Farabaugh Engineering and Testing Inc.

Project No. T137-19

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Total Pages: 26 pages (inclusive)

ASTM E 1592
STANDARD TEST METHOD FOR
STRUCTURAL PERFORMANCE OF SHEET METAL ROOF AND SIDING SYSTEMS
BY UNIFORM STATIC AIR PRESSURE DIFFERENCE

ON

T-PANEL - METAL ROOF PANEL
16" WIDE X 24 GA. STEEL
WITH CONTINUOUS CLIPS AND INTERMITTENT CLIPS
(5 SPANS @ 5'-0" O.C. & 12 SPANS @ 2'-0" O.C.)

FOR

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

Report Prepared By:

Paul G. Farabaugh

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3/4/19

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Project No. T137-19

ASTM E1592-05
STANDARD TEST METHOD FOR
STRUCTURAL PERFORMANCE OF SHEET METAL ROOF AND SIDING SYSTEMS
BY UNIFORM STATIC AIR PRESSURE DIFFERENCE

Purpose

This test method covers the evaluation of the structural performance of Sheet Metal Panels and Anchor to Panel Attachments for roof or siding systems under uniform static air pressure difference.

Test Date

2/13/19 Test #1 - 5 Spans @ 5'-0" o.c. with intermittent clips
2/19/19 Test #2 - 5 Spans @ 5'-0" o.c. with continuous clips
2/18/19 Test #3 - 12 Spans @ 2'-0" o.c. with intermittent clips
2/22/19 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 24 ga. steel with 24 ga. steel cap

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

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

Testing Apparatus

A test chamber was used with two static pressure taps located at diagonally opposite corners. A controlled blower provided a uniformly load the specimen mock-up. 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 clips 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 24 ga. 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 ASTM E-1592-05 and as noted herein. In our opinion the tape and plastic had no influence on the results of the test.

Project No. T137-19

TEST #1

Specimen: T-PANEL - Metal Roof Panel, 16" wide x 24 ga. steel with intermittent Clip

Clip Spacing: 5 ft o/c

NEGATIVE (UPLIFT) PRESSURE

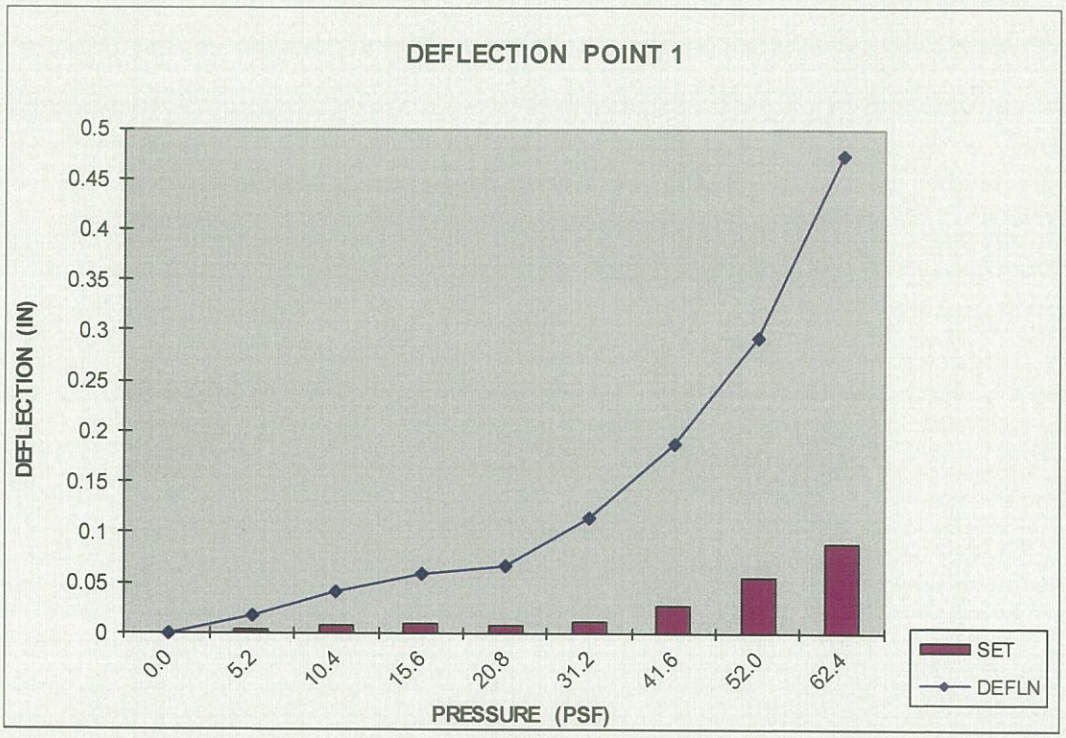
PETERSEN ALUM. T-PANEL 16" WIDE X 24 GA. STEEL (5 SPANS @ 5' O.C.) INTERMITTENT CLIP

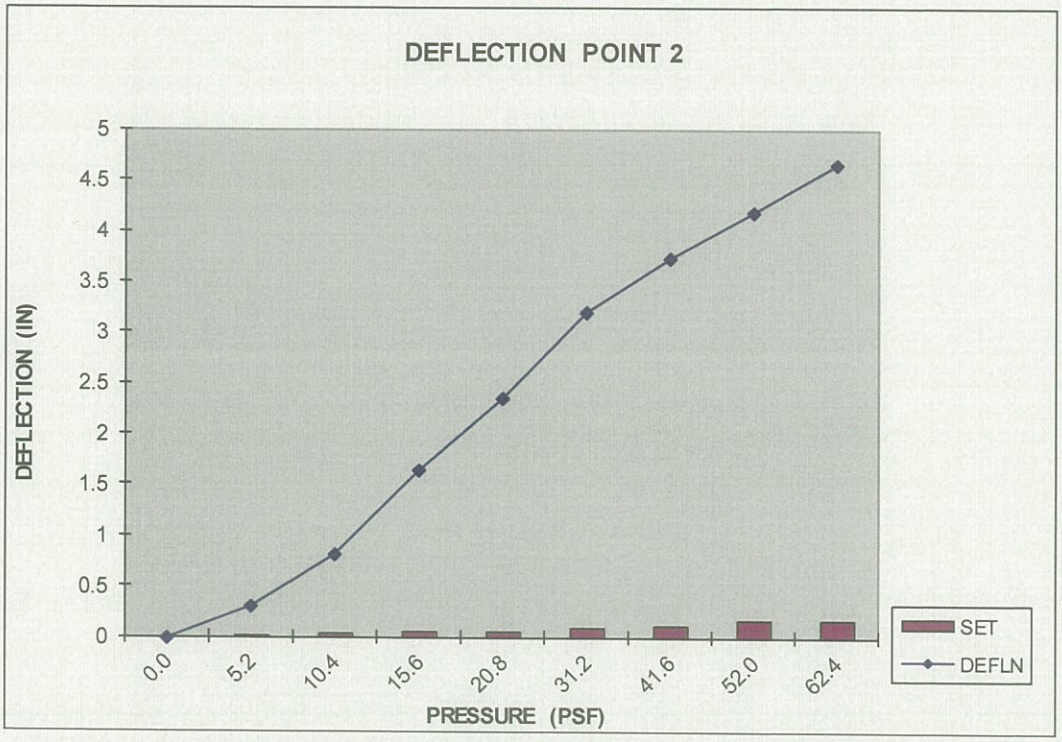
	DEFLECTION DIAL READINGS (INCHES)					
LOAD (PSF)	D-1	D-2	D-3	D-4	D-5	D-6
0.0	0.000	0.000	0.000	0.000	0.000	0.000
5.2	0.018	0.303	0.023	0.297	0.013	0.278
0.0	0.004	0.006	0.003	0.009	0.003	0.006
10.4	0.041	0.828	0.063	0.793	0.039	0.790
0.0	0.007	0.022	0.009	0.026	0.006	0.020
15.6	0.060	1.654	0.100	1.567	0.058	1.583
0.0	0.009	0.047	0.013	0.048	0.008	0.039
20.8	0.067	2.358	0.124	2.264	0.065	2.272
0.0	0.008	0.061	0.015	0.063	0.011	0.051
31.2	0.115	3.204	0.172	3.103	0.088	3.103
0.0	0.011	0.088	0.010	0.094	0.020	0.082
41.6	0.189	3.742	0.223	3.685	0.125	3.634
0.0	0.027	0.105	0.031	0.115	0.030	0.093
52.0	0.293	4.192	0.243	4.204	0.161	4.082
0.0	0.056	0.177	0.067	0.178	0.053	0.167
62.4	0.474	4.670	0.239	4.779	0.185	4.392
0.0	0.089	0.175	0.113	0.204	0.070	0.104

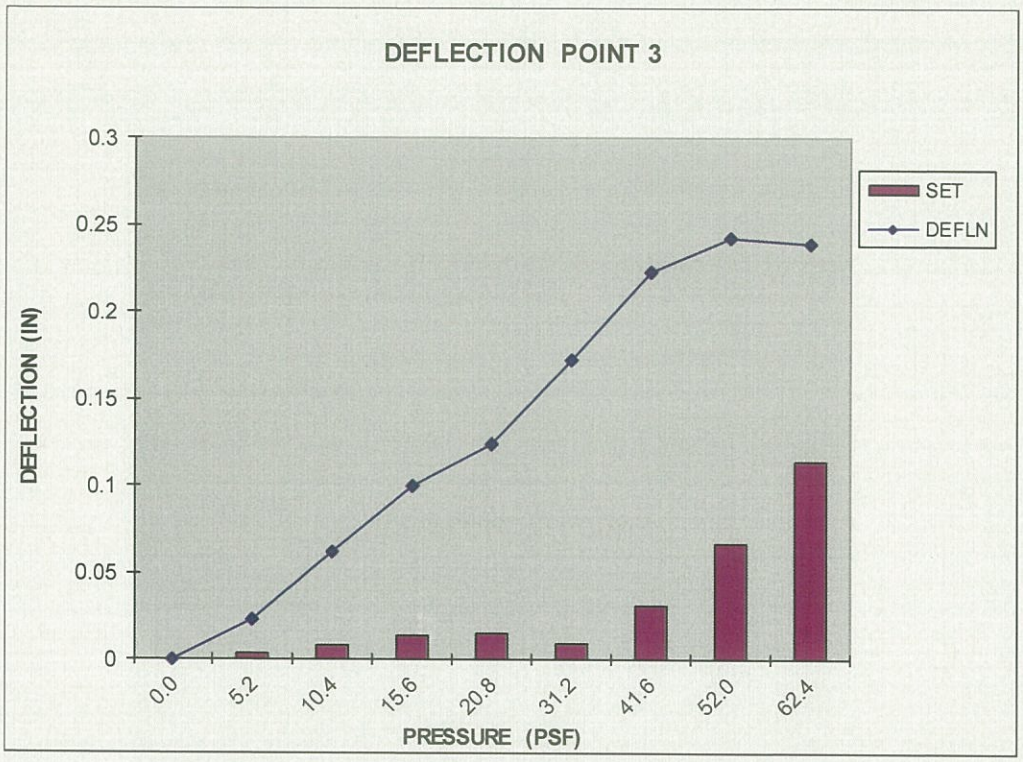
RESULTS:

