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SHEFFIELD METALS
TEST REPORT

SCOPE OF WORK
UL 580 UPLIFT RESISTANCE TESTING OF 0.040" ALUMINUM 1-3/4" SNAPLOCK PANELS OVER 1/2" PLY WOOD

REPORT NUMBER
I3448.01-450-44 R0

TEST DATE(S)
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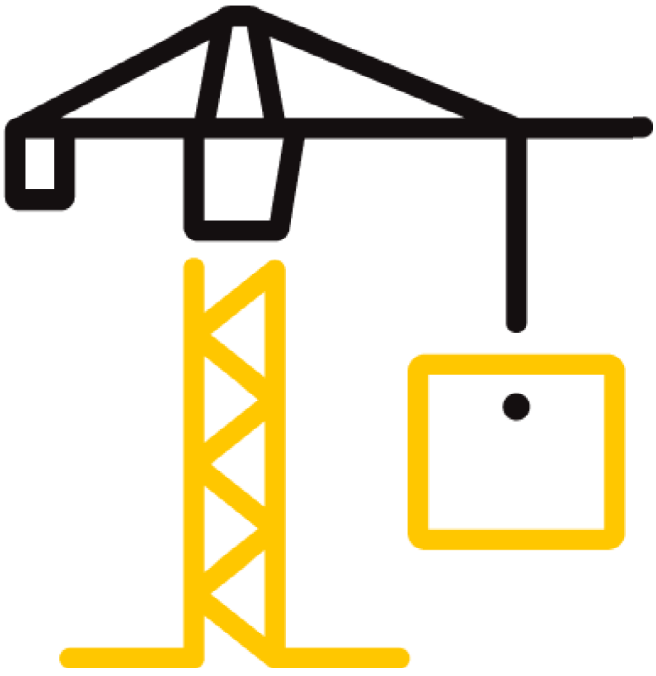
Date: 2018.08.14 18:34:45 -04'00'



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TEST REPORT FOR SHEFFIELD METALS
Report No.: I3448.01-450-44 R0
Date: 08/14/18

REPORT ISSUED TO

SHEFFIELD METALS
5467 Evergreen Parkway
Sheffield Village, OH 44054

SECTION 1

SCOPE

Intertek Building & Construction (B&C) was contracted by Sheffield Metals, 5467 Evergreen Parkway, Sheffield Village, OH 44054, to perform testing in accordance with UL 580, *Standard for Safety, Tests for Uplift Resistance of Roof Assemblies*, on their 0.040" Aluminum 1-3/4" SnapLock roof panels. Results obtained are tested values and were secured by using the designated test method(s). Testing was conducted at Intertek test facility in West Palm Beach, Florida. This report does not constitute certification of this product nor an opinion or endorsement by this laboratory.

SECTION 2

SUMMARY OF TEST RESULTS

Product Type: Metal Roof Panel
Series/Model: 0.040" Aluminum 1-3/4" SnapLock
Ultimate Test Load Achieved: -152 psf

For INTERTEK B&C:

COMPLETED BY:	Melissa Nuttall	**REVIEWED BY:**	Vinu Abraham, P.E.
TITLE:	Technician Team Leader - Product	**TITLE:**	Vice President – Global Business Development
SIGNATURE:	Digitally Signed by: Melissa Nuttall	**SIGNATURE:**	Digitally Signed by: Vinu Abraham
DATE:	08/14/18	**DATE:**	08/14/18

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SECTION 3
TEST METHOD(S)

The specimens were evaluated in accordance with the following:

UL 580, *Standard for Safety, Tests for Uplift Resistance of Roof Assemblies,* Underwriters Laboratories, Inc. (Fifth Edition November 2, 2006, revised through July 9, 2009).

ASTM E8/E8m-16a, *Standard Test Method for Tension Testing of Metallic Materials.*

SECTION 4
MATERIAL SOURCE/INSTALLATION

The test specimen was provided by the client. Representative samples of the test specimen will be retained by Intertek B&C for a minimum of four years from the test completion date. Installation of the tested product was performed by the client.

