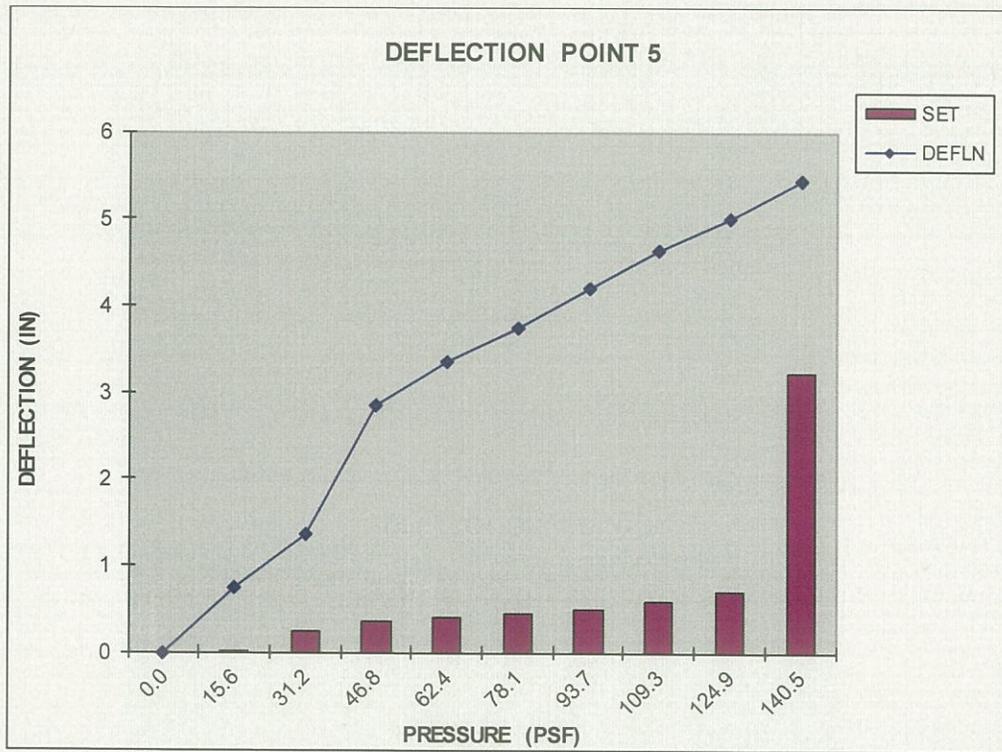
*Maximum Test Load Rating (held for 1 min.) = 150.0 psf*

Additional Test Pressure that was held for a minute was 156 psf

Maximum Test Load = 161.7 psf (Panel disengaged from clip – Clip straightened out)







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## TEST #4

Specimen: T-PANEL - Metal Roof Panel, 16" wide x 0.040" aluminum with continuous Clip

Clip Spacing: 2 ft o/c

### NEGATIVE (UPLIFT) PRESSURE

PETERSEN ALUM. T-PANEL 16" WIDE X 0.040" ALUM. (12 SPANS @ 2' O.C.) CONT. CLIP

DEFLECTION DIAL READINGS (INCHES)						
LOAD (PSF)	D-1	D-2	D-3	D-4	D-5	D-6
0.0	0.000	0.000	0.000	0.000	0.000	0.000
15.6	0.103	0.012	0.589	0.006	0.352	0.018
0.0	0.102	0.009	0.433	0.001	-0.018	0.010
31.2	0.459	0.019	0.677	0.014	0.515	0.028
0.0	0.006	0.006	0.316	0.004	0.010	0.009
46.8	0.866	0.025	2.471	0.023	0.886	0.041
0.0	0.304	0.004	0.907	0.003	0.311	0.013
62.4	2.644	0.044	2.898	0.036	2.794	0.063
0.0	0.420	0.008	0.968	0.002	0.413	0.015
78.1	3.050	0.058	3.249	0.049	3.244	0.081
0.0	0.590	0.009	1.018	0.003	0.575	0.014
93.7	3.399	0.068	3.586	0.059	3.679	0.103
0.0	1.661	0.013	1.095	0.006	1.737	0.013
109.3	3.629	0.081	3.870	0.071	4.079	0.122
0.0	2.555	0.021	2.015	0.006	2.687	0.025