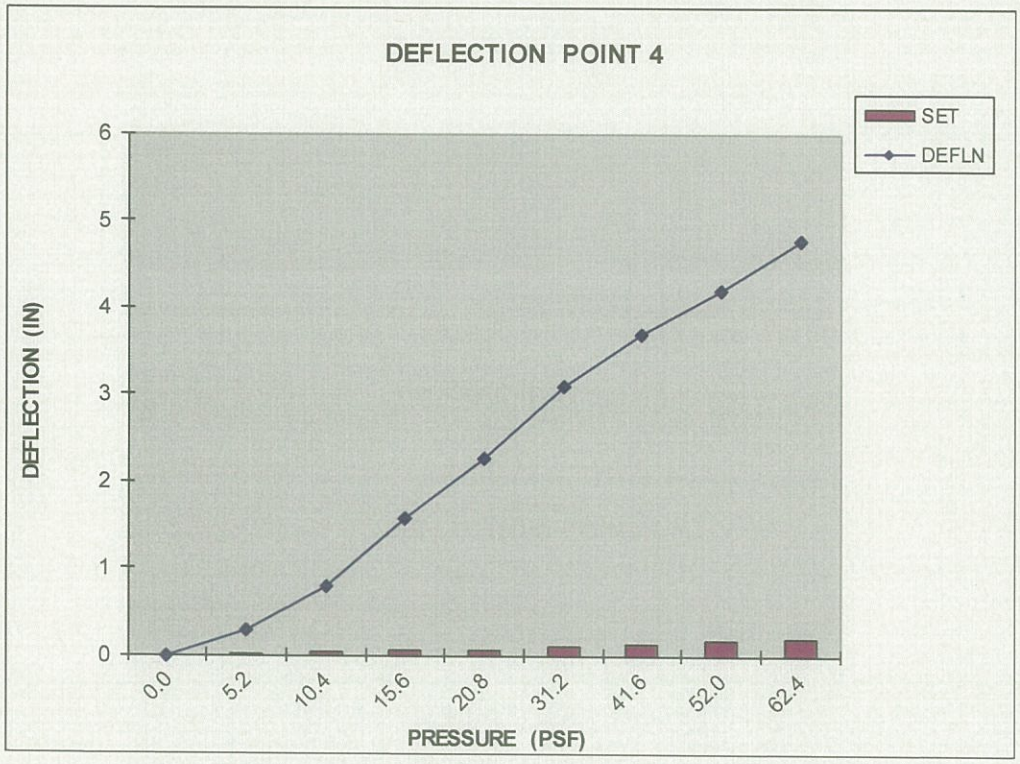
Load held for 1 minute = 67.6 psf

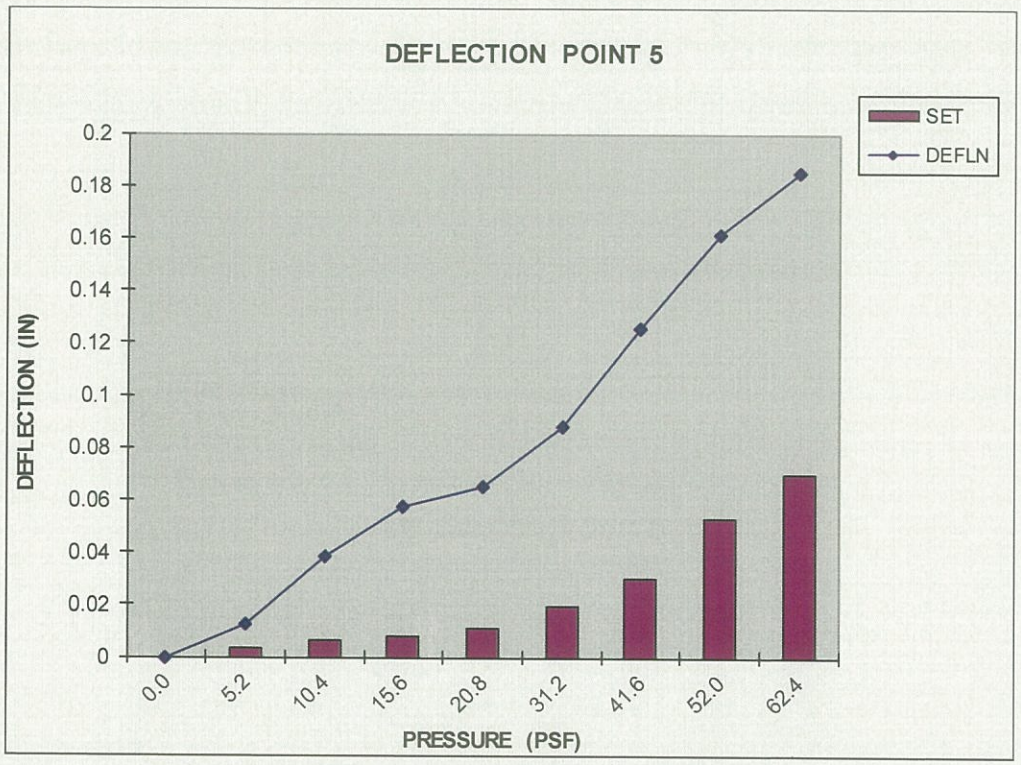
Maximum Test Load = 72.8 psf (Panel disengaged from clip)

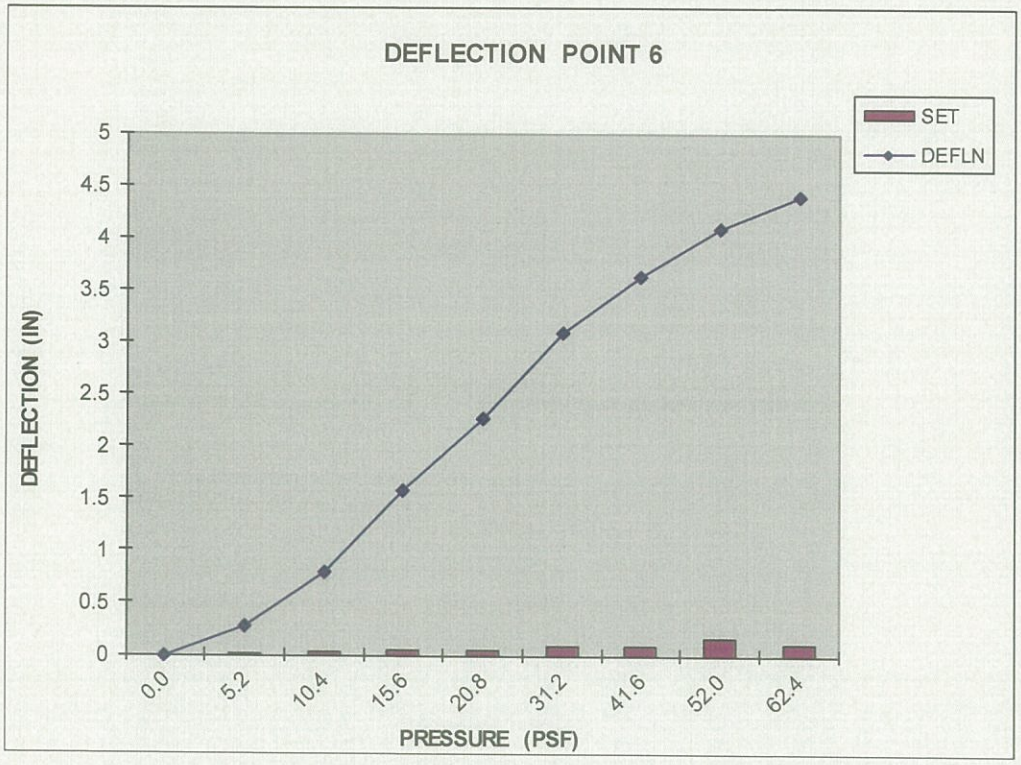

DEFLECTION POINT 1
DEFLECTION (IN)
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0.0
5.2
10.4
15.6
20.8
31.2
41.6
52.0
62.4
PRESSURE (PSF)
SET
DEFLN


DEFLECTION POINT 2
DEFLECTION (IN)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0.0
5.2
10.4
15.6
20.8
31.2
41.6
52.0
62.4
PRESSURE (PSF)
SET
DEFLN


DEFLECTION POINT 3
DEFLECTION (IN)
0.3
0.25
0.2
0.15
0.1
0.05
0
SET
DEFLN
0.0
5.2
10.4
15.6
20.8
31.2
41.6
52.0
62.4
PRESSURE (PSF)


DEFLECTION POINT 4
DEFLECTION (IN)
6
5
4
3
2
1
0
SET
DEFLN
0.0
5.2
10.4
15.6
20.8
31.2
41.6
52.0
62.4
PRESSURE (PSF)


DEFLECTION POINT 5
SET
DEFLN
DEFLECTION (IN)
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0.0
5.2
10.4
15.6
20.8
31.2
41.6
52.0
62.4
PRESSURE (PSF)


DEFLECTION POINT 6
SET
DEFLN
DEFLECTION (IN)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0.0
5.2
10.4
15.6
20.8
31.2
41.6
52.0
62.4
PRESSURE (PSF)

Project No. T137-19

TEST #2

Specimen: T-PANEL - Metal Roof Panel, 16" wide x 24 ga. steel with continuous Clip