SECTION 5
EQUIPMENT

Cycling and Static Load Mechanism: Computer controlled centrifugal blowers with electronic pressure measuring device
Deflection Measuring Device: Transit and steel scales

SECTION 6
LIST OF OFFICIAL OBSERVERS

NAME	COMPANY
Veron Wickham	Intertek B&C
Melissa Nuttall	Intertek B&C
Felipe Morales	Intertek B&C
Vinu Abraham, P.E.	Intertek B&C
Alan Rule	Intertek B&C

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SECTION 7
TEST PROCEDURE

This test evaluates the comparative resistance of roof assemblies to positive and negative pressures by simulating the effects of wind gusts by use of oscillating exterior pressure and constant interior pressures. One assembly was tested per UL 580 at each class rating. (Reference Chart No. 1 for test pressures and load durations.) The measurements were taken via a transit and steel scales mounted to the roof panels. The initial measurements were "zero" point, not actual deflection. Actual deflection is Phase 1, 2, 3 minimum, 3 maximum, 4 or 5 reading less the initial (0.0 psf) reading. The final reading was taken after the completion of an entire class had been completed and became the initial reading for the following class test.

		NEGATIVE PRESSURE		POSITIVE PRESSURE	
TEST PHASE	**DURATION minutes**	**POUNDS PER SQUARE FOOT psf (kPa)**	**INCHES OF WATER inches (mm)**	**POUNDS PER SQUARE FOOT psf (kPa)**	**INCHES OF WATER inches (mm)**
Class 30					
1	5	16.2 (0.79)	3.1 (79)	0.0 (0.00)	0.0 (0)
2	5	16.2 (0.79)	3.1 (79)	13.8 (0.66)	2.7 (69)
3	60	8.1 - 27.7 (0.39 - 1.33)	1.5 - 5.3 (38 - 135)	13.8 (0.66)	2.7 (69)
4	5	24.2 (1.16)	4.7 (119)	0.0 (0.00)	0.0 (0)
5	5	24.2 (1.16)	4.7 (119)	20.8 (1.00)	4.0 (102)
Class 60					
1	5	32.3 (1.55)	6.2 (157)	0.0 (0.00)	0.0 (0)
2	5	32.3 (1.55)	6.2 (157)	27.7 (1.33)	5.3 (135)
3	60	16.2 - 55.4 (0.79 - 2.66)	3.1 - 10.7 (79 - 272)	27.7 (1.33)	5.3 (135)
4	5	40.4 (1.94)	7.8 (198)	0.0 (0.00)	0.0 (0)
5	5	40.4 (1.94)	7.8 (198)	34.6 (1.66)	6.7 (170)
Class 90 (maximum combined uplift pressure of 105 psf)					
1	5	48.5 (2.33)	9.3 (236)	0.0 (0.00)	0.0 (0)
2	5	48.5 (2.33)	9.3 (236)	41.5 (1.99)	8.0 (203)
3	60	24.2 - 48.5 (1.16 - 2.33)	4.7 - 9.3 (119 - 236)	41.5 (1.99)	8.0 (203)
4	5	56.5 (2.71)	10.9 (277)	0.0 (0.00)	0.0 (0)
5	5	56.5 (2.71)	10.9 (277)	48.5 (2.33)	9.3 (236)

Chart No. 1
UL 580 Load Table Test Pressures

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SECTION 8
TEST SPECIMEN DESCRIPTION

Product Type: Metal Roof Panel
Series/Model: 0.040" Aluminum 1-3/4" SnapLock
Ultimate Test Load Achieved: -152 psf

Product Size(s):

All Test Specimens

OVERALL AREA:	**WIDTH**		**LENGTH**	
9.3 m^2 (100.0 ft^2)	**millimeters**	**inches**	**millimeters**	**inches**
Overall Size	3048	120	3048	120
Panel Coverage	406	16	3048	120

The following descriptions apply to all specimens except as noted.

Test Deck Construction:
The 10' 0" wide by 10' 0" long by 1' 3" deep test frame was fabricated from C15 by 33.9 steel channels. The test frame utilized six joists constructed from Southern Yellow Pine 2 x 12 lumber located on two sides of the test frame and spaced 24" on center. The joists were secured to the test frame using two 1/2" x 3" long bolts with washers and nuts through an 8" long, 2" by 4" by 1/8" steel angle with pre-drilled fastener locations. The steel angles were welded to the test frame 24" on center. Southern Yellow Pine 2 x 12 lumber was utilized as cross members at the midspan of the joists. The cross members were secured to the joists using two #8 X 3" long Torx flat head screws at each end. 1/2" (15/32" min) thick 4–ply CDX plywood sheathing was utilized on the top of the test deck. The plywood was secured using 8d coated ring shank nails spaced 6" on center.

