

SHEFFIELD METALS TEST REPORT

SCOPE OF WORK

UL 580 UPLIFT RESISTANCE TESTING OF 0.029" ALUMINUM 1.5" MECHANICAL SEAM ROOF PANELS

REPORT NUMBER

L3734.01-450-18 R1

TEST DATES

09/16/20 – 10/07/20

ISSUE DATE

12/03/20

REVISED DATE

02/01/21

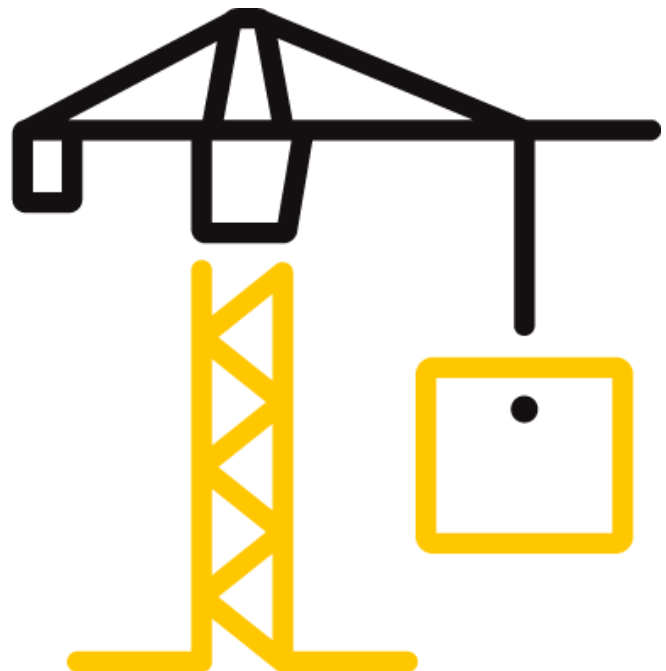
PAGES

22

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TEST REPORT FOR SHEFFIELD METALS

Report No.: L3734.01-450-18 R1

Date: 02/01/21

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, Sheffield Village, OH to perform testing in accordance with UL 580, *Standard for Safety, Tests for Uplift Resistance of Roof Assemblies*, on their 0.029" Aluminum 1.5" Mechanical Seam Roof Panels. Results obtained are tested values and were secured by using the designated test methods. Testing was conducted at Intertek B&C test facility in West Palm Beach, FL.

This report does not constitute certification of this product nor an opinion or endorsement by this laboratory. Intertek B&C will service this report for the entire test record retention period. The test record retention period ends four years after the test date. Test records, such as detailed drawings, datasheets, representative samples of test specimens, or other pertinent project documentation, will be retained for the entire test record retention period.

SECTION 2

SUMMARY OF TEST RESULTS

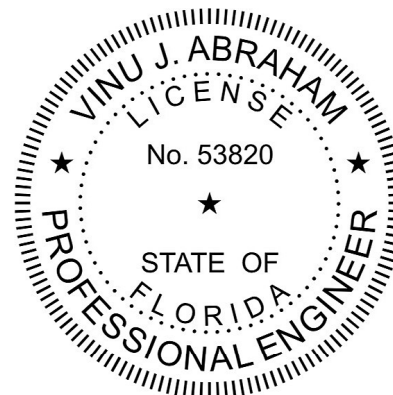
Product Type: Metal Roof Panels

Series/Model: SMI 1.5 MS Aluminum


Specimen 1 - Ultimate Test Load Achieved: -187 psf


Specimen 2 - Ultimate Test Load Achieved: -202 psf

Specimen 3 - Ultimate Test Load Achieved: -232 psf



For INTERTEK B&C:

COMPLETED BY: Melissa Nuttall
TITLE: Technician Team Leader - Product
SIGNATURE: 
Digitally Signed by: Melissa Nuttall
DATE: 02/01/21

REVIEWED BY: Vinu J. Abraham, P.E.
TITLE: Vice President – Global Business Development & Regional Operations
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DATE: 2021.02.01 16:11:48 -05'00'

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SECTION 3

TEST METHODS

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).