Clip Spacing: 5 ft o/c

NEGATIVE (UPLIFT) PRESSURE

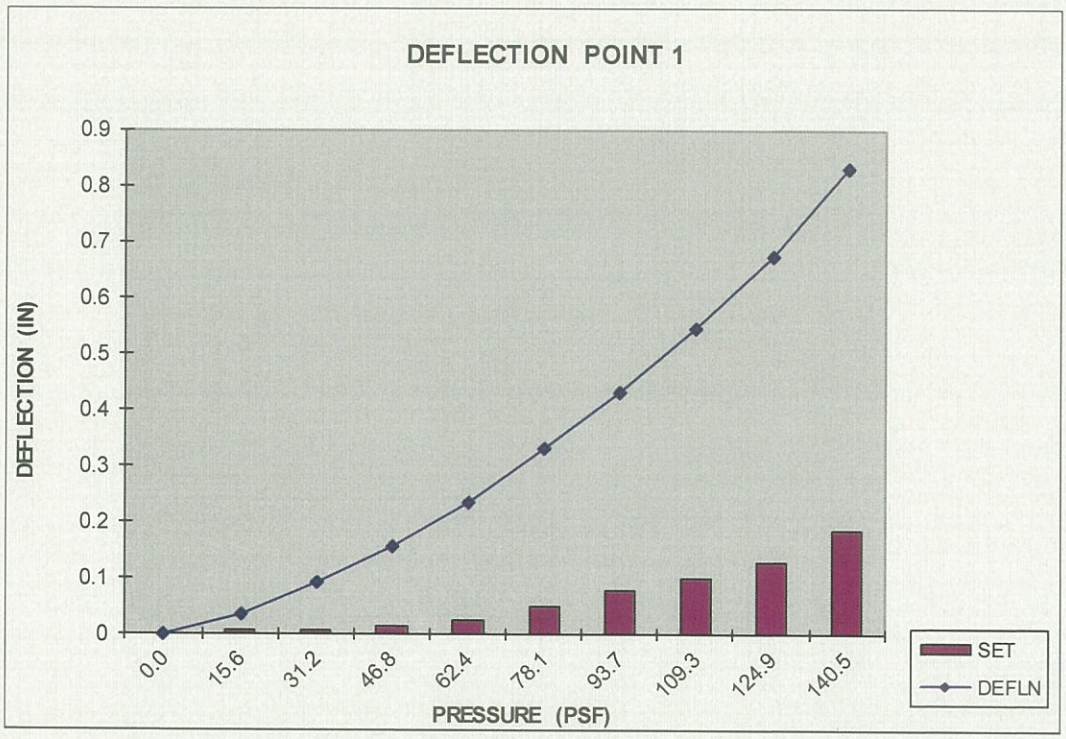
PETERSEN ALUM. T-PANEL 16" WIDE X 24 GA. STEEL (5 SPANS @ 5' O.C.) CONT. CLIP

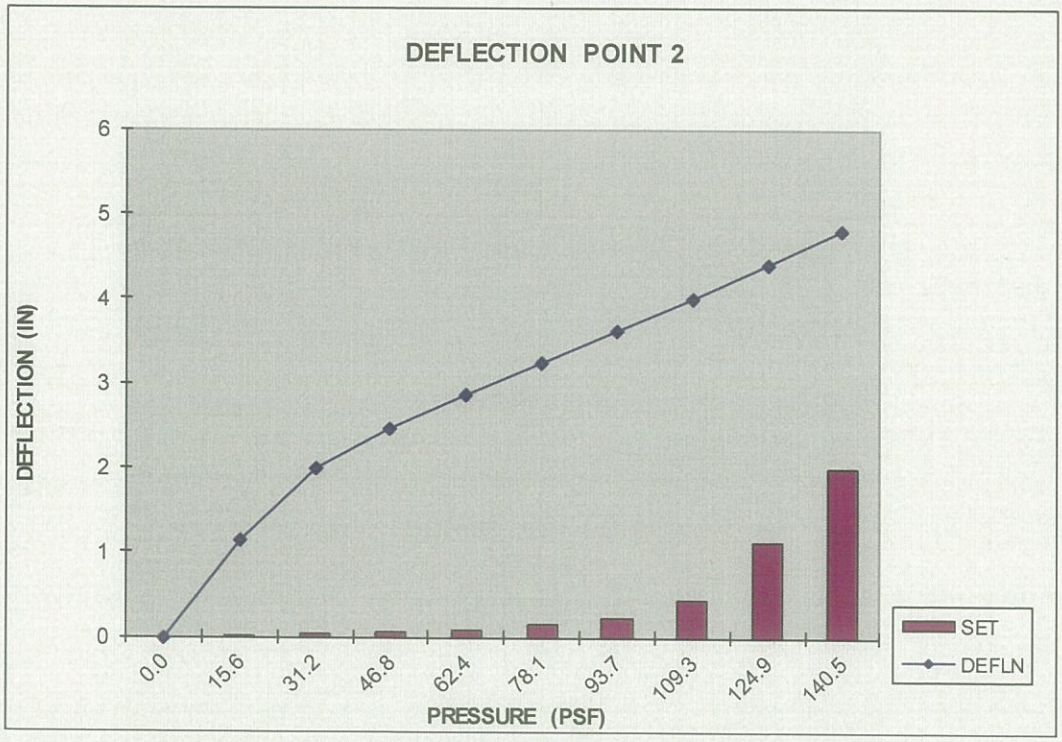
	DEFLECTION DIAL READINGS (INCHES)					
LOAD (PSF)	D-1	D-2	D-3	D-4	D-5	D-6
0.0	0.000	0.000	0.000	0.000	0.000	0.000
15.6	0.035	1.150	0.041	1.243	0.008	1.229
0.0	0.005	0.014	0.005	0.011	0.002	0.006
31.2	0.091	1.990	0.104	2.094	0.018	2.104
0.0	0.008	0.044	0.010	0.034	0.006	0.038
46.8	0.157	2.475	0.175	2.577	0.046	2.597
0.0	0.013	0.060	0.018	0.037	0.012	0.047
62.4	0.236	2.883	0.259	2.967	0.078	3.008
0.0	0.025	0.095	0.034	0.061	0.021	0.079
78.1	0.331	3.251	0.353	3.309	0.100	3.364
0.0	0.051	0.161	0.060	0.108	0.029	0.133
93.7	0.430	3.623	0.448	3.599	0.113	3.745
0.0	0.078	0.232	0.083	0.158	0.030	0.202
109.3	0.544	4.000	0.560	3.908	0.128	4.117
0.0	0.100	0.429	0.118	0.230	0.040	0.429
124.9	0.673	4.410	0.691	4.246	0.136	4.520
0.0	0.128	1.120	0.163	0.438	0.047	1.301
140.5	0.831	4.822	0.852	4.576	0.146	4.908
0.0	0.186	2.011	0.226	2.217	0.055	2.234

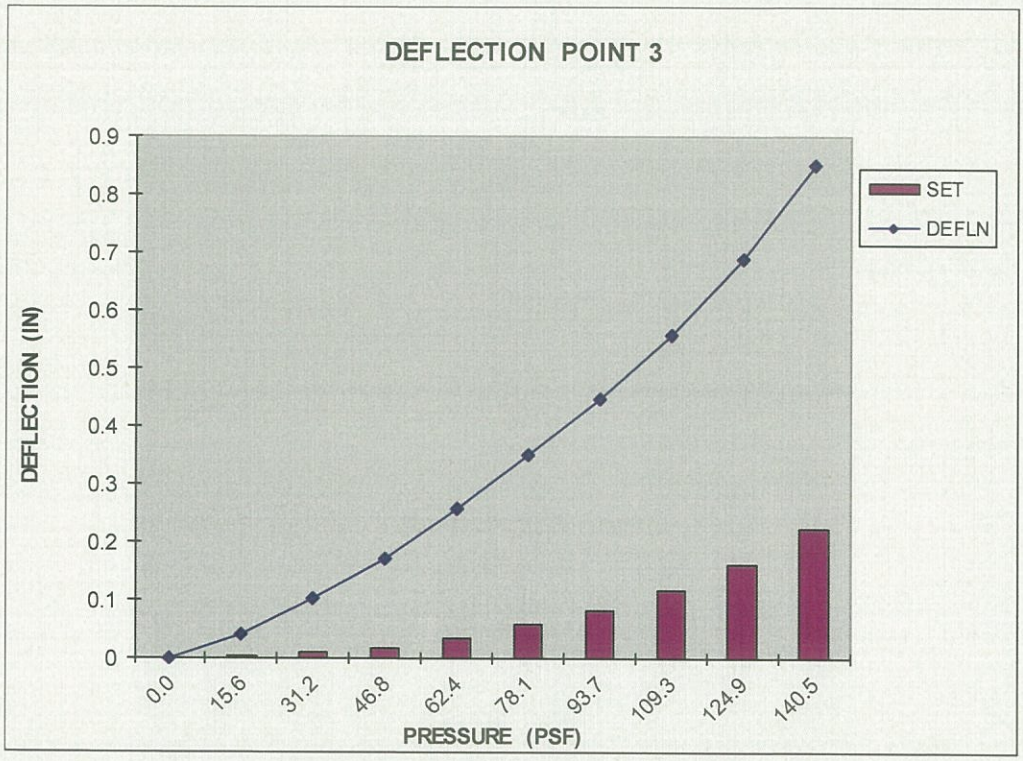
RESULTS:

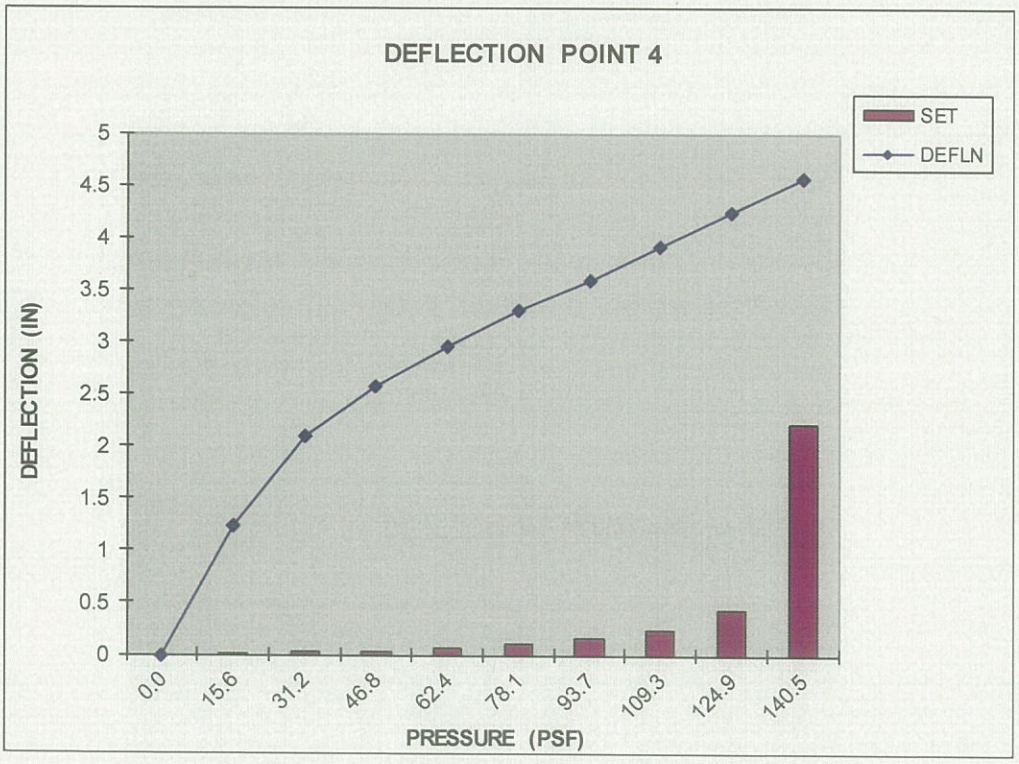
Load held for 1 minute = 197.6 psf

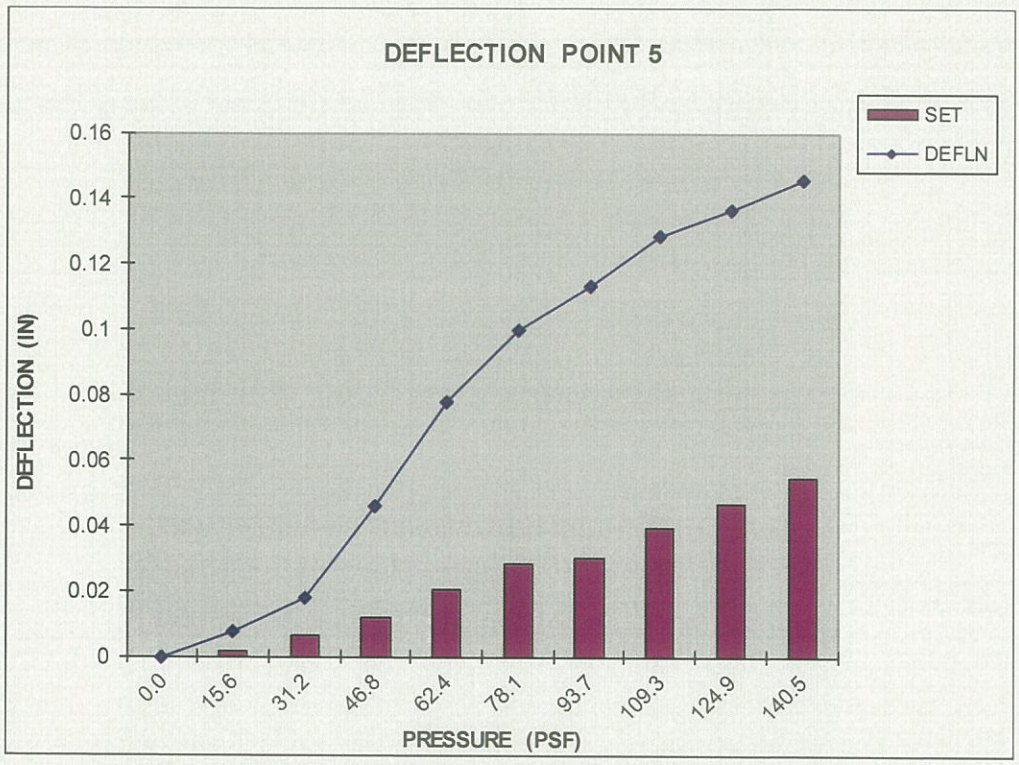
Maximum Test Load = 200.2 psf (clip fastener pulled thru clip)

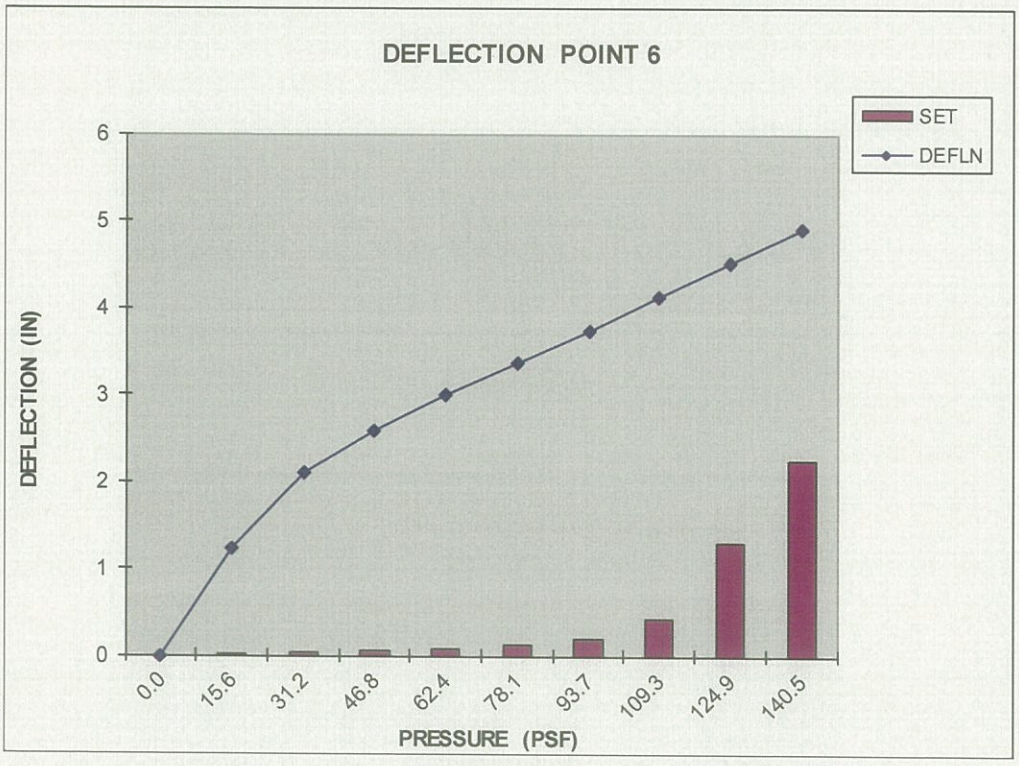

DEFLECTION POINT 1
DEFLECTION (IN)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.0
15.6
31.2
46.8
62.4
78.1
93.7
109.3
124.9
140.5
PRESSURE (PSF)
SET
DEFLN