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Roof System:

COMPONENTS	DETAILS	ATTACHMENT METHOD
30# Asphalt saturated organic felt paper	A single layer was used with a 4" overlap between adjacent sheets.	0.120" x 1-1/4" galvanized annular ring shank roofing nails with 32 Ga tin caps spaced a maximum of 3-1/2" on center at the perimeter and overlaps, with two intermediate rows spaced 6" on center.
Clip	The 1.86" high x 2.032" wide x 3.50" long clips were constructed from 18 Ga steel.	The clips were spaced at 16" on center and attached using two #10-13 x 1" pancake head fasteners per clip.
1-3/4" SnapLock Panels	The panels were constructed from 0.040" aluminum and had a 16" coverage width. Six full and two partial width panels were tested.	The male leg of the panels were secured using clips spaced 16" on center. The female leg of the panels snap-fit to the male leg of the adjacent panels. The same fasteners were used at the perimeter of the panels spaced 3" on center.

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SECTION 9
TEST RESULTS

The temperature during testing was 24°C - 27°C (75°F - 80°F). The results are tabulated as follows.

Test Specimen #1

TEST TITLE	OBSERVATIONS	DEFLECTION MEASUREMENTS	RESULTS
Class 30, Phases 1-5	No visible damage to system	Reference Table No. 1	PASSED
Class 60, Phases 1-5	No visible damage to system	Reference Table No. 1	PASSED
Class 90, Phases 1-5	No visible damage to system	Reference Table No. 1	PASSED
Supplemental Loads -112 psf to -152 psf	No visible damage to system	Reference Table No. 2	PASSED
Supplemental Loads -162 psf	Seam separated	Reference Table No. 2	FAILED

Notes:
Reference Chart No. 1 for test pressures and load durations.
Reference Sketch No. 1 for location of deflection measurement devices.
Deflection measurements are included in Table Nos. 1 through 4.

A loose fitting, pleated 2-mil plastic film was utilized to assist in obtaining uniform pressure on the roof system. The plastic film was located between the moisture barrier and the roof panels to facilitate testing. In our opinion, this did not influence test results.

Supplemental Loads were applied in 10 psf increments and held for one minute duration as modified from the procedures of UL 1897-2004 (Revised 2008) Uplift Tests for Roof Covering Systems

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TENSILE TEST RESULTS

Tensile tests were conducted on two specimens from each panel sample. The specimens were machined from the metal members to the dimensions of the sheet-type 0.5" wide specimen given in Figure 1 of ASTM E8. The coating on the specimens was removed from the reduced section prior to testing. Tensile properties were determined utilizing a Satec Universal Test Machine (ICN: Y002011) equipped with a 5,000 pound load cell (ICN: 65607) and a Class C extensometer (ICN: Y002015)The test was run at a crosshead speed of 0.2 in/min.

Specimen No.	Base Thickness (in)	Yield Strength (ksi)	Tensile Strength (ksi)	Modulus of Elasticity (ksi)	Reduction of Area (%)	Elongation (%)
1	0.0297	26.7	27.1	12,262	12	10.9

SECTION 10
CONCLUSION

The 0.040" Aluminum 1-3/4" SnapLock panels tested per UL 580 achieved an ultimate test load of -152 psf.

