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May 2, 2018

Mr. James Bush
ATAS International, Inc.
6612 Snowdrift Road
Allentown, PA 18106

RE: MRD/Dutch Seam HVHZ Florida Product Approval
Report No: MRD-2017-Non HVHZ

Dear Jim:

At your request I have evaluated the wind resistance performance of the ATAS MRD/Dutch Seam roof panels for use in non-high-velocity hurricane zones (non-HVHZ) in conjunction with the 2017 Florida Building Code and Florida product approval system. The substantiating calculations and design assumptions are attached to this letter.

A summary of the results is given below:

Product:	MRD
Material:	0.032" aluminum and 24-gauge steel
Structural Substrate:	5/8" thick (minimum) plywood
	1/2" thick (minimum) plywood for reroofing
Fastener:	#10-13 screws
Clip Spacing and Screw:	see tables below

The 2017 Florida Building Code prescribes ASTM E 1592-05 (2012 reapproval) test standard for evaluation of roof panel assemblies. The ASTM E 1592 versions used to evaluate the MRD panel are equivalent to the referenced standard.

The 2017 Florida Building Code prescribes the test standard UL 580-06, with revisions through July 2009. The report references UL 580-09. The UL 580 versions used to evaluate the MRD panel are equivalent to the referenced standard.

Please note that my investigation has been limited to the conditions discussed, and is based in part on information provided to me. The work was performed using the standard of care exercised by structural engineers in this area at the time of the work. No expressed or implied warranties are made.

If you have any questions regarding these findings or conclusions, feel free to contact me. Thanks again for allowing me to assist you with this work.

Sincerely,

Christopher S. Blechschmidt
P.E. 61272



5-2-18

Non-HVHZ 24-Gauge Steel Allowable Spans									
Uplift Pressure (psf)	MRD 110			MRD 150			MRD 194		
	1 Screw		2 Screws	1 Screw		2 Screws	1 Screw		2 Screws
	1/2" Plyw'd	5/8" Plyw'd	1/2" & 5/8" Plyw'd	1/2" Plyw'd	5/8" Plyw'd	1/2" & 5/8" Plyw'd	1/2" Plyw'd	5/8" Plyw'd	1/2" & 5/8" Plyw'd
20	6'-4"	7'-0"	7'-0"	4'-8"	5'-2"	7'-0"	3'-7"	4'-0"	6'-0"
25	5'-1"	5'-7"	5'-7"	3'-8"	4'-2"	5'-7"	2'-11"	3'-2"	4'-9"
30	4'-3"	4'-8"	4'-8"	3'-1"	3'-5"	4'-8"	2'-5"	2'-8"	4'-0"
35	3'-7"	4'-0"	4'-0"	2'-8"	2'-11"	4'-0"	2'-1"	2'-2"	3'-5"
40	3'-2"	3'-6"	3'-6"	2'-4"	2'-7"	3'-6"	1'-9"	2'-0"	3'-0"
45	2'-10"	3'-1"	3'-1"	2'-1"	2'-3"	3'-1"	1'-7"	1'-9"	2'-8"
50	2'-6"	2'-9"	2'-9"	1'-10"	2'-1"	2'-9"	1'-5"	1'-7"	2'-4"
55	2'-3"	2'-6"	2'-6"	1'-8"	1'-10"	2'-6"	1'-3"	1'-5"	2'-2"
60	2'-1"	2'-4"	2'-4"	1'-7"	1'-8"	2'-4"	1'-2"	1'-4"	2'-0"
65	1'-11"	2'-1"	2'-1"	1'-5"	1'-7"	2'-1"	1'-1"	1'-2"	1'-10"
70	1'-9"	2'-0"	2'-0"	1'-4"	1'-4"	2'-0"	1'-0"	1'-1"	1'-8"
75	1'-8"	1'-10"	1'-10"	1'-3"	1'-4"	1'-10"	0'-11"	1'-0"	1'-7"
80	1'-7"	1'-9"	1'-9"	1'-2"	1'-3"	1'-9"	0'-10"	1'-0"	1'-6"
85	1'-6"	1'-7"	1'-7"	1'-1"	1'-2"	1'-7"	0'-10"	0'-11"	1'-5"
90	1'-5"	1'-6"	1'-6"	1'-0"	1'-1"	1'-6"	0'-9"	0'-10"	1'-4"
95	1'-4"	1'-5"	1'-5"	0'-11"	1'-1"	1'-5"	0'-9"	0'-10"	1'-3"
100	1'-3"	1'-4"	1'-4"	0'-11"	1'-0"	1'-4"	0'-8"	0'-9"	1'-2"
105	1'-2"	1'-4"	1'-4"	0'-10"	0'-11"	1'-4"	0'-8"	0'-9"	1'-1"
110	1'-2"	1'-3"	1'-3"	0'-10"	0'-10"	1'-3"	0'-7"	0'-8"	1'-1"