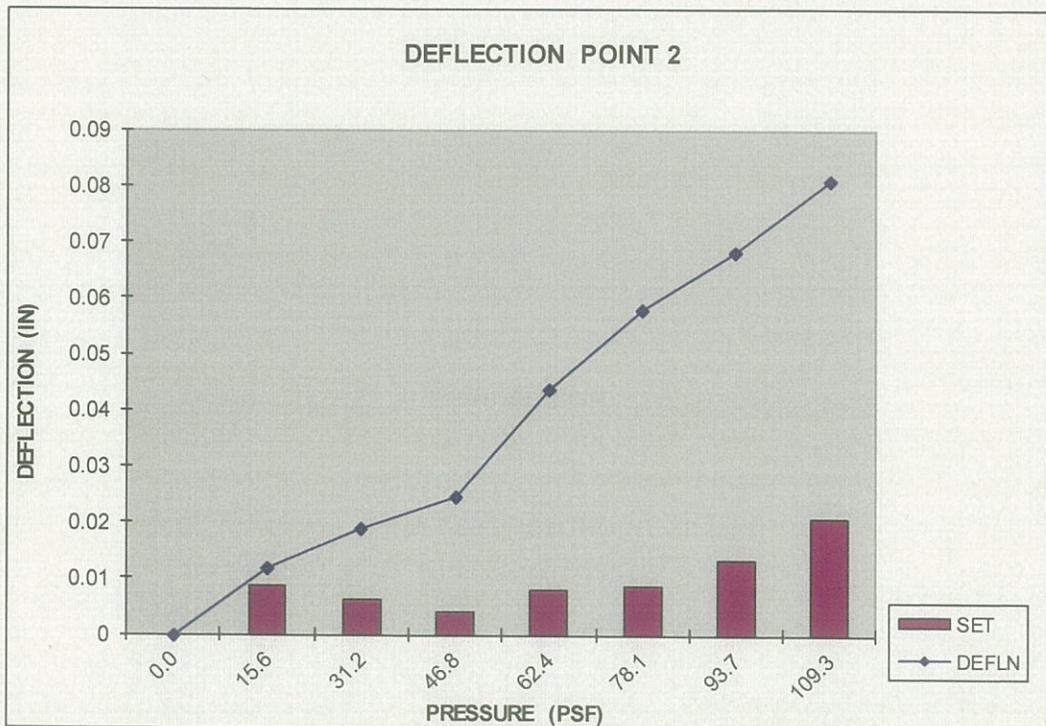
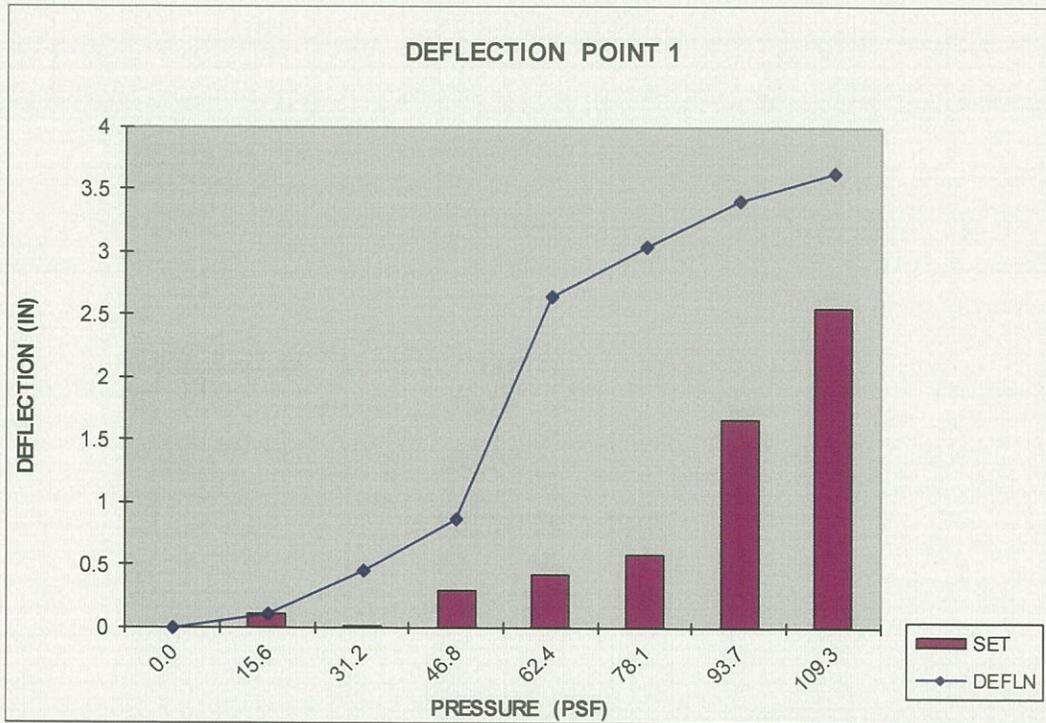
### RESULTS:

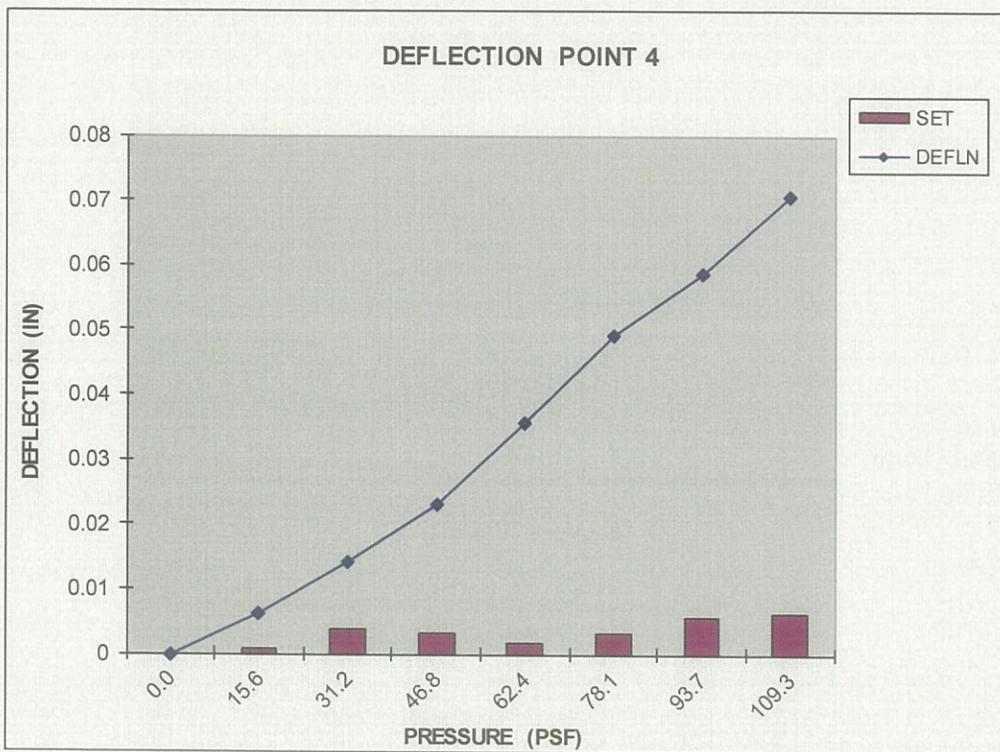
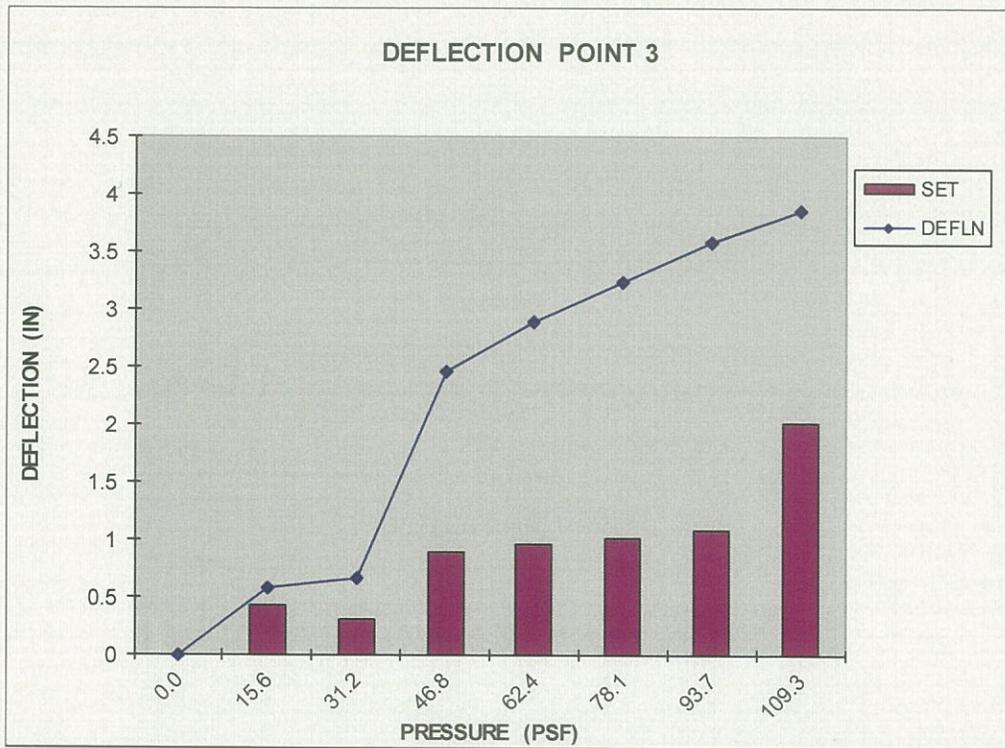
*Based on FM 4474 Test Method Appendix D*