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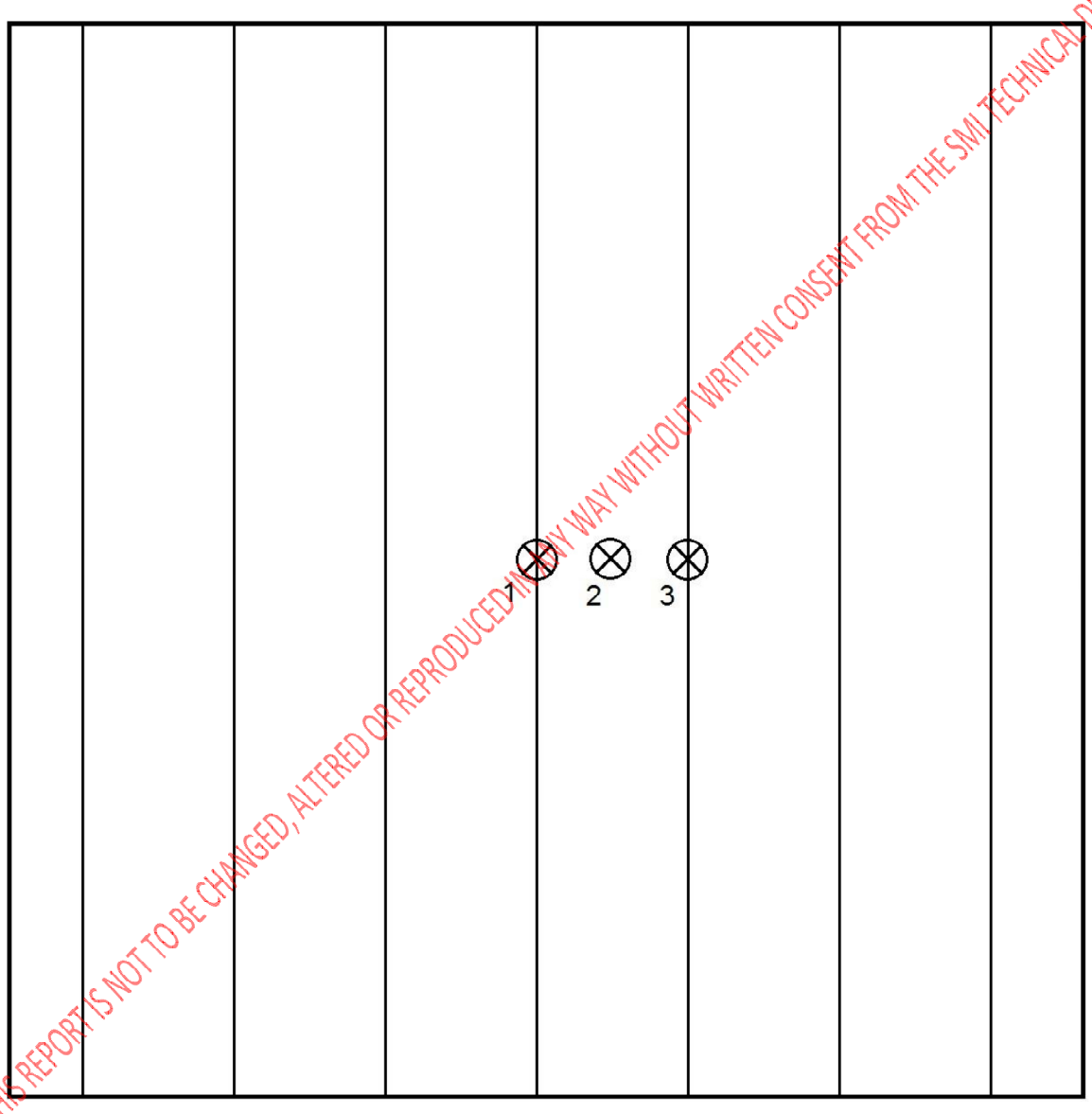
SECTION 11
SKETCH(ES)



Sketch No. 1
Deflection Measurement Device Locations

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SECTION 12
TABLES

CLASS	PHASE	DEFLECTION MEASUREMENTS (inches) INDICATOR #1	#2	#3
30	Initial (0.0 psf)	4.0	4.1	4.2
	1	4.3	5.1	4.3
	2	4.4	5.6	4.5
	3 Minimum	4.3	5.6	4.5
	3 Maximum	4.4	5.8	4.6
	4	4.3	5.5	4.4
	5	4.4	6.0	4.6
	Final (0.0 psf)	4.0	4.1	4.2
60	Initial (0.0 psf)	4.0	4.1	4.2
	1	4.4	5.8	4.5
	2	4.6	6.3	4.7
	3 Minimum	4.5	6.3	4.7
	3 Maximum	4.6	6.6	4.8
	4	4.4	6.0	4.7
	5	4.6	*	4.8
	Final (0.0 psf)	4.0	*	4.2
90	Initial (0.0 psf)	4.0	*	4.2
	1	4.5	*	4.7
	2	4.7	*	4.9
	3 Minimum	4.6	*	4.8
	3 Maximum	4.8	*	4.9
	4	4.6	*	4.8
	5	4.7	*	5.0
	Final (0.0 psf)	4.3	*	4.0