The specimens were evaluated in general accordance with the following:

UL 1897, *Uplift Tests for Roof Covering Systems*, Underwriters Laboratories, Inc. (Seventh Edition September 23, 2015).

SECTION 4

MATERIAL SOURCE/INSTALLATION

Test specimens were provided by the client. Representative samples of the test specimen(s) 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: Linear Transducers

SECTION 6

LIST OF OFFICIAL OBSERVERS

NAME	COMPANY
Melissa Nuttall	Intertek B&C
Veron Wickham	Intertek B&C

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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. Three assembly were 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 measurements were taken via linear transducers.

		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 Panels

Series/Model: SMI 1.5 MS Aluminum

Product Sizes:

All Specimens:

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

The following descriptions apply to all specimens.

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. The cross members were located under the side seams of the plywood (approximately 48" and 96" from the edge of the test ring) and 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 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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Specimen #1 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 6" on center at the perimeter and overlaps, with two intermediate rows spaced 12" on center.
2-Piece Clip	The clip was made up of a 6" long x 2-1/8" wide x 7/8" high base constructed from 18 Ga steel and a 1-3/4" long x 1/2" wide x 1-1/2" high top constructed from 24 Ga steel.	The clips were spaced 16" on center and attached using a pair of #10 x 1" pancake head fasteners.
1.5" Mechanical Seam Panels	The panels were constructed from 0.029" aluminum and had a 16" coverage width. Seven 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 was placed over the male leg of the panel and mechanically seamed 180°. The same fasteners were used at the perimeter of the panels spaced 2" on center.

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Specimen #2 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 6" on center at the perimeter and overlaps, with two intermediate rows spaced 12" on center.
2-Piece Clip	The clip was made up of a 6" long x 2-1/8" wide x 7/8" high base constructed from 18 Ga steel and a 1-3/4" long x 1/2" wide x 1-1/2" high top constructed from 24 Ga steel.	The clips were spaced 16" on center and attached using a pair of #10 x 1" pancake head fasteners.
1.5" Mechanical Seam Panels	The panels were constructed from 0.029" aluminum and had a 16" coverage width. Seven 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 was placed over the male leg of the panel and mechanically seamed 180°. The same fasteners were used at the perimeter of the panels spaced 2" on center.

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Specimen #3 Roof System:

COMPONENTS	DETAILS	ATTACHMENT METHOD
Moisture Barrier	A single layer was used with a 4" overlap between adjacent sheets.	Self-adhered.
2-Piece Clip	The clip was made up of a 6" long x 2-1/8" wide x 7/8" high base constructed from 18 Ga steel and a 1-3/4" long x 1/2" wide x 1-1/2" high top constructed from 24 Ga steel.	The clips were spaced 8" on center and attached using a pair of #10 x 1" pancake head fasteners.
1.5" Mechanical Seam Panels	The panels were constructed from 0.029" aluminum and had a 16" coverage width. Seven full and two partial width panels were tested.	The male leg of the panels were secured using clips spaced 8" on center. The female leg of the panels was placed over the male leg of the panel and mechanically seamed 180°. The same fasteners were used at the perimeter of the panels spaced 2" on center.

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SECTION 9

TEST RESULTS

The temperature during testing was 84°F - 87°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 -187 psf	No visible damage to system	Reference Table No. 2	PASSED
Supplemental Loads -202 psf	Seam Buckled	Reference Table No. 2	FAILED

Test Specimen #2

TEST TITLE	OBSERVATIONS	DEFLECTION MEASUREMENTS	RESULTS
Class 30, Phases 1-5	No visible damage to system	Reference Table No. 3	PASSED
Class 60, Phases 1-5	No visible damage to system	Reference Table No. 3	PASSED
Class 90, Phases 1-5	No visible damage to system	Reference Table No. 3	PASSED
Supplemental Loads -112 psf to -202 psf	No visible damage to system	Reference Table No. 4	PASSED
Supplemental Loads -217 psf	Seam Buckled	Reference Table No. 4	FAILED