DEFLECTION POINT 2
DEFLECTION (IN)
6
5
4
3
2
1
0
0.0
15.6
31.2
46.8
62.4
78.1
93.7
109.3
124.9
140.5
PRESSURE (PSF)
SET
DEFLN


DEFLECTION POINT 3
DEFLECTION (IN)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.0
15.6
31.2
46.8
62.4
78.1
93.7
109.3
124.9
140.5
PRESSURE (PSF)
SET
DEFLN


DEFLECTION POINT 4
DEFLECTION (IN)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0.0
15.6
31.2
46.8
62.4
78.1
93.7
109.3
124.9
140.5
PRESSURE (PSF)
SET
DEFLN


DEFLECTION POINT 5
SET
DEFLN
DEFLECTION (IN)
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0.0
15.6
31.2
46.8
62.4
78.1
93.7
109.3
124.9
140.5
PRESSURE (PSF)


DEFLECTION POINT 6
SET
DEFLN
DEFLECTION (IN)
6
5
4
3
2
1
0
0.0
15.6
31.2
46.8
62.4
78.1
93.7
109.3
124.9
140.5
PRESSURE (PSF)

Project No. T137-19

TEST #3

Specimen: T-PANEL - Metal Roof Panel, 16" wide x 24 ga. steel with intermittent Clip

Clip Spacing: 2 ft o/c

NEGATIVE (UPLIFT) PRESSURE

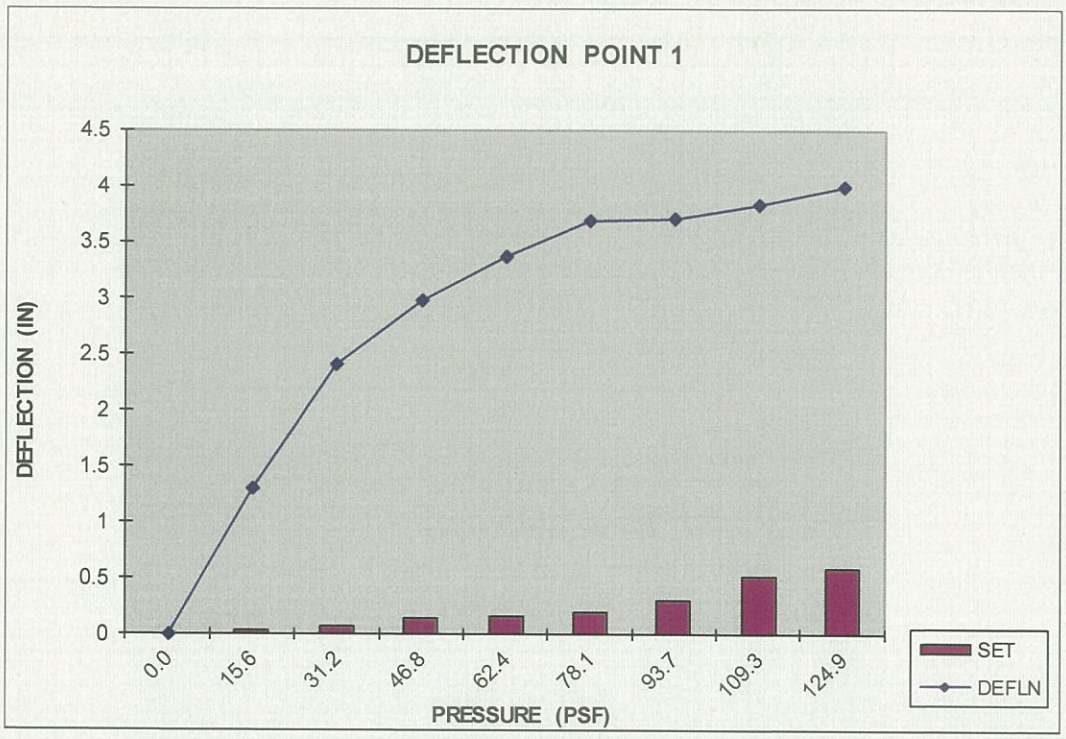
PETERSEN ALUM. T-PANEL 16" WIDE X 24 GA. STEEL (12 SPANS @ 2' O.C.) INTERMITTENT CLIP

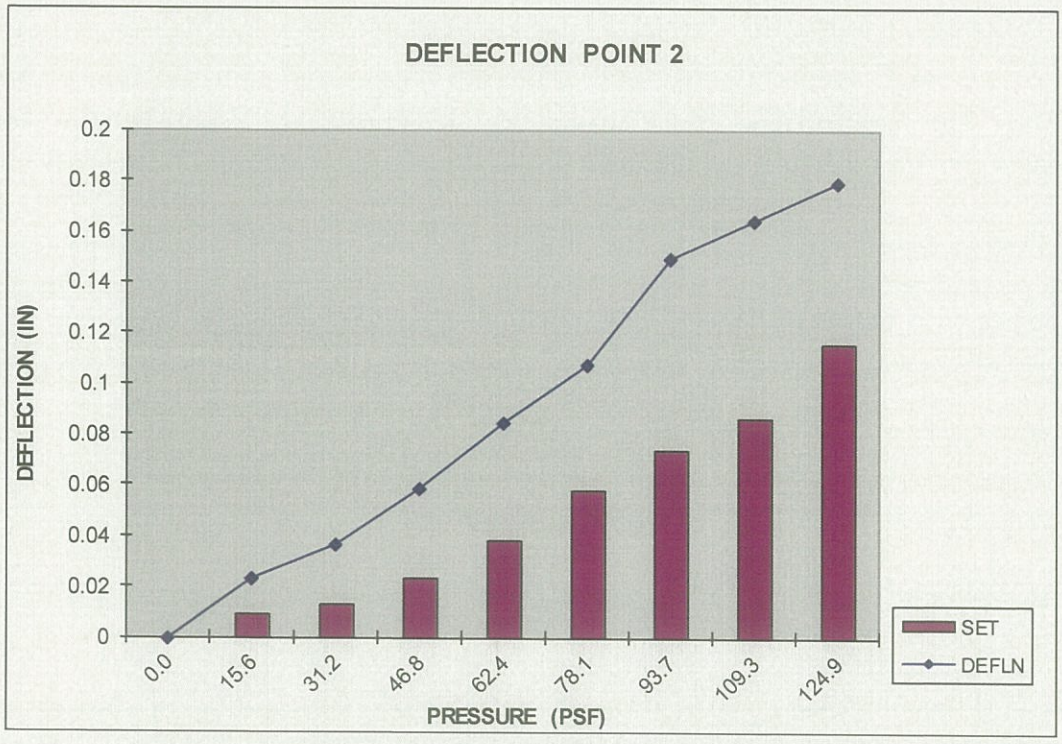
	DEFLECTION DIAL READINGS (INCHES)					
LOAD (PSF)	D-1	D-2	D-3	D-4	D-5	D-6
0.0	0.000	0.000	0.000	0.000	0.000	0.000
15.6	1.302	0.023	1.375	0.021	1.335	0.021
0.0	0.035	0.010	0.049	0.012	0.029	0.006
31.2	2.403	0.037	2.550	0.034	2.473	0.030
0.0	0.066	0.013	0.085	0.015	0.060	0.009
46.8	2.968	0.059	3.143	0.063	3.071	0.046
0.0	0.137	0.023	0.149	0.024	0.130	0.013
62.4	3.376	0.085	3.606	0.098	3.537	0.063
0.0	0.150	0.038	0.175	0.040	0.141	0.017
78.1	3.691	0.108	4.072	0.133	3.994	0.068
0.0	0.187	0.058	0.211	0.060	0.178	0.016
93.7	3.710	0.149	4.384	0.143	4.340	0.081
0.0	0.302	0.074	0.240	0.083	0.296	0.017
109.3	3.830	0.164	4.718	0.151	4.699	0.099
0.0	0.521	0.087	0.261	0.098	0.523	0.023
124.9	3.992	0.179	5.041	0.175	5.073	0.132
0.0	0.580	0.116	0.501	0.124	0.592	0.043

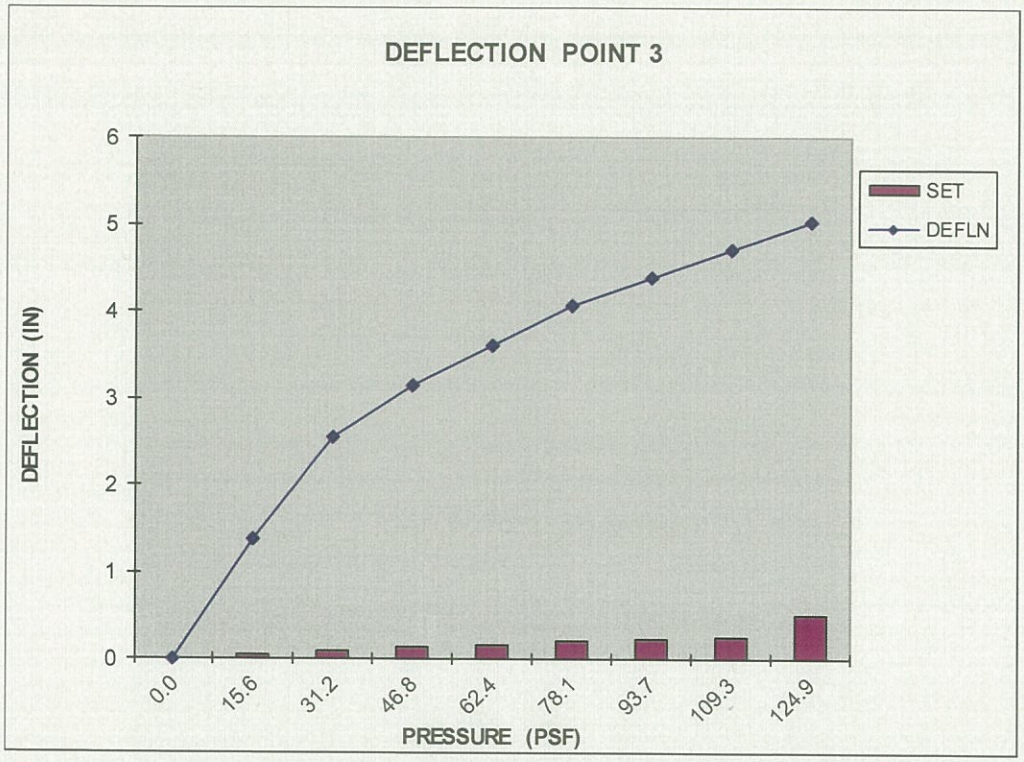
RESULTS:

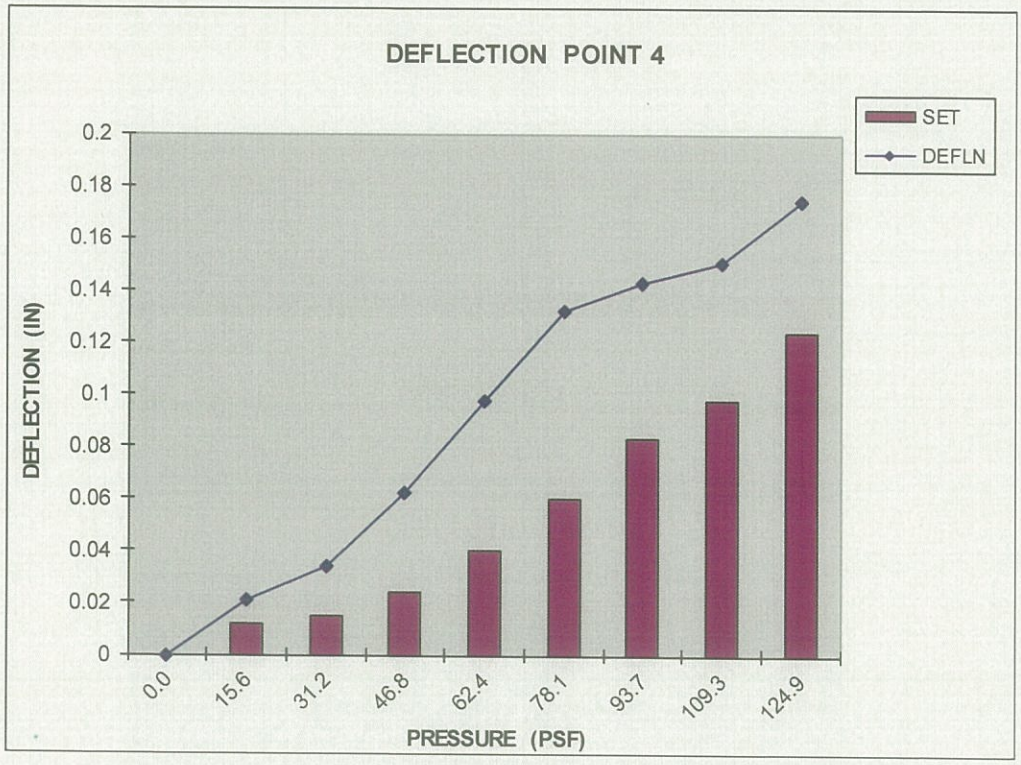
Load held for 1 minute = 130.0 psf

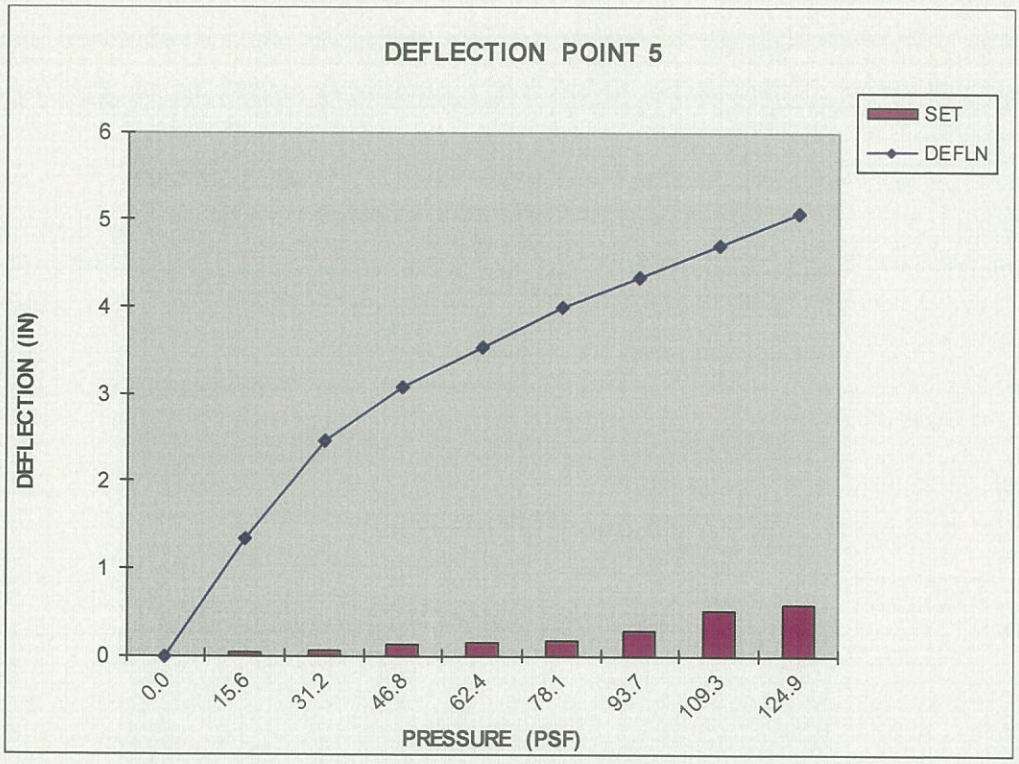
Maximum Test Load = 134.7 psf (Panel disengaged from clip – Clip straightened out)

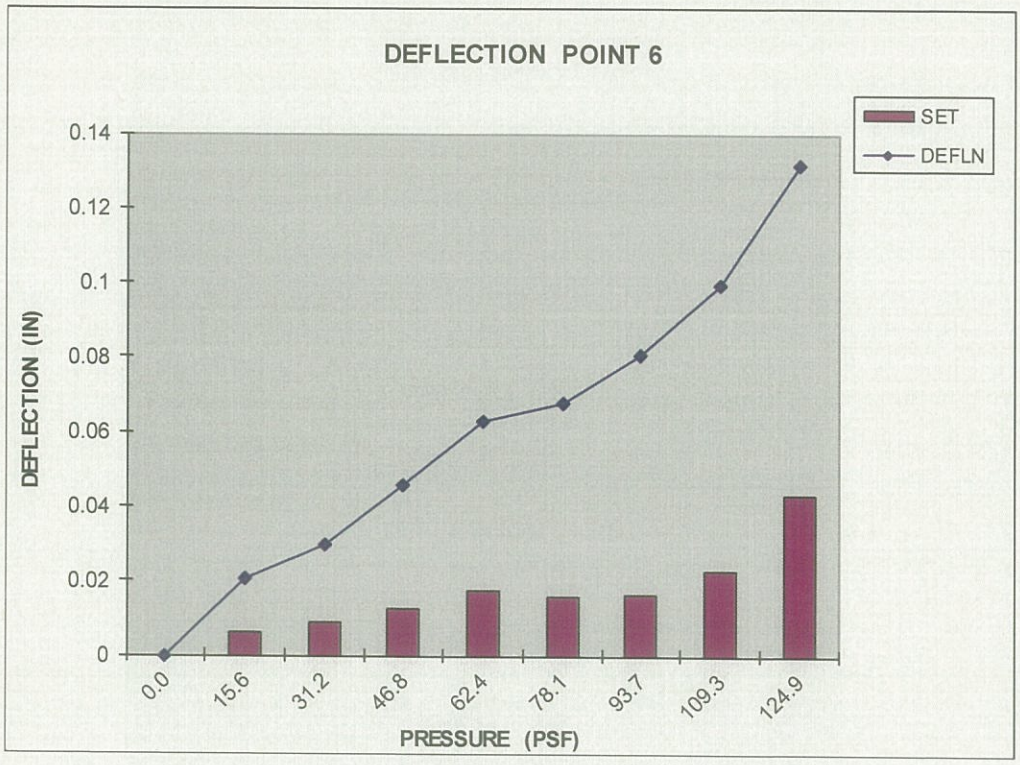

DEFLECTION POINT 1
DEFLECTION (IN)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0.0
15.6
31.2
46.8
62.4
78.1
93.7
109.3
124.9
PRESSURE (PSF)
SET
DEFLN


DEFLECTION POINT 2
DEFLECTION (IN)
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0.0
15.6
31.2
46.8
62.4
78.1
93.7
109.3
124.9
PRESSURE (PSF)
SET
DEFLN


DEFLECTION POINT 3
DEFLECTION (IN)
6
5
4
3
2
1
0
SET
DEFLN
0.0
15.6
31.2
46.8
62.4
78.1
93.7
109.3
124.9
PRESSURE (PSF)


DEFLECTION POINT 4
DEFLECTION (IN)
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
SET
DEFLN
0.0
15.6
31.2
46.8
62.4
78.1
93.7
109.3
124.9
PRESSURE (PSF)


DEFLECTION POINT 5
SET
DEFLN
DEFLECTION (IN)
0
1
2
3
4
5
6
0.0
15.6
31.2
46.8
62.4
78.1
93.7
109.3
124.9
PRESSURE (PSF)


DEFLECTION POINT 6
SET
DEFLN
DEFLECTION (IN)
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.0
15.6
31.2
46.8
62.4
78.1
93.7
109.3
124.9
PRESSURE (PSF)

Project No. T137-19

TEST #4

Specimen: T-PANEL - Metal Roof Panel, 16" wide x 24 ga. steel with continuous Clip