Table No. 1
Specimen #1 Deflection Measurements
*Gauge Error

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VACUUM (psf)	UPLIFT (psf)	LOAD (psf)	SUPPLEMENTAL DEFLECTION MEASUREMENTS (inches) INDICATOR		
			#1	#2	#3
-48.5	-63.5	-112	**4.7**	*	**5.0**
-48.5	-73.5	-122	**4.7**	*	**5.1**
-48.5	-83.5	-132	**4.8**	*	**5.1**
-48.5	-93.5	-142	**5.0**	*	**5.5**
-48.5	-103.5	-152	**5.2**	*	**5.7**
-48.5	-113.5	-162	**Failed**		

Table No. 2
Specimen #1 Supplemental Deflection Measurements
*Gauge Error

Note: Supplemental Loads were applied in 10 psf increments and held for one minute duration as modified from the procedures of UL 1897-2004 (Revised 2008) Uplift Tests for Roof Covering System.

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SECTION 13
DRAWINGS

The test specimen drawings have been reviewed by Intertek B&C and are representative of the test specimen(s) reported herein. Test specimen construction was verified by Intertek B&C per the drawings included in this report. Any deviations are documented herein or on the drawings.

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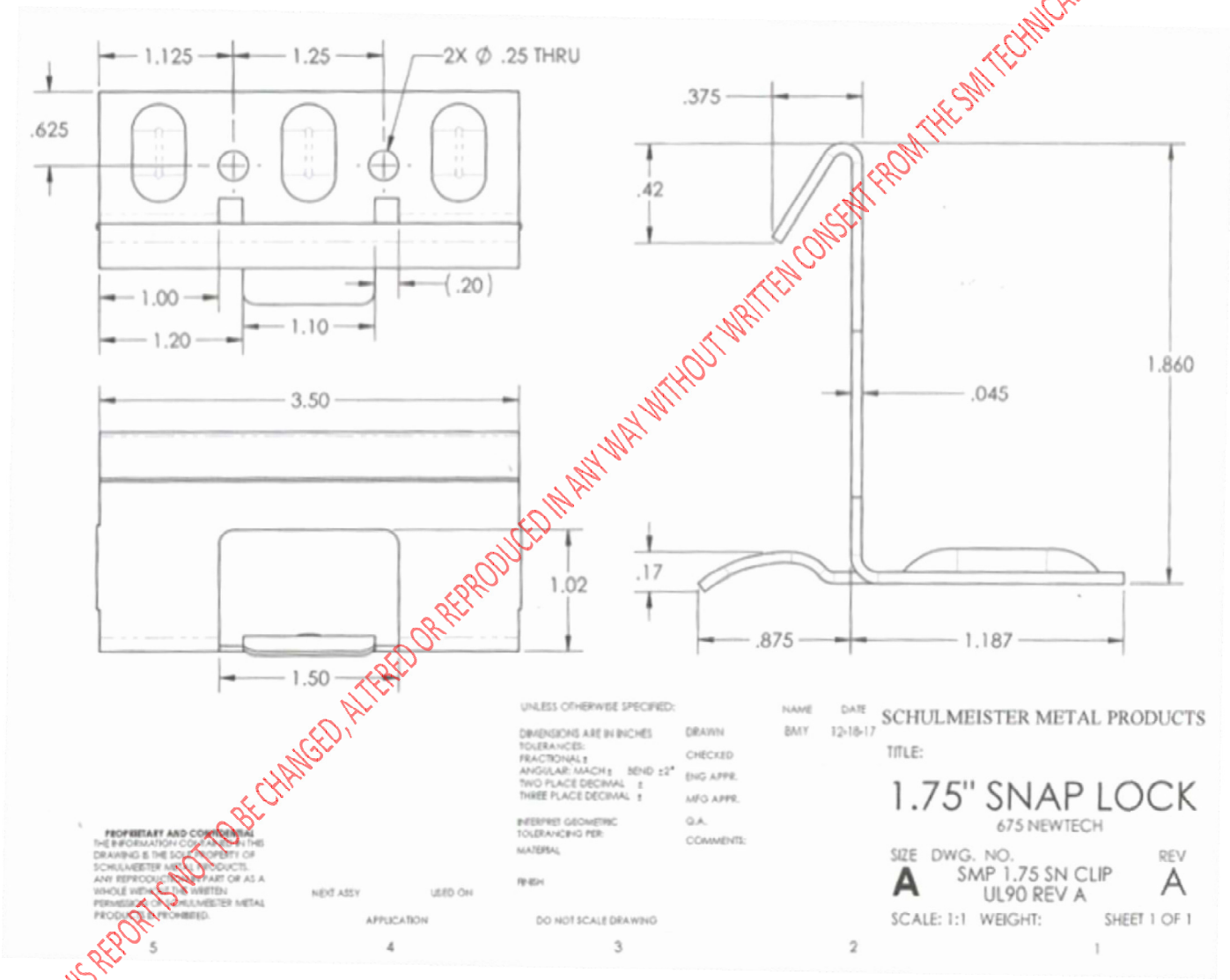

