



Farabaugh Engineering and Testing Inc.

Project No. T239-20

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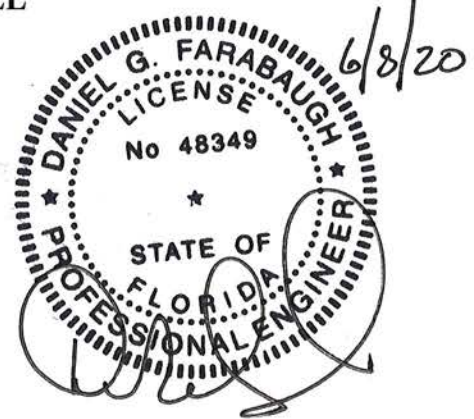
UL 580 / UL1897 UPLIFT RESISTANCE TESTING

ON

BOSS FIRM LOC METAL ROOF PANEL 16" WIDE X 0.032" ALUMINUM

FOR

BOSS METALS INC.
1750 FRANKFORD AVE.
PANAMA CITY, FL. 32405



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Project No. T239-20

Purpose

This test method covers the evaluation of uplift resistance of roof assemblies per UL 580-06 and UL 1897-12 and as provided herein.

Test Dates:

6/6/20 - Test #1 – Clip spacing @ 6" o.c.

6/3/20 - Test #2 – Clip spacing @ 24" o.c.

Test Specimen

Manufacturer: Boss Metals Inc.
1750 Frankford Ave.
Panama City, FL. 32405

Panel: Boss Firm Loc Panel, 16" wide x 0.032" aluminum

Panel Clip: 3" wide x 24 ga. galvanized steel

Substrate: 15/32" plywood

Testing Apparatus

Test Chamber: The test chamber consists of three sections: a top section to create a uniform vacuum, a center section in which the roof assembly is constructed, and a bottom section to create a uniform positive pressure.

Pressure Chamber: The air pressure in the pressure chamber was measured at five points. Each of four points were located 42" from chamber corners at a 45 degrees angle, with the fifth tube located 18" from the center of the air inlet opening. The end of each tube was 7" above the chamber floor. The tubes were connected to a manifold that, in turn was connected to a manometer.

Vacuum Chamber Measurement: The air pressure in the vacuum chamber was measured at five points. Each of four points was located 18" from chamber corners at a 45 degrees angle and 8" above the chamber floor. The fifth tube located 12" from the center of the exhaust opening and 6" below the opening. The tubes were connected to a manifold that, in turn was connected to a manometer. The pressure in the vacuum chamber was controlled by an automatic damper. The damper door was moved by means of an air motor hooked to an air line and controlled by pressure switches located in the control console. An additional pressure line from the manifold to pressure switches controlled the automatic damper.

Installation

- The 15/32" plywood was attached to the wood joist (2x10) supports (spaced at 2'-0" o.c.) using 8d ring shank nails at 6" on center around the perimeter and at interior supports.
- The metal roof panels were attached to the wood deck substrate using (2)#10-15 X 2" long, HiLo Wood ZAC screws per clip. The clips were at 6" or 24" o.c. The panel sidejoint was mechanically 180 degree seamed joint. The outer perimeter of the assembly was secured with perimeter fastening as required to maintain a periphery seal.
- A plastic barrier was located between the panels and the underlying substrate.

Test Procedure

- The test assembly was subjected to positive and negative pressures to form an uplift pressure at the values and time duration as shown in the attached table.
- Each pressure increment was held for at least 1 minute.
- Vertical movement of the assembly during the tests was recorded.
- Subsequent to the completion of Phase 5 of the Class 90 test sequence, the test specimen was subjected to higher static uplift pressures per UL 1897 as shown on the attached table. The positive uplift pressure supplied from below was maintained at 48.5 psf while the negative uplift pressure supplied from above was increased in increments until failure or the desired uplift pressure was obtained.

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TEST #1
UL 580 UPLIFT TEST

Test Date: 6/6/20

Test Specimen: Boss Firm Loc Panel, 16" wide x 0.032" aluminum

Clip Spacing: 6" o.c.