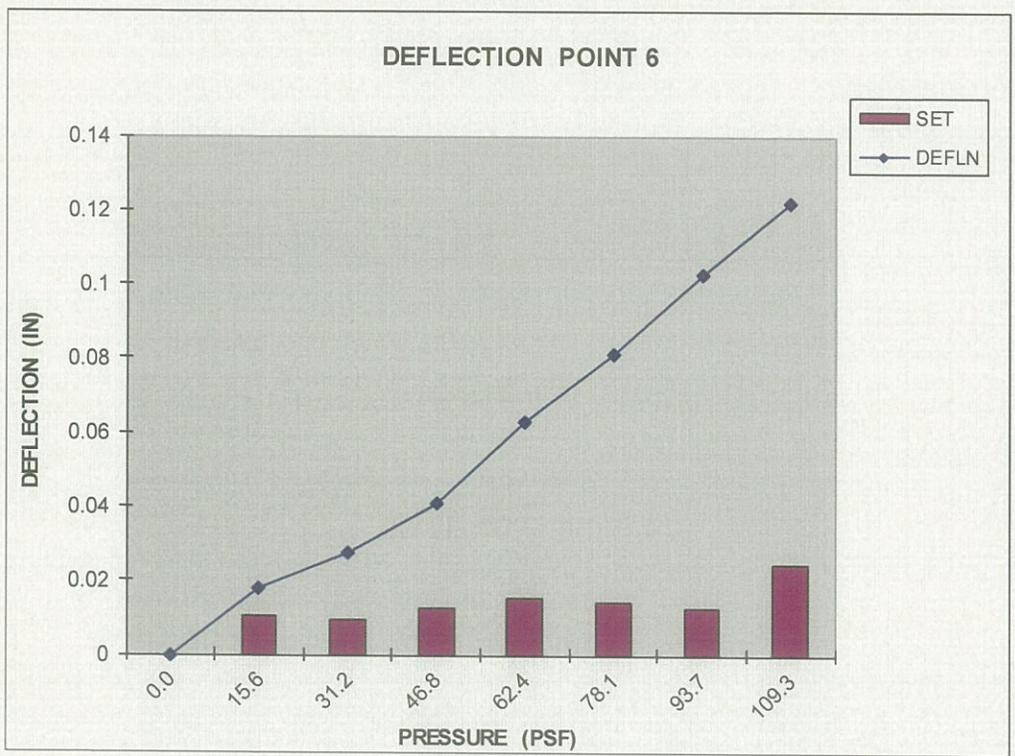
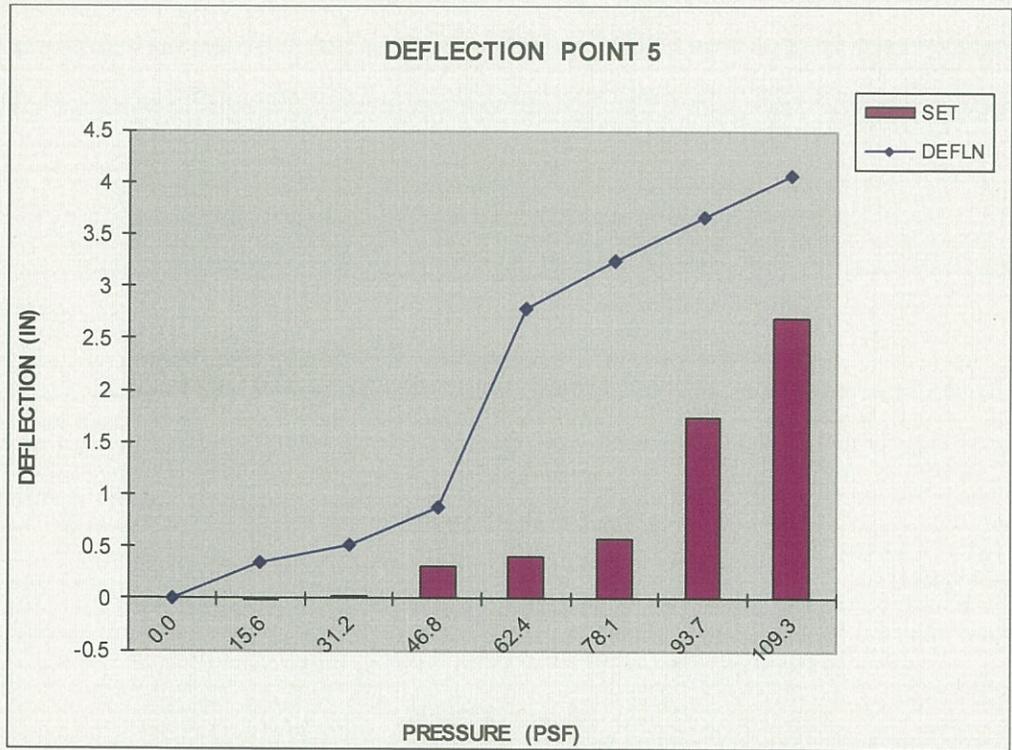
*Maximum Test Load Rating (held for 1 min.) = 240.0 psf*