Drawing No. 1
Clip Details

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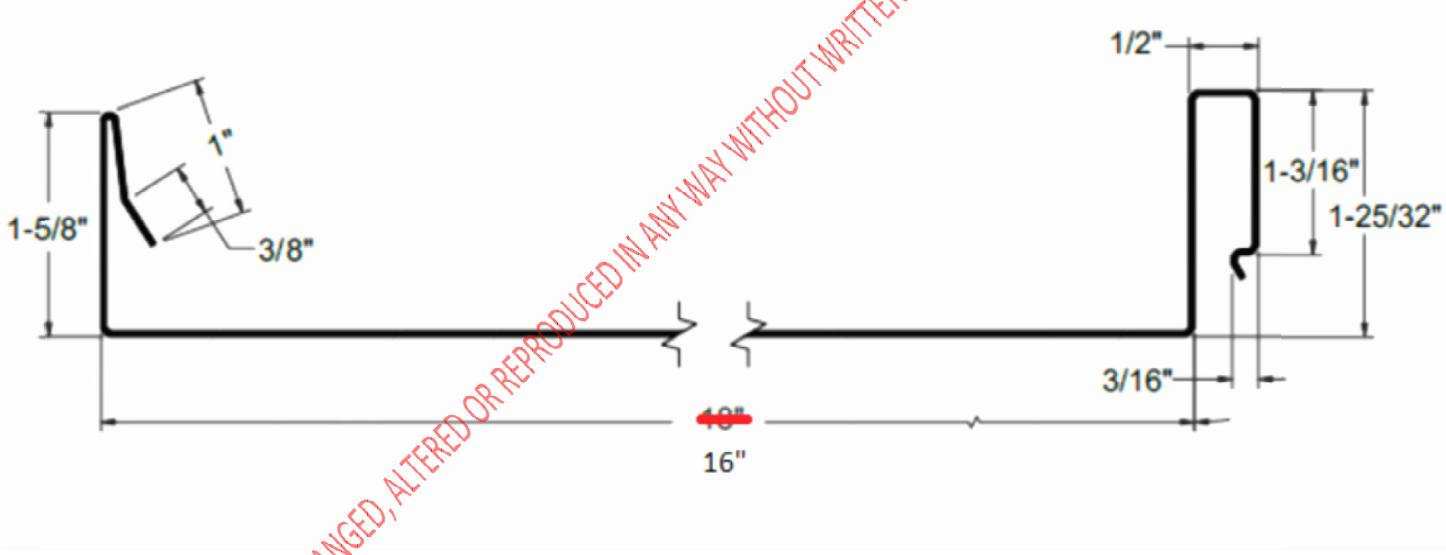

Drawing No. 2
Panel Details

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SECTION 14
REVISION LOG

REVISION #	DATE	PAGES	REVISION
0	08/14/18	N/A	Original Report Issue