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Test Specimen #3

TEST TITLE	OBSERVATIONS	DEFLECTION MEASUREMENTS	RESULTS
Class 30, Phases 1-5	No visible damage to system	Reference Table No. 5	PASSED
Class 60, Phases 1-5	No visible damage to system	Reference Table No. 5	PASSED
Class 90, Phases 1-5	No visible damage to system	Reference Table No. 5	PASSED
Supplemental Loads -112 psf to -232 psf	No visible damage to system	Reference Table No. 6	PASSED
Supplemental Loads -247 psf	Seam Buckled	Reference Table No. 6	FAILED

Notes:

Reference Chart No. 1 for test pressures and load durations.

Reference Sketch No. 1 for location of deflection measurement devices.

A loose fitting, pleated 4-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 per UL 1897 started at -112 psf total load.

SECTION 10

TENSILE TEST RESULTS

Tensile tests were conducted on one coupon. The test specimens were evaluated in accordance with the most recent revision of ASTM B557, *Standard Test Methods for Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products*. The tensile coupons were machined from the metal members to the dimensions of the sheet-type 0.5" wide specimen given in Figure 6 of ASTM B557. Elongation was measured after fracture.

Test Method:	ASTM B557		
Orientation:	Longitudinal		
Specimen No.	Yield Strength @ 0.2% Offset (ksi)	Tensile Strength (ksi)	Elongation in 2" (%)
1	20.6	23.4	8.0

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SECTION 11

CONCLUSION

The product tested per UL 580 and UL 1897 achieved an ultimate test load of:

Specimen 1: -187 psf

Specimen 2: -202 psf

Specimen 3: -232 psf

THIS REPORT IS NOT TO BE CHANGED, ALTERED OR REPRODUCED IN ANY WAY WITHOUT WRITTEN CONSENT FROM THE SMI TECHNICAL DEPT.

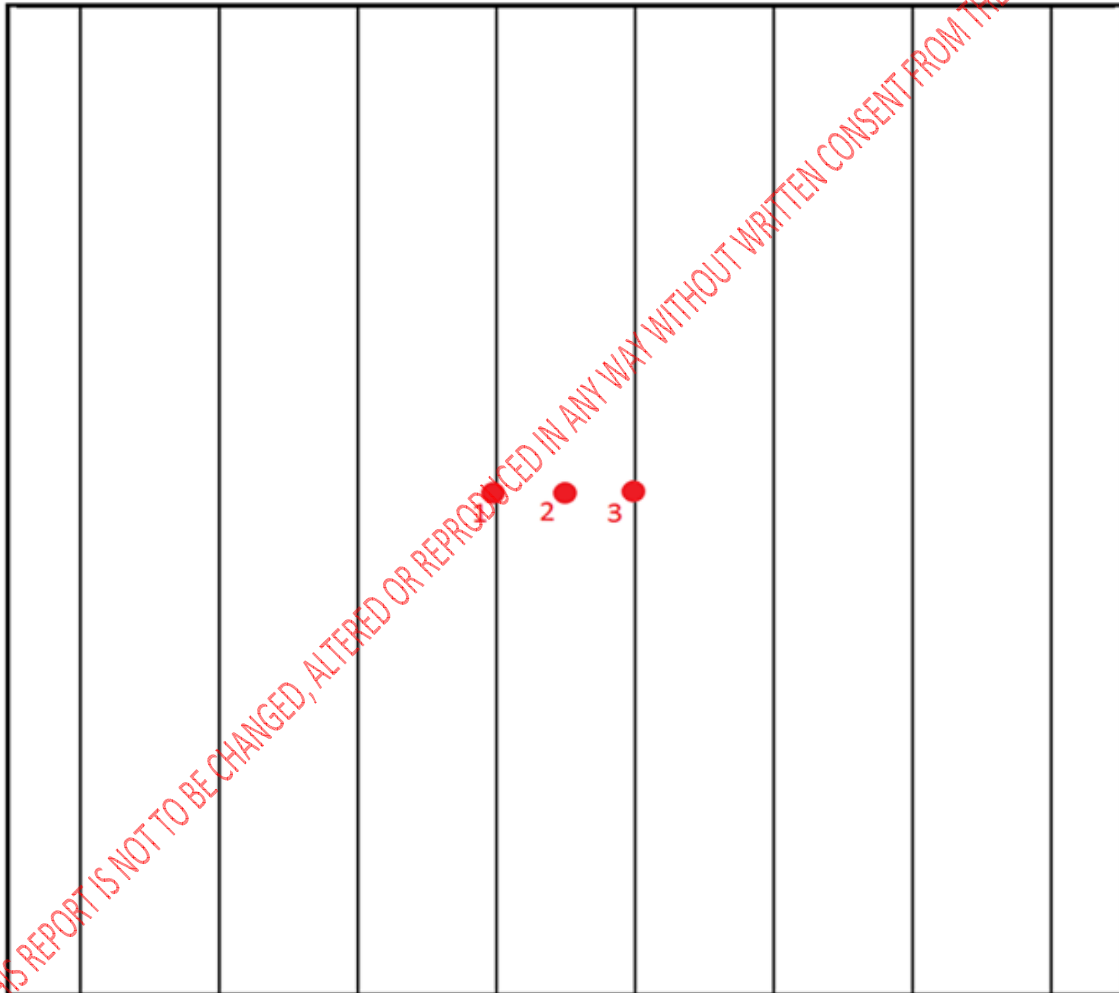
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SECTION 12