Additional Test Pressure that was held for a minute was 254.3 psf

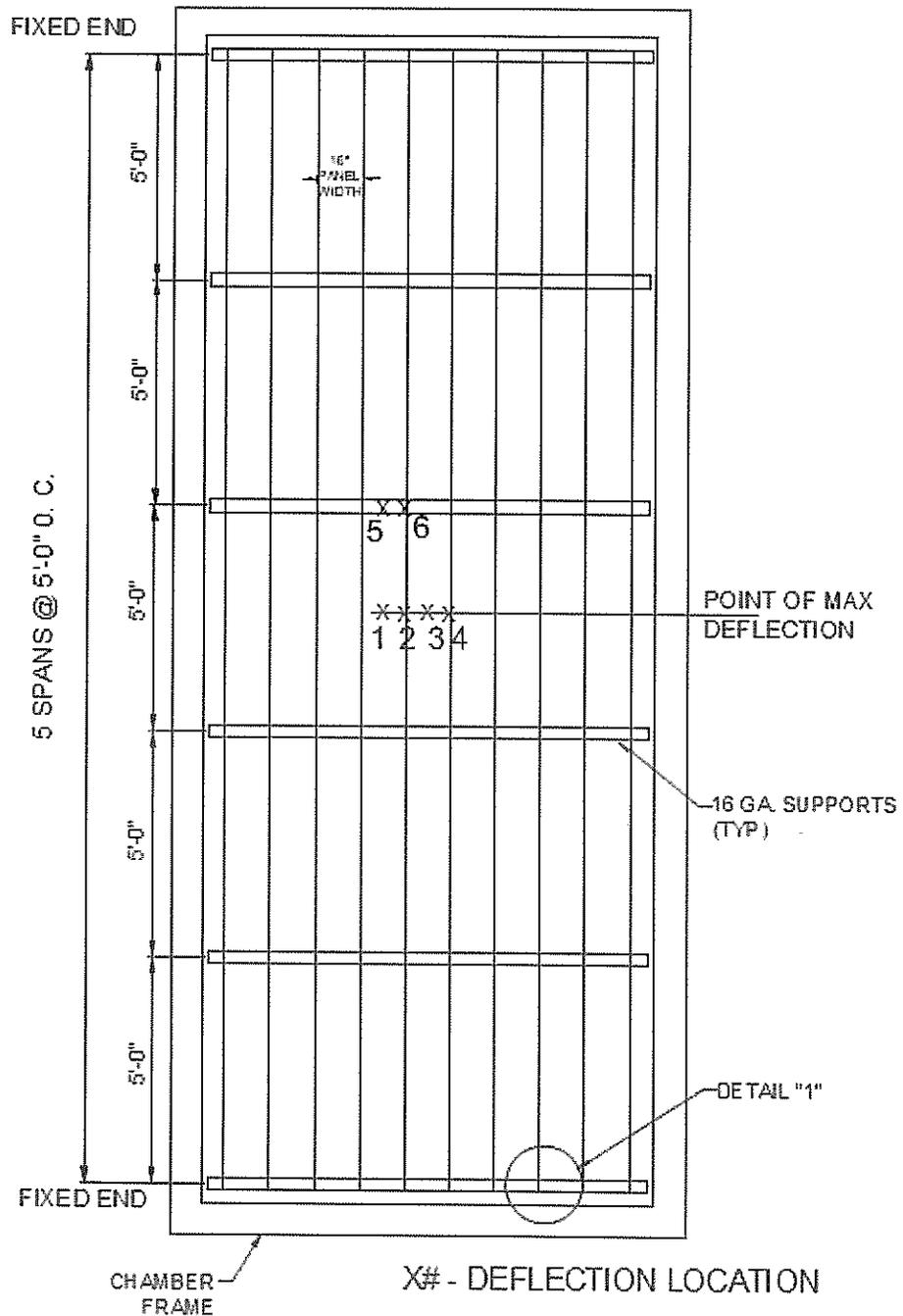
Maximum Test Load = 254.3 psf (No Failures)