Clip Spacing: 2 ft o/c

NEGATIVE (UPLIFT) PRESSURE

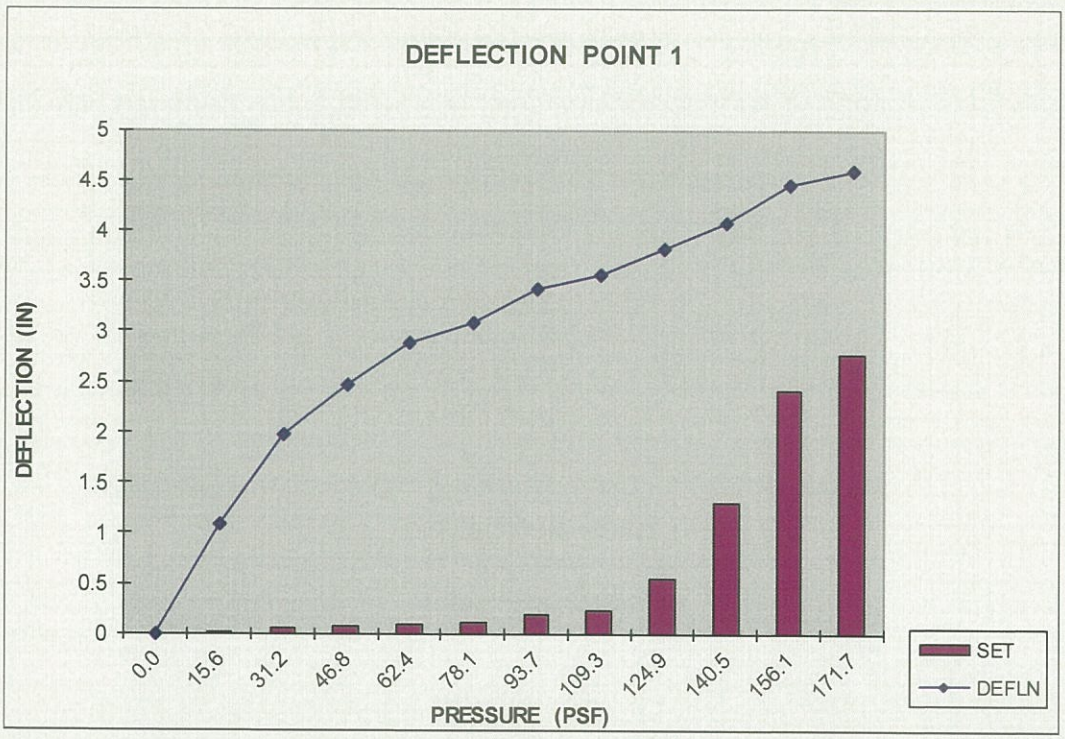
PETERSEN ALUM. T-PANEL 16" WIDE X 24 GA. STEEL (12 SPANS @ 2' O.C.) CONT. CLIP

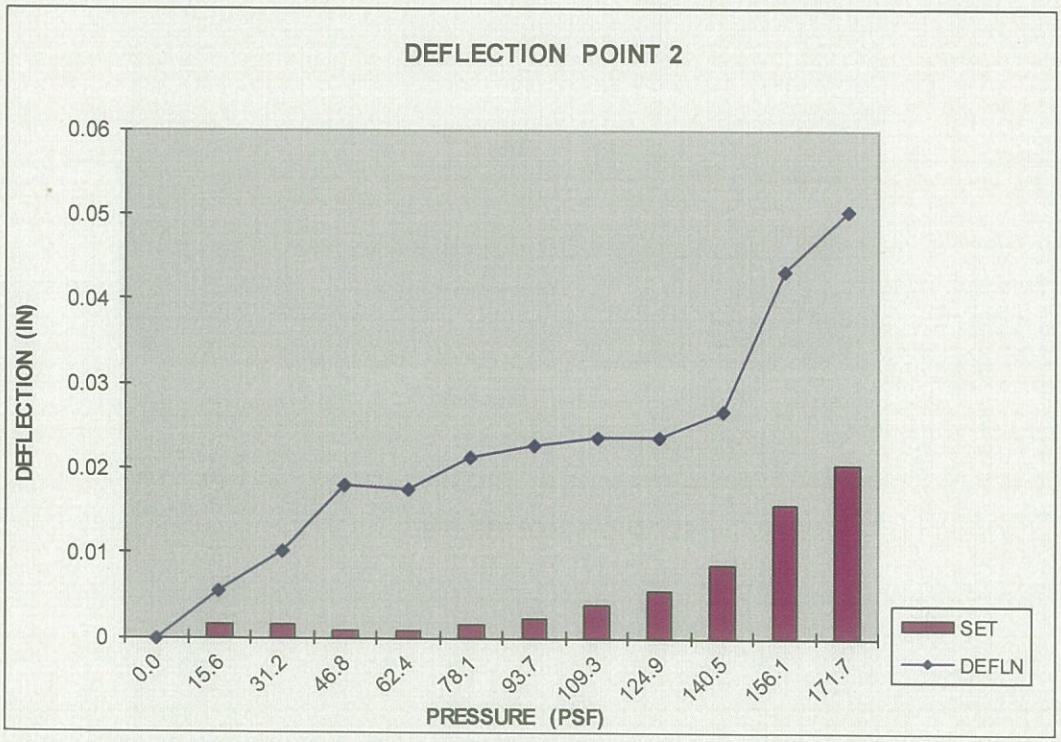
	DEFLECTION DIAL READINGS (INCHES)					
LOAD (PSF)	D-1	D-2	D-3	D-4	D-5	D-6
0.0	0.000	0.000	0.000	0.000	0.000	0.000
15.6	1.092	0.006	1.108	0.005	1.196	0.004
0.0	0.018	0.002	0.013	0.002	0.017	0.001
31.2	1.975	0.010	2.053	0.009	2.178	0.005
0.0	0.055	0.002	0.038	0.001	0.045	0.004
46.8	2.466	0.018	2.523	0.010	2.681	0.016
0.0	0.067	0.001	0.048	0.000	0.065	0.005
62.4	2.892	0.018	2.911	0.011	3.108	0.017
0.0	0.102	0.001	0.077	0.000	0.095	0.005
78.1	3.087	0.021	3.086	0.013	3.313	0.017
0.0	0.121	0.002	0.091	0.002	0.117	0.006
93.7	3.419	0.023	3.360	0.013	3.631	0.018
0.0	0.189	0.002	0.141	0.008	0.180	0.006
109.3	3.570	0.024	3.475	0.016	3.795	0.019
0.0	0.243	0.004	0.168	0.009	0.209	0.007
124.9	3.821	0.024	3.658	0.016	4.040	0.021
0.0	0.543	0.006	0.350	0.011	0.414	0.007
140.5	4.078	0.027	3.860	0.023	4.313	0.021
0.0	1.312	0.009	0.708	0.016	0.767	0.008
156.1	4.463	0.043	4.137	0.040	4.733	0.023
0.0	2.417	0.016	2.558	0.024	2.795	0.009
171.7	4.587	0.051	4.207	0.043	4.876	0.023
0.0	2.775	0.021	2.867	0.028	3.157	0.013

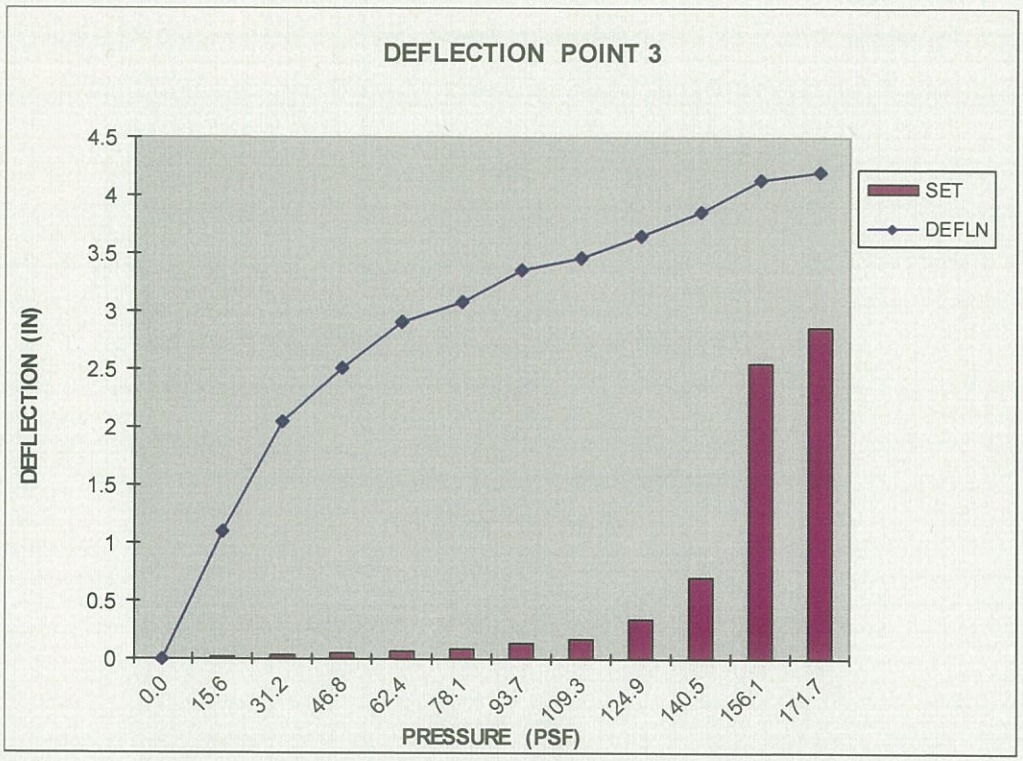
RESULTS:

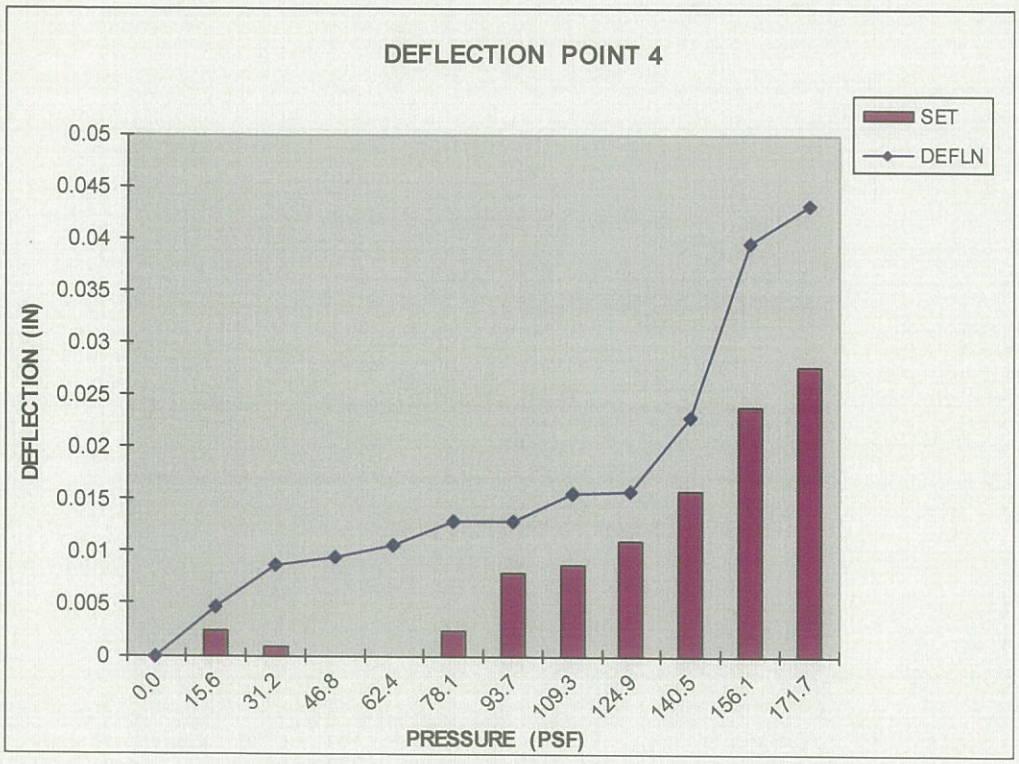
Load held for 1 minute = 239.7 psf

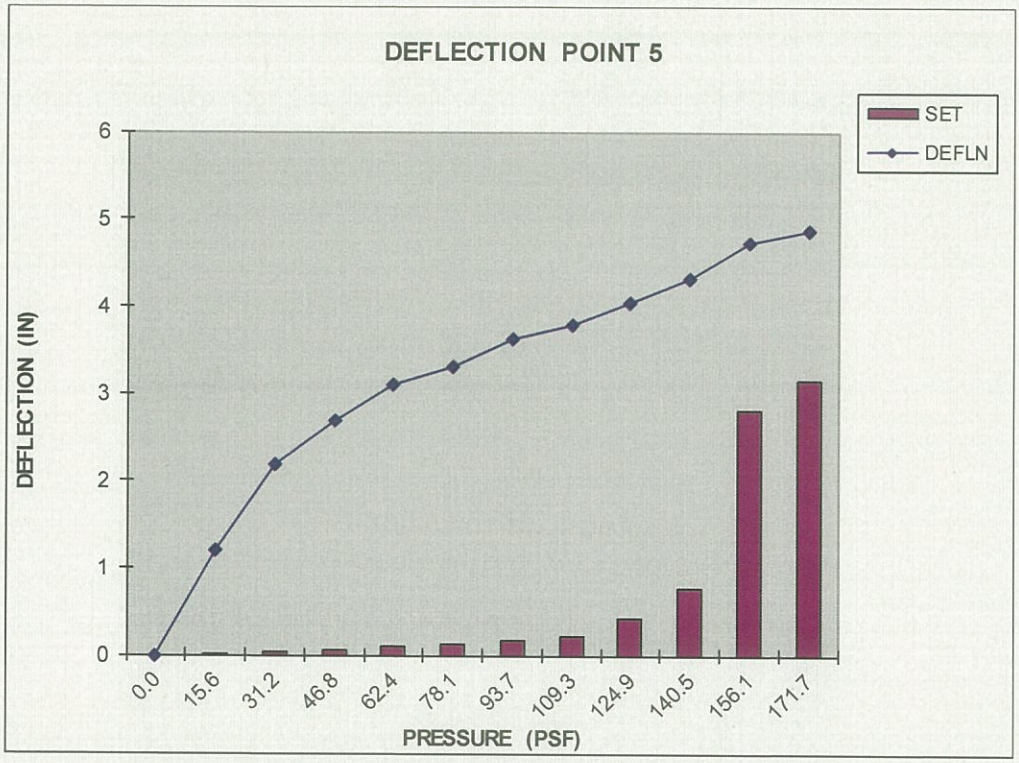
Maximum Test Load = 239.7 psf (No Failures)