Class 30 Deflection Measurements

Phase	Time Duration (min.)	Negative Pressure (psf)	Positive Pressure (psf)	#1 (in)	#2 (in)	#3 (in)	#4 (in)
Initial	0	0	0	5	6-11/16	4-5/8	6-3/16
1	5	16.2	0	4-15/16	5-5/8	4-9/16	5-3/8
2	5	16.2	13.8	4-7/8	4-7/8	4-1/2	4-3/4
3	60	8.1 – 27.7*	13.8	4-3/4	4-3/4	4-7/16	4-5/8
4	5	24.2	0	4-7/8	4-7/8	4-1/2	4-7/8
5	5	24.2	20.8	4-13/16	4-3/4	4-1/2	4-5/8

Class 60 Deflection Measurements

Phase	Time Duration (min.)	Negative Pressure (psf)	Positive Pressure (psf)	#1 (in)	#2 (in)	#3 (in)	#4 (in)
1	5	32.3	0	4-13/16	4-3/4	4-1/2	4-5/8
2	5	32.3	27.7	4-13/16	4-5/8	4-7/16	4-1/2
3	60	16.2 – 55.4*	27.7	4-11/16	4-1/4	4-5/16	4-1/8
4	5	40.4	0	4-13/16	4-5/8	4-7/16	4-1/2
5	5	40.4	34.6	4-11/16	4-3/16	4-5/16	4-1/8

Class 90 Deflection Measurements

Phase	Time Duration (min.)	Negative Pressure (psf)	Positive Pressure (psf)	#1 (in)	#2 (in)	#3 (in)	#4 (in)
1	5	48.5	0	4-3/4	4-3/8	4-3/8	4-1/4
2	5	48.5	41.5	4-5/8	4-1/16	4-1/4	4
3	60	24.2 – 48.5*	41.5	4-5/8	4-1/16	4-1/4	4
4	5	56.5	0	4-3/4	4-1/4	4-3/8	4-1/8
5	5	56.5	48.5	4-1/2	3-13/16	4-3/16	3-3/4

* Oscillation frequency as specified in UL 580.

Results: Upon completion of the above loading, there were no specimen failures.

Project No. T239-20

TEST #1 (cont.)

UL 1897 UPLIFT TEST

Test Date: 6/6/20

Test Specimen: Boss Firm Loc Panel, 16" wide x 0.032" aluminum

Clip Spacing: 6" o.c.

Results:

Deflection Measurements

Total Uplift Pressure (psf)	Time Duration (min.)	#1 (in)	#2 (in)	#3 (in)	#4 (in)
112	1	4-9/16	3-7/8	4-1/4	3-13/16
127	1	4-1/2	3-11/16	4-3/16	3-5/8
142	1	4-7/16	3-1/2	4-1/8	3-1/2
157	1	4-3/8	3-5/16	4-1/16	3-5/16
172	1	4-1/4	3-1/16	4	3-1/8
187	1	4-1/4	3	3-15/16	3
202	1	4-3/16	2-3/4	3-7/8	2-7/8
217	1	4-1/8	2-5/8	3-13/16	2-11/16
232	1	4-1/16	2-7/16	3-3/4	2-9/16
247	1	3-15/16	2-1/4	3-11/16	2-5/16

Results:

Maximum Total Uplift Pressure (sustained for 1 min.) = 277.0 psf

Maximum Total Uplift Test Pressure = 282.4 psf (Clip screw pulled out of plywood and panel buckling)

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TEST #2
UL 580 UPLIFT TEST

Test Date: 6/3/20

Test Specimen: Boss Firm Loc Panel, 16" wide x 0.032" aluminum

Clip Spacing: 24" o.c.

Class 30 Deflection Measurements

Phase	Time Duration (min.)	Negative Pressure (psf)	Positive Pressure (psf)	#1 (in)	#2 (in)	#3 (in)	#4 (in)
Initial	0	0	0	5-5/16	7-1/8	5-3/8	7
1	5	16.2	0	5-5/16	5-15/16	5-3/8	6-1/6
2	5	16.2	13.8	5-1/4	5-9/16	5-5/16	5-3/4
3	60	8.1 – 27.7*	13.8	5-3/16	5-1/8	5-1/4	5-3/8
4	5	24.2	0	5-1/4	5-5/16	5-5/16	5-1/2
5	5	24.2	20.8	5-3/16	5	5-1/4	5-1/4

Class 60 Deflection Measurements

Phase	Time Duration (min.)	Negative Pressure (psf)	Positive Pressure (psf)	#1 (in)	#2 (in)	#3 (in)	#4 (in)
1	5	32.3	0	5-3/16	5-1/8	5-1/4	5-5/16
2	5	32.3	27.7	5-1/8	4-3/4	5-3/16	5
3	60	16.2 – 55.4*	27.7	5	4-1/4	5-1/8	4-5/8
4	5	40.4	0	5-1/8	4-7/16	5-3/16	4-13/16
5	5	40.4	34.6	5	4-1/8	5-1/16	4-9/16

Class 90 Deflection Measurements

Phase	Time Duration (min.)	Negative Pressure (psf)	Positive Pressure (psf)	#1 (in)	#2 (in)	#3 (in)	#4 (in)
1	5	48.5	0	5-1/16	4-5/16	5-1/8	4-11/16
2	5	48.5	41.5	4-15/16	4-5/16	5	4-3/8
3	60	24.2 – 48.5*	41.5	4-15/16	4-3/16	5	4-9/16
4	5	56.5	0	5	4-3/16	5-1/8	4-9/16
5	5	56.5	48.5	4-7/8	4	4-7/8	4-7/16

* Oscillation frequency as specified in UL 580.