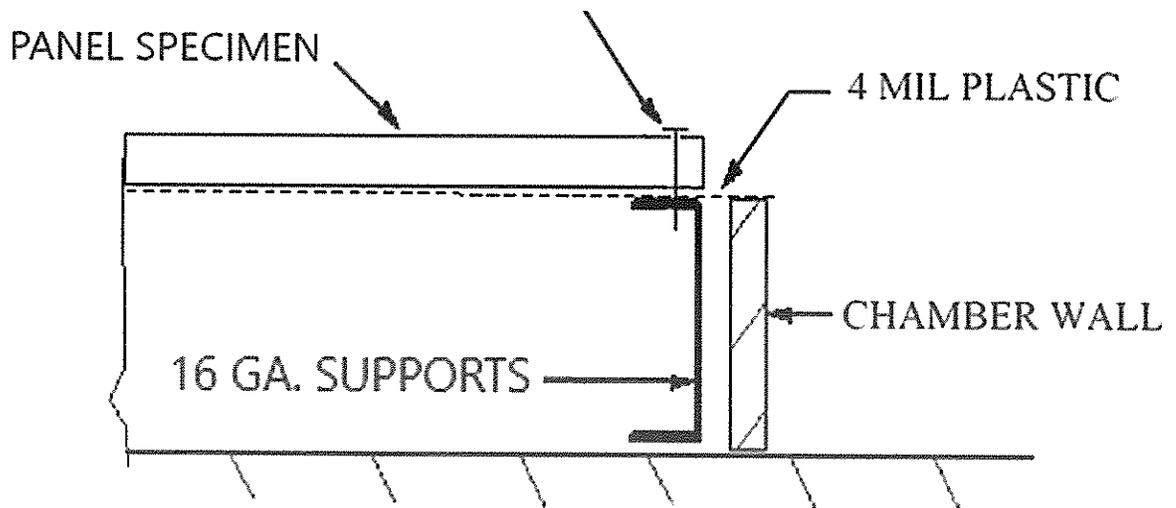
# TEST #1 & #2



## PLAN VIEW

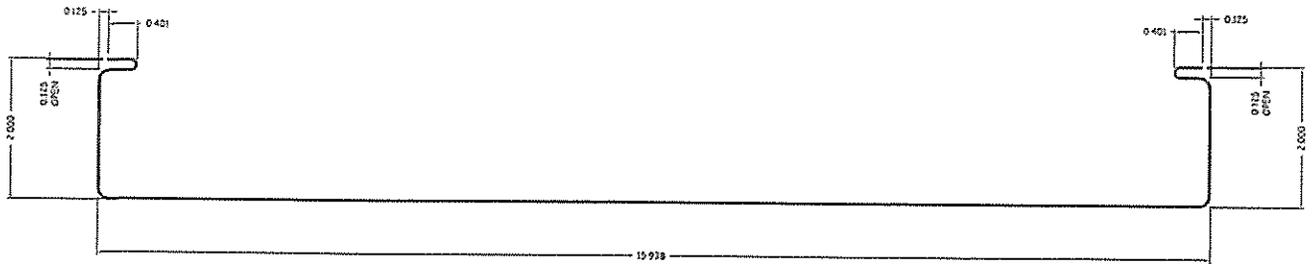


1/4-14 SELF DRILLING FASTENERS  
(5 PER PANEL AT FIXED ENDS)

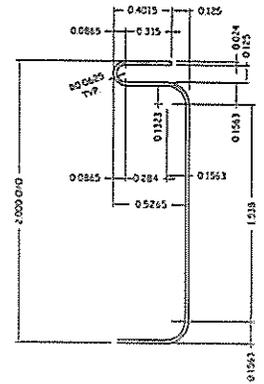
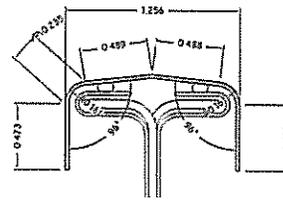
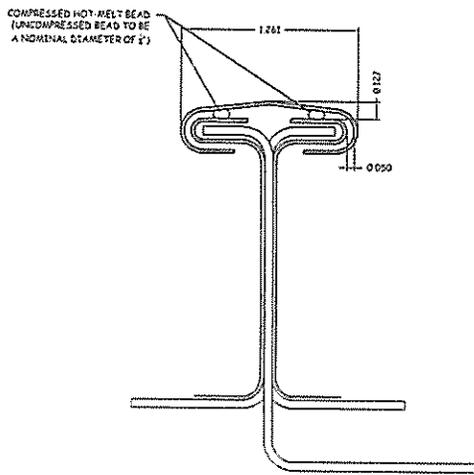