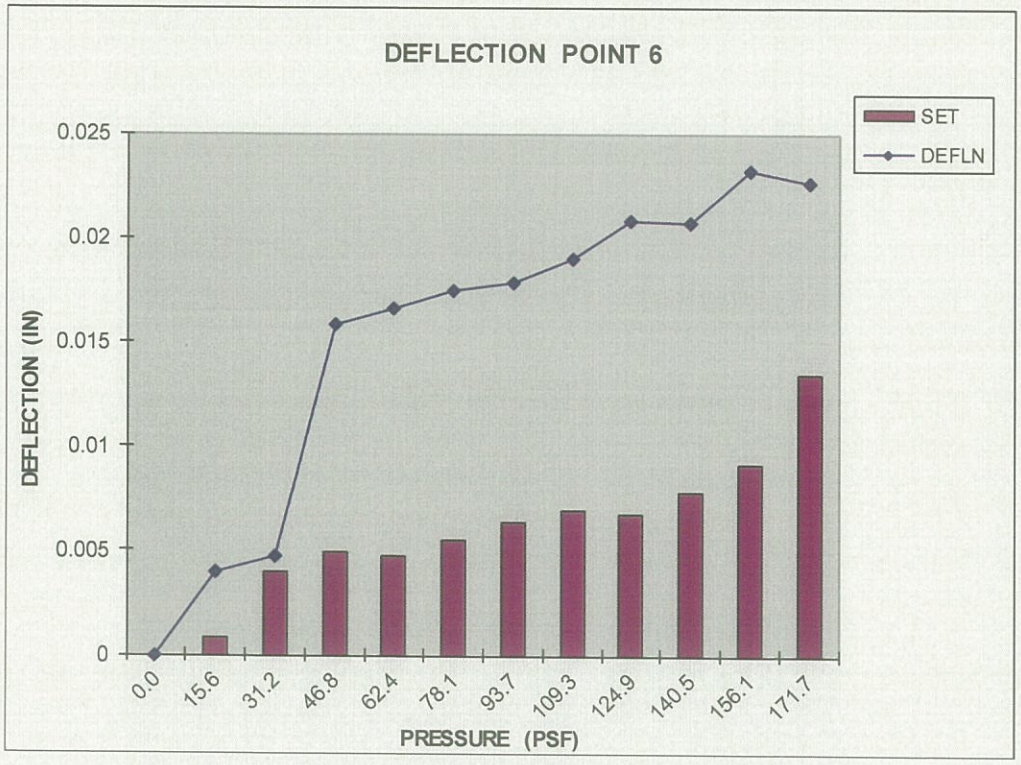

DEFLECTION POINT 1
DEFLECTION (IN)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0.0
15.6
31.2
46.8
62.4
78.1
93.7
109.3
124.9
140.5
156.1
171.7
PRESSURE (PSF)
SET
DEFLN


DEFLECTION POINT 2
DEFLECTION (IN)
0.06
0.05
0.04
0.03
0.02
0.01
0
0.0
15.6
31.2
46.8
62.4
78.1
93.7
109.3
124.9
140.5
156.1
171.7
PRESSURE (PSF)
SET
DEFLN


DEFLECTION POINT 3
DEFLECTION (IN)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0.0
15.6
31.2
46.8
62.4
78.1
93.7
109.3
124.9
140.5
156.1
171.7
PRESSURE (PSF)
SET
DEFLN

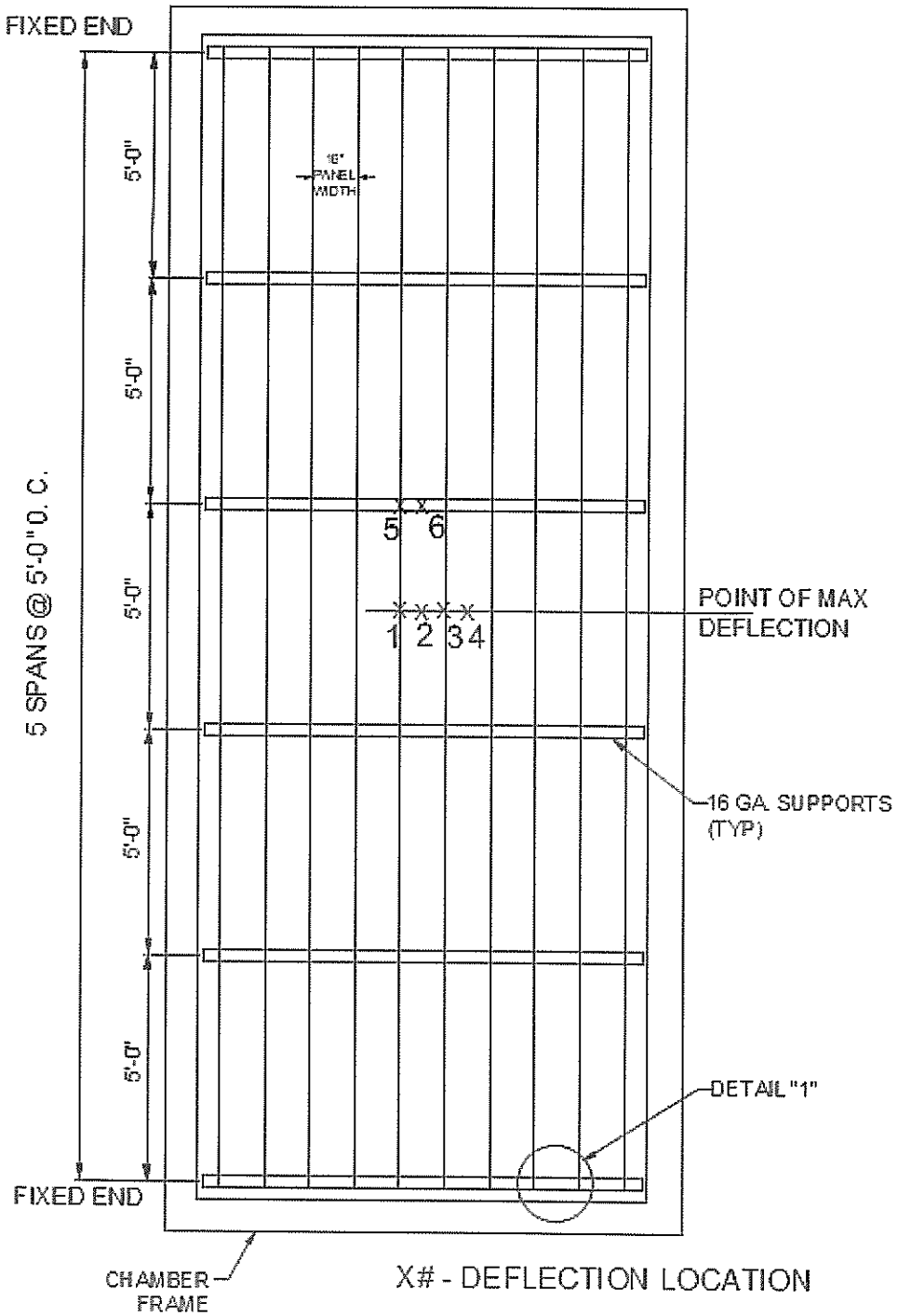

DEFLECTION POINT 4
DEFLECTION (IN)
0.05
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
0.0
15.6
31.2
46.8
62.4
78.1
93.7
109.3
124.9
140.5
156.1
171.7
PRESSURE (PSF)
SET
DEFLN


DEFLECTION POINT 5
SET
DEFLN
DEFLECTION (IN)
0
1
2
3
4
5
6
0.0
15.6
31.2
46.8
62.4
78.1
93.7
109.3
124.9
140.5
156.1
171.7
PRESSURE (PSF)


DEFLECTION POINT 6
SET
DEFLN
DEFLECTION (IN)
0
0.005
0.01
0.015
0.02
0.025
0.0
15.6
31.2
46.8
62.4
78.1
93.7
109.3
124.9
140.5
156.1
171.7
PRESSURE (PSF)