Results: Upon completion of the above loading, there were no specimen failures.

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TEST #2 (cont.)

UL 1897 UPLIFT TEST

Test Date: 6/3/20

Test Specimen: Boss Firm Loc Panel, 16" wide x 0.032" aluminum

Clip Spacing: 24" o.c.

Results:

Deflection Measurements

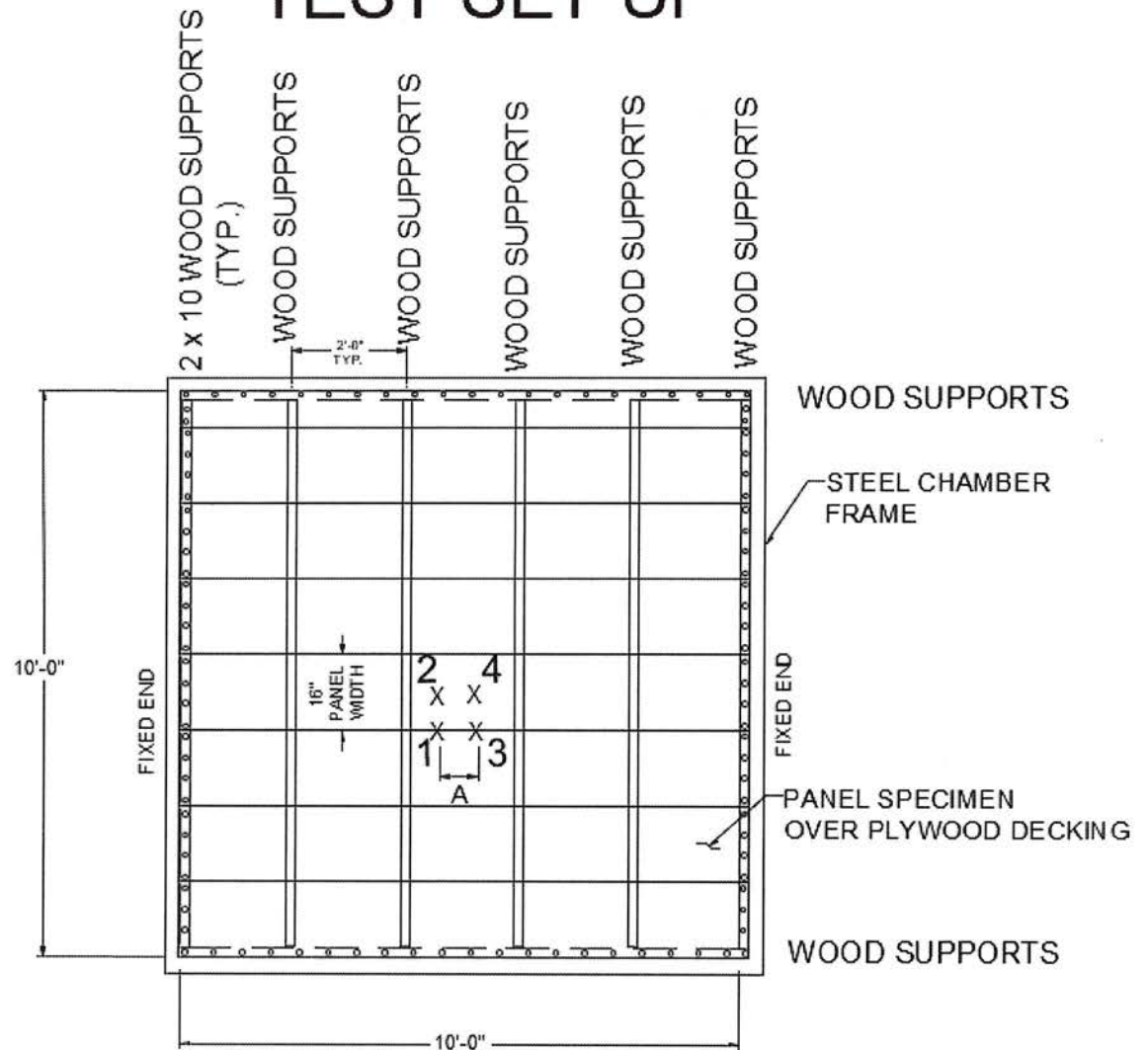
Total Uplift Pressure (psf)	Time Duration (min.)	#1 (in)	#2 (in)	#3 (in)	#4 (in)
0	0	5-1/2	7-3/16	5-7/16	7
112	1	5	3-7/8	5	4-1/8
127	1	4-15/16	3-3/4	5	4