SKETCH(ES)



Sketch No. 1
Deflection Measurement Device Locations

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SECTION 13

TABLES

CLASS	PHASE	DEFLECTION MEASUREMENTS (inches)		
		INDICATOR		
		#1	#2	#3
30	1	0.28	1.14	0.32
	2	0.34	1.49	0.43
	3 Minimum	0.37	1.53	0.44
	3 Maximum	0.41	1.71	0.51
	4	0.35	1.46	0.42
	5	0.44	1.82	0.55
	Final (0.0 psf)	0.22	0.48	0.20
60	1	0.40	1.66	1.49
	2	0.51	2.08	0.65
	3 Minimum	0.53	2.13	0.66
	3 Maximum	0.62	2.36	0.79
	4	0.48	1.99	0.61
	5	0.63	2.39	0.80
	Final (0.0 psf)	0.25	0.68	0.24
90	1	0.52	2.09	0.66
	2	0.73	2.64	0.94
	3 Minimum	0.70	2.56	0.88
	3 Maximum	0.74	2.66	0.95
	4	0.60	2.32	0.77
	5	0.81	2.83	1.05
	Final (0.0 psf)	0.28	0.90	0.28

Table No. 1

Deflection Measurements – Test Specimen #1

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VACUUM (psf)	UPLIFT (psf)	LOAD (psf)	SUPPLEMENTAL DEFLECTION MEASUREMENTS (inches)		
			INDICATOR		
			#1	#2	#3
-63.5	-48.5	-112.0	0.85	2.90	1.09
-78.5	-48.5	-127.0	0.91	3.05	1.18
-93.5	-48.5	-142.0	1.00	3.23	1.29
-108.5	-48.5	-157.0*	0.83	2.34	1.13
-123.5	-48.5	-172.0	0.96	2.57	1.30
-138.5	-48.5	-187.0	1.06	2.80	1.47
-153.5	-48.5	-202.0	Failed		