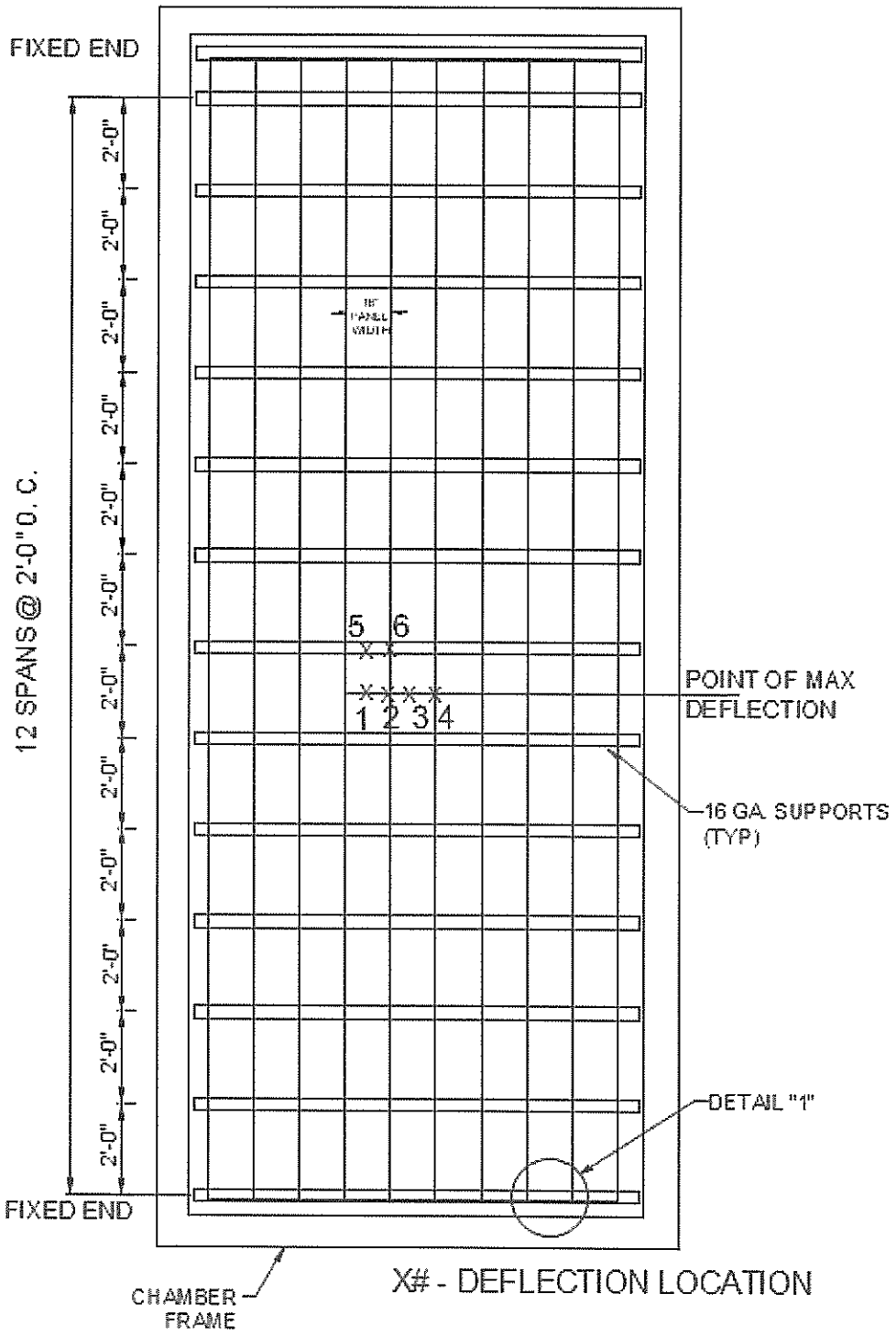
Project No. T137-19

TEST #1 & #2

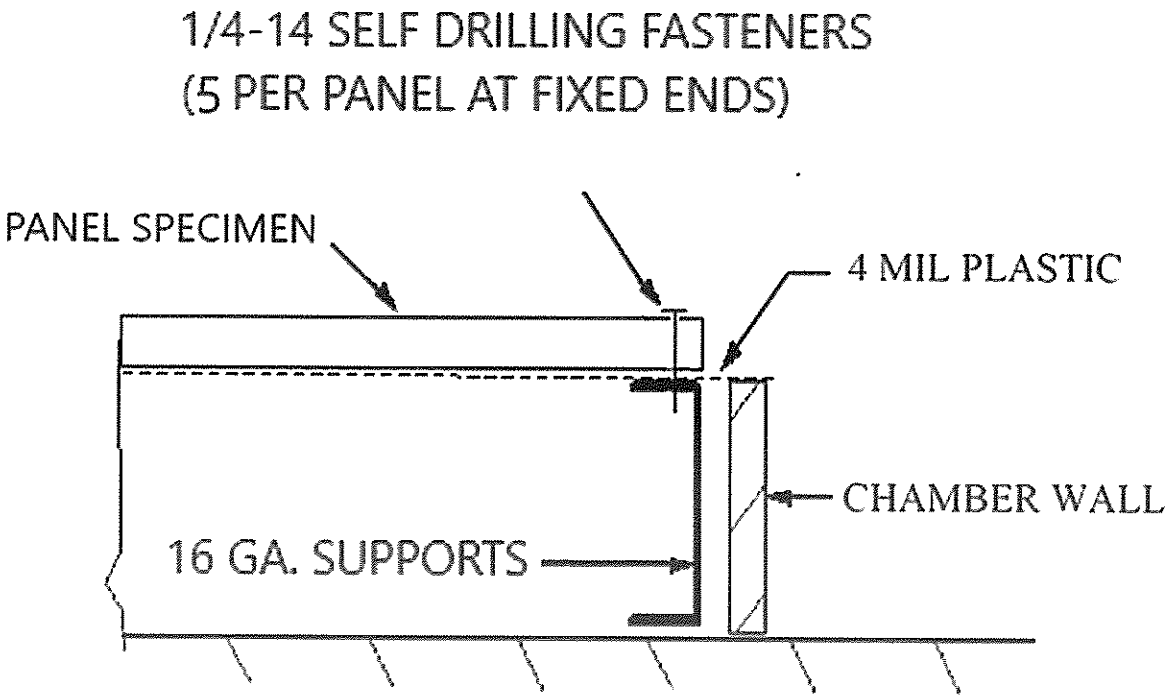


PLAN VIEW

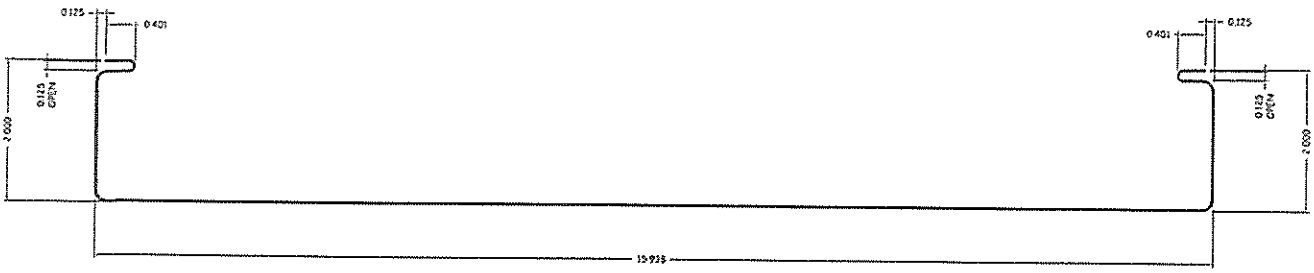
TEST #3 & #4



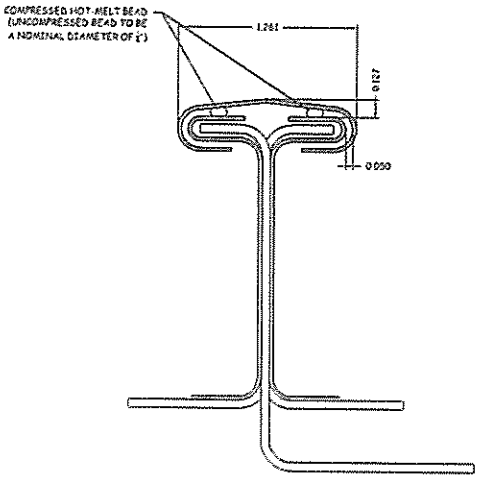
PLAN VIEW


1/4-14 SELF DRILLING FASTENERS
(5 PER PANEL AT FIXED ENDS)
PANEL SPECIMEN
4 MIL PLASTIC
CHAMBER WALL
16 GA. SUPPORTS

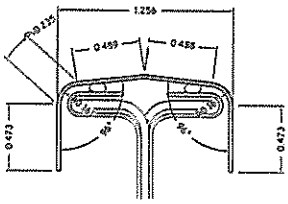
DETAIL 1

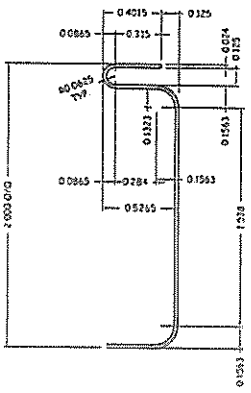


16" T PANEL



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

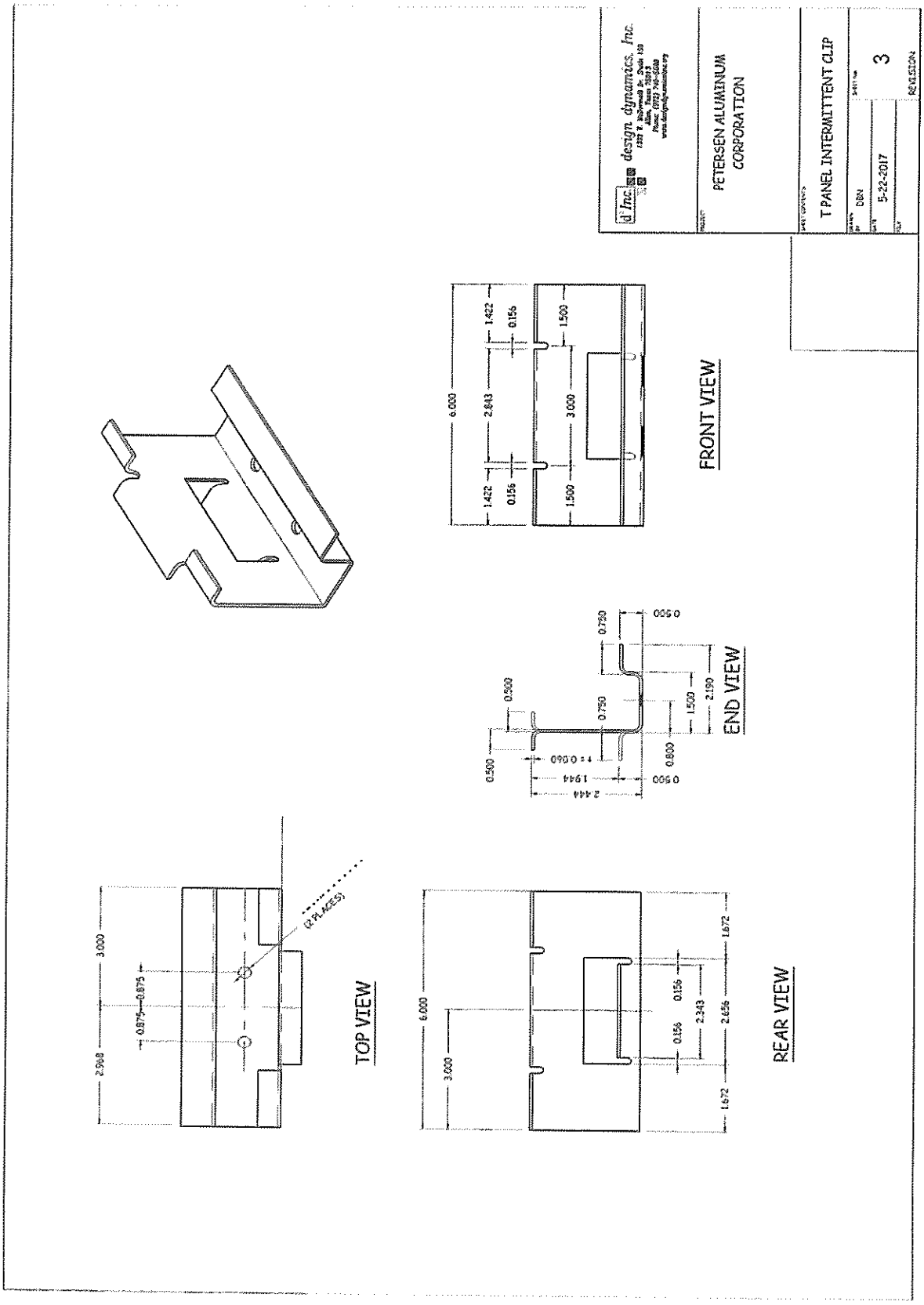




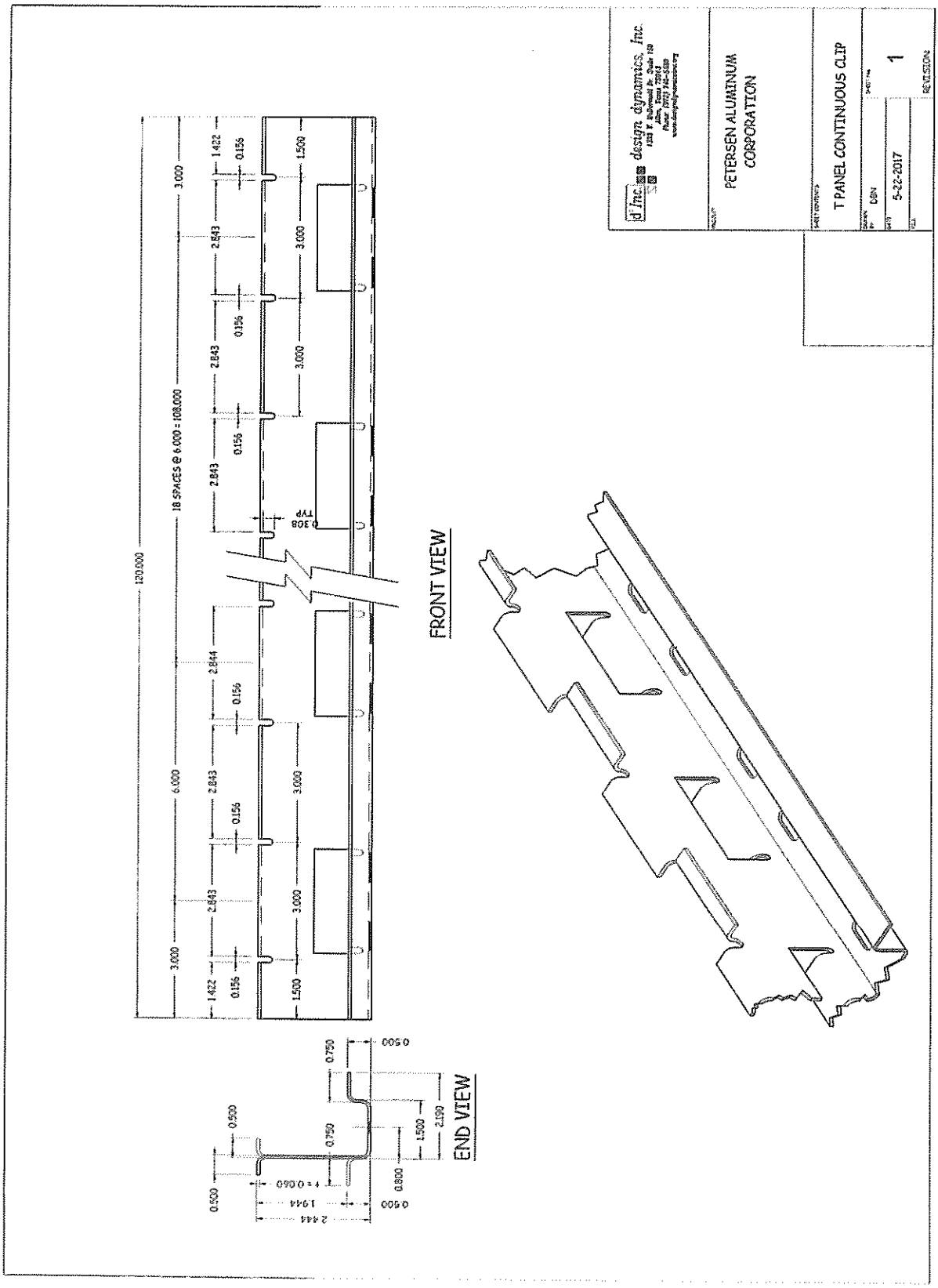
ENLARGED SIDE JOINT DETAIL

PANEL PROFILE

Project No. T137-19



Project No. T137-19



Project No. T137-19

TENSILE TEST REPORT

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

Test Date: February 8, 2019

Test Method: ASTM A370-10

Material Description: T-PANEL - Metal Roof Panel, 16" wide x 24 ga. steel

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)
19008	0.500	0.022	644.3	690.6	58,568	62,783	19.8

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