Results:

Maximum Total Uplift Pressure (sustained for 1 min.) = 131.6 psf

Maximum Total Uplift Test Pressure = 141.9 psf (Panel seam disengaged)

TEST SET UP

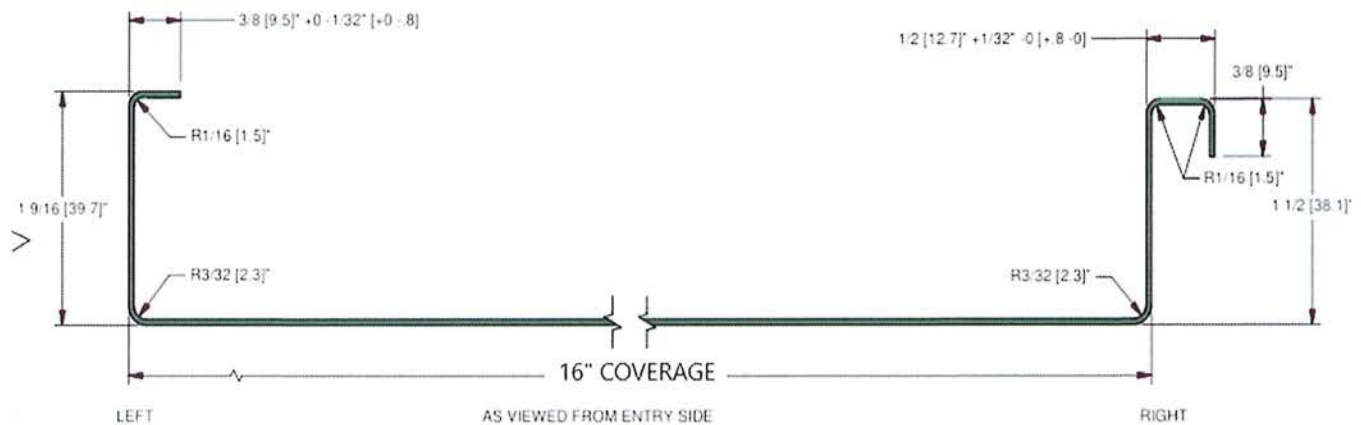


NOTE:- DEFLECTION POINT #1 AT CLIP LOCATION
A = CLIP LOCATION / 2

X# - DEFLECTION LOCATION

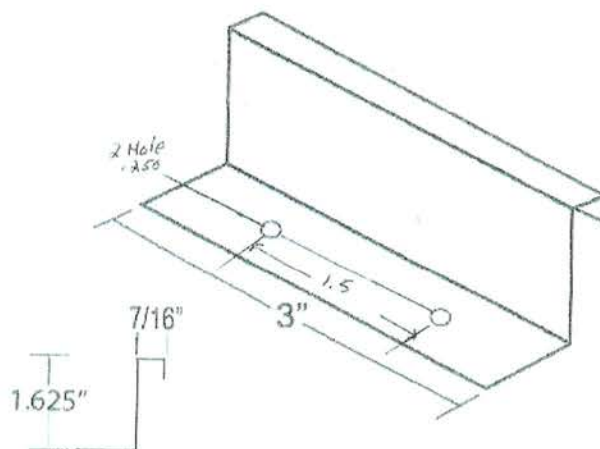
PLAN VIEW OF PANELS

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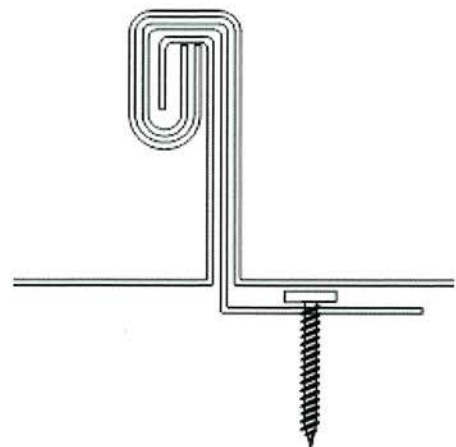


BOSS FIRM LOC PANEL PROFILE

SMP ML 3" LONG



3" X 24 GA. GALVANIZED CLIP



180 DEGREE SEAM

Project No. T239-20

TENSILE TEST REPORT

Client: Boss Metals Inc.
1750 Frankford Ave.
Panama City, FL. 32405

Test Date: June 8, 2020

Test Method: ASTM B557-10

Material Description: Boss Firm Loc Panel, 16" wide x 0.032" 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)
20074	0.492	0.032	364	376	23,865	24,648	4.0

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