# DETAIL 1

Project No. T139-19



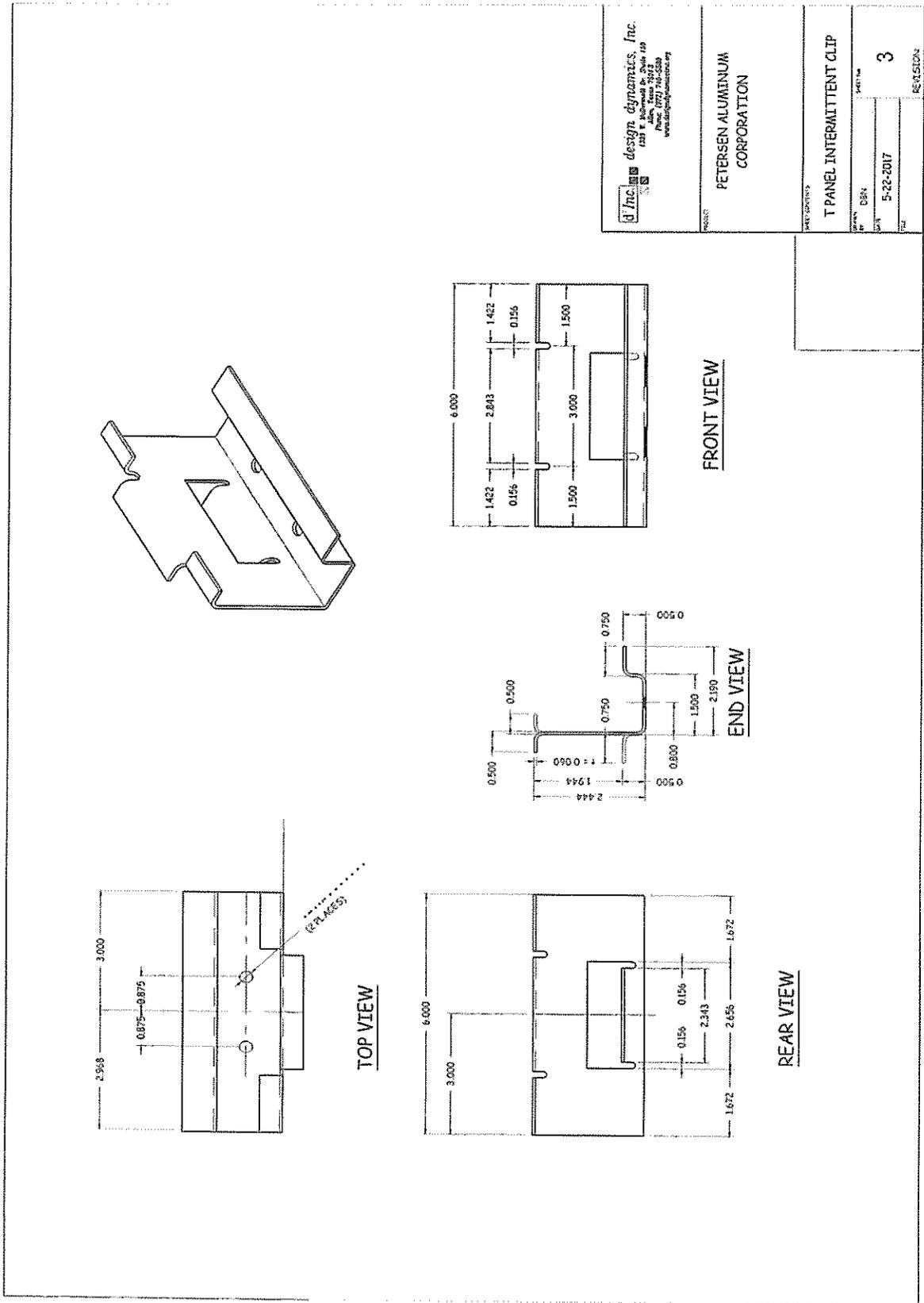
16" T PANEL



ENLARGED SIDE JOINT DETAIL

STUDY AT SIDE JOINT W/ CLIP CAP (AFTER SEAMING)

## PANEL PROFILE



**d / inc.** design dynamics, inc.  
 12511 15th Street, Suite 200  
 Irvine, CA 92618  
 (949) 754-0529  
 info@design-dynamics.com

PETERSEN ALUMINUM CORPORATION

T PANEL INTERMITTENT CLIP

REV: 3  
 DATE: 5-22-2017



Project No. T139-19

## TENSILE TEST REPORT

Client: Petersen Aluminum  
10551 PAC Rd.  
Tyler, TX. 75707

Test Date: February 8, 2019

Test Method: ASTM B557-10

Material Description: T-PANEL - Metal Roof Panel, 16" wide x 0.040" aluminum

Sample No.	Width (in)	Thickness (in)	Yield Load (lb)	Max. Load (lb)	0.2% Offset Yield Strength (psi)	Tensile Strength (psi)	Elongation (% in 2 inches)
19004	0.508	0.038	487.4	533.9	25,249	27,656	9.98

Equipment Used: Tensile Machine #QT7-061196-020  
Caliper #1074379  
Extensometer #10311744D  
Micrometer #110596927