Non-HVHZ 0.032" Aluminum Allowable Spans									
Uplift Pressure (psf)	MRD 110			MRD 150			MRD 194		
	1 Screw		2 Screws	1 Screw		2 Screws	1 Screw		2 Screws
	1/2" Plyw'd	5/8" Plyw'd	1/2" & 5/8" Plyw'd	1/2" Plyw'd	5/8" Plyw'd	1/2" & 5/8" Plyw'd	1/2" Plyw'd	5/8" Plyw'd	1/2" & 5/8" Plyw'd
20	6'-4"	6'-9"	6'-9"	4'-8"	5'-2"	5'-3"	3'-0"	3'-0"	3'-0"
25	5'-1"	5'-5"	5'-5"	3'-8"	4'-2"	4'-2"	2'-4"	2'-4"	2'-4"
30	4'-3"	4'-6"	4'-6"	3'-1"	3'-5"	3'-6"	2'-0"	2'-0"	2'-0"
35	3'-7"	3'-10"	3'-10"	2'-8"	2'-11"	3'-0"	1'-8"	1'-8"	1'-8"
40	3'-2"	3'-4"	3'-4"	2'-4"	2'-7"	2'-7"	1'-6"	1'-6"	1'-6"
45	2'-10"	3'-0"	3'-0"	2'-1"	2'-3"	2'-4"	1'-4"	1'-4"	1'-4"
50	2'-6"	2'-8"	2'-8"	1'-10"	2'-1"	2'-1"	1'-2"	1'-2"	1'-2"
55	2'-3"	2'-5"	2'-5"	1'-8"	1'-10"	1'-11"	1'-1"	1'-1"	1'-1"
60	2'-1"	2'-3"	2'-3"	1'-6"	1'-8"	1'-9"	1'-0"	1'-0"	1'-0"
65	1'-11"	2'-1"	2'-1"	1'-5"	1'-7"	1'-7"	0'-11"	0'-11"	0'-11"
70	1'-9"	2'-0"	2'-0"	1'-4"	1'-4"	1'-6"	0'-10"	0'-10"	0'-10"
75	1'-8"	1'-9"	1'-9"	1'-3"	1'-4"	1'-5"	0'-9"	0'-9"	0'-9"
80	1'-7"	1'-8"	1'-8"	1'-2"	1'-3"	1'-3"	0'-9"	0'-9"	0'-9"
85	1'-6"	1'-7"	1'-7"	1'-1"	1'-2"	1'-2"	0'-8"	0'-8"	0'-8"
90	1'-5"	1'-6"	1'-6"	1'-0"	1'-1"	1'-2"	0'-8"	0'-8"	0'-8"
95	1'-4"	1'-5"	1'-5"	0'-11"	1'-1"	1'-1"	0'-7"	0'-7"	0'-7"
100	1'-3"	1'-4"	1'-4"	0'-11"	1'-0"	1'-0"	0'-7"	0'-7"	0'-7"
105	1'-2"	1'-3"	1'-3"	0'-10"	0'-11"	1'-0"	0'-6"	0'-6"	0'-6"
110	1'-2"	1'-2"	1'-2"	0'-10"	0'-11"	0'-11"	0'-6"	0'-6"	0'-6"