Table No. 2

Supplemental Deflection Measurements – Test Specimen #1

*Gauges zeroed before load

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CLASS	PHASE	DEFLECTION MEASUREMENTS (inches)		
		INDICATOR		
		#1	#2	#3
30	1	0.24	1.03	0.22
	2	0.29	1.35	0.29
	3 Minimum	0.30	1.40	0.30
	3 Maximum	0.34	1.53	0.34
	4	0.31	1.40	0.30
	5	0.38	1.68	0.38
	Final (0.0 psf)	0.20	0.42	0.15
60	1	0.35	1.56	0.34
	2	0.45	1.94	0.45
	3 Minimum	0.46	2.07	0.49
	3 Maximum	0.56	2.28	0.58
	4	0.44	1.91	0.45
	5	0.56	2.27	0.58
	Final (0.0 psf)	0.22	0.59	0.18
90	1	0.47	2.02	0.49
	2	0.63	2.46	0.66
	3 Minimum	0.61	2.42	0.64
	3 Maximum	0.65	2.50	0.68
	4	0.55	2.23	0.57
	5	0.74	2.68	0.79
	Final (0.0 psf)	0.26	0.88	0.24

Table No. 3
Deflection Measurements – Test Specimen #2

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VACUUM (psf)	UPLIFT (psf)	LOAD (psf)	SUPPLEMENTAL DEFLECTION MEASUREMENTS (inches)		
			INDICATOR		
			#1	#2	#3
-63.5	-48.5	-112.0	0.77	2.75	0.81
-78.5	-48.5	-127.0	0.84	2.91	0.90
-93.5	-48.5	-142.0	0.93	3.11	1.01
-108.5	-48.5	-157.0	1.03	3.30	1.12
-123.5	-48.5	-172.0	1.12	3.47	1.22
-138.5	-48.5	-187.0	1.27	3.76	1.42
-153.5	-48.5	-202.0	1.41	4.03	1.65
-168.5	-48.5	-217.0	Failed		

Table No. 4

Supplemental Deflection Measurements – Test Specimen #2

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CLASS	PHASE	DEFLECTION MEASUREMENTS (inches)		
		INDICATOR		
		#1	#2	#3
30	1	0.07	0.40	0.08
	2	0.28	0.94	0.29
	3 Minimum	0.31	1.04	0.34
	3 Maximum	0.35	1.10	0.36
	4	0.31	1.11	0.35
	5	0.39	1.22	0.41
	Final (0.0 psf)	0.18	0.35	0.20
60	1	0.36	1.26	0.39
	2	0.50	1.47	0.50
	3 Minimum	0.54	1.63	0.54
	3 Maximum	0.64	1.77	0.61
	4	0.50	1.61	0.51
	5	0.63	1.78	0.61
	Final (0.0 psf)	0.23	0.46	0.24
90	1	0.54	1.69	0.55
	2	0.65	1.88	0.63
	3 Minimum	0.65	1.88	0.63
	3 Maximum	0.72	1.95	0.67
	4	0.64	1.91	0.62
	5	0.84	2.22	0.77
	Final (0.0 psf)	0.28	0.65	0.27

Table No. 5
Deflection Measurements – Test Specimen #3

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VACUUM (psf)	UPLIFT (psf)	LOAD (psf)	SUPPLEMENTAL DEFLECTION MEASUREMENTS (inches)		
			INDICATOR		
			#1	#2	#3
-63.5	-48.5	-112.0	0.89	2.34	0.81
-78.5	-48.5	-127.0	0.98	2.51	0.88
-93.5	-48.5	-142.0	1.08	2.69	0.96
-108.5	-48.5	-157.0	1.19	2.87	1.04
-123.5	-48.5	-172.0	1.30	3.05	1.12
-138.5	-48.5	-187.0	1.42	3.23	1.20
-153.5	-48.5	-202.0	1.62	3.50	1.31
-168.5	-48.5	-217.0	1.75	3.68	1.40
-183.5	-48.5	-232.0	1.90	4.02	1.59
-348.5	-48.5	-397.0	Failed		

Table No. 6
Supplemental Deflection Measurements – Test Specimen #3

TEST REPORT FOR SHEFFIELD METALS

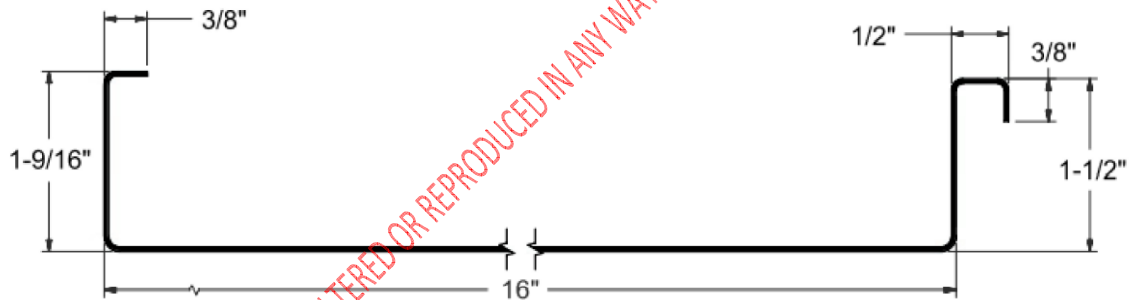
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SECTION 14 DRAWINGS

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.

SMI 1.5 MS

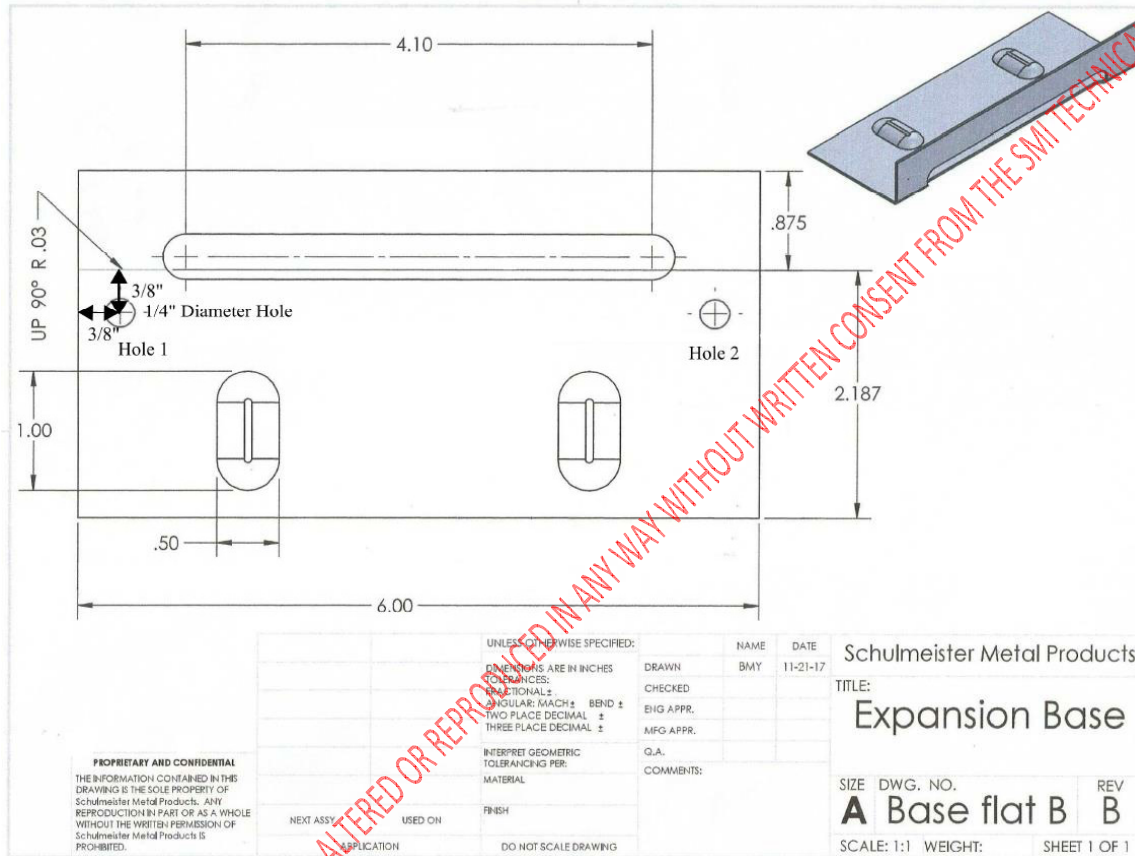


**Drawing No. 1
Panel Profile**

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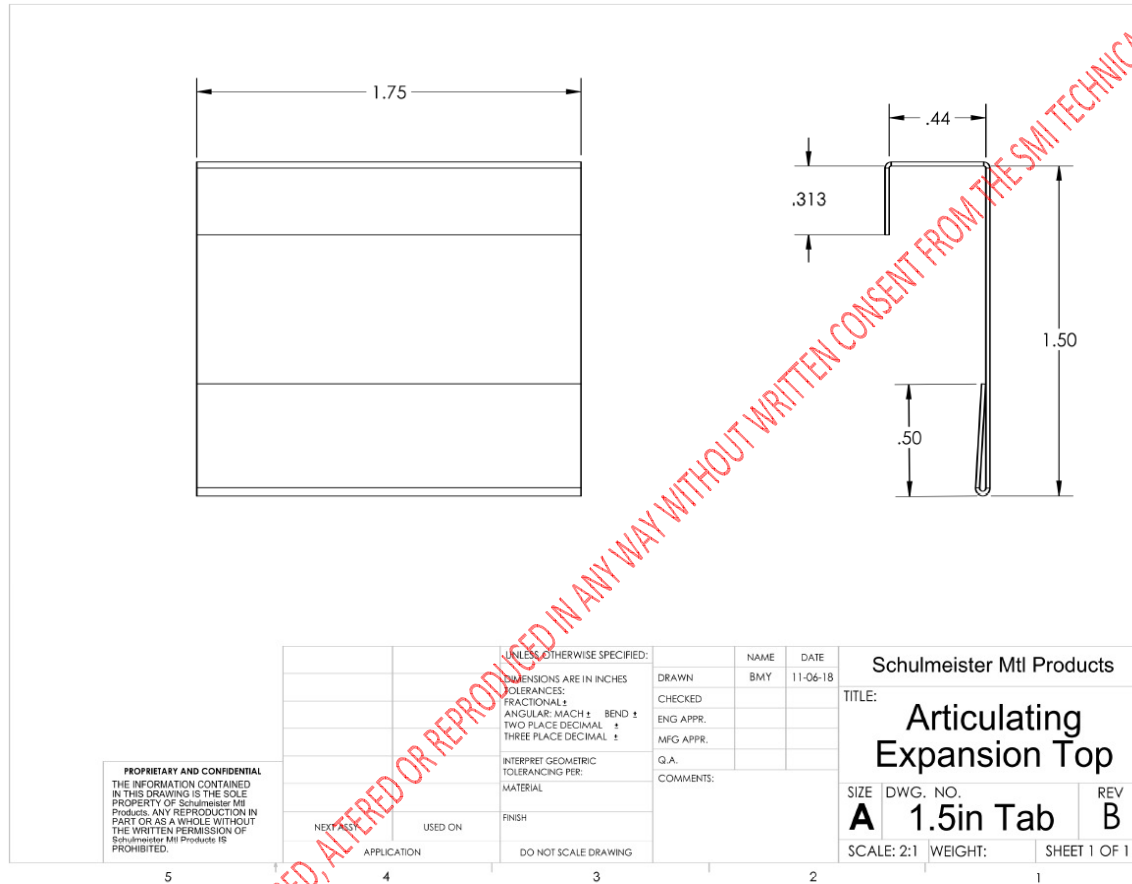


Drawing No. 2
Clip Base

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SECTION 15

REVISION LOG

REVISION #	DATE	PAGES	REVISION
0	12/03/20	N/A	Original Report Issue
1	02/01/21	10	Revised to include tensile test results

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