Design Assumptions

0.032" MRD 110, 150 and 194 aluminum panel (0.030" minimum delivered thickness)
24-gauge steel MRD 110, 150 and 194 panel

Sloped roof from 2.33:12 to 12:12 slope

5/8" plywood roof sheathing for new construction, 1/2" sheathing for reroofing

#10 screws per clip into plywood

Varying clip spacings in non-HVHZ

Allowable fastener loads from 2001 NDS, and *N. Amer. Spec. for the Design of CF Stl. Str. Members*, 2012

No stress increase for wind applied

3003-H14 aluminum sheet ($F_y = 17$ ksi, $F_u = 20$ ksi), ASTM A 653 SQ Gr. 50 steel sheet ($F_y = 50$ ksi, $F_u = 65$ ksi).

24 gage ASTM A 653 SS Gr. 50 steel clips ($F_y = 50$ ksi, $F_u = 65$ ksi), or
22 gauge ASTM A 240, alloy 304 stainless steel clips ($F_y = 30$ ksi, $F_u = 75$ ksi)

Tested in accordance with:

TAS 100-1995 (ATI report 66446.02-109-18)
TAS 110-2000 (ASTM G23 -- Accelerated Weathering, ASTM B117 -- Salt Spray)
TAS 125-2003 (ATI report 66446.01-109-18)

Panels tested to failure according to UL 580, ASTM E 1592 and TAS 125 protocols

F. S. = 2.0 on panel test pressures

MRD Test Summary

MRD 110											
	Panel Thick.	Width (ft)	Test	Report No.	Decking	Clip Thk. (in.)	Clip Spacing (ft)	Screws Each Clip	Ultimate Pressure (psf)	Clip Load (lbs)	Failure Mode
Material											
aluminum	0.032	0.916667	E 1592	01-30696.01	none	0.0359	4	2	70	257	fastener pullover at non-eave condition
steel	0.0239	0.916667	E 1592	01-30695.01	none	0.0299	4	2	70	257	seam separation
aluminum	0.032	0.916667	E 1592	T121-05	none	0.033	2	2	135.9	249	clip and seam disengagement

MRD 150											
	Panel Thick. (in.)	Width (ft)	Test	Report No.	Decking	Clip Thk. (in.)	Clip Spacing (ft)	Screws Each Clip	Ultimate Pressure (psf)	Clip Load (lbs)	Failure Mode
steel	0.0239	1.25	UL 580	R12113-25	steel	0.029	2	2	105	263	not tested to failure (raised clip)
steel	0.0239	1.25	UL 580	R12113-25	steel	0.029	2	2	105	263	not tested to failure (raised clip)
aluminum	0.032	1.25	UL 580	ATI-11112	none	0.049	3	2	105	394	not tested to failure
aluminum	0.04	1.25	UL 580	ATI-20388	none	0.049	4	2	105	525	not tested to failure
aluminum	0.032	1.25	E 1592	01-30698.01	none	0.0359	4	2	70	350	seam separation
steel	0.0239	1.25	E 1592	01-30697.01	none	0.0359	4	2	90	450	clip yielding
aluminum	0.032	1.25	E 1592	T120-05	none	0.033	2	2	104	260	clip and seam disengagement
aluminum	0.03	1.25	TAS125	66445.01	plywood	0.0299	1	2	150	188	seam disengagement
aluminum	0.03	1.25	TAS125	66445.01	plywood	0.0299	2	2	135	338	seam disengagement
aluminum	0.03	1.25	TAS125	66445.01	plywood	0.0299	0.667	2	225	188	seam disengagement

MRD 194											
	Panel Thick. (in.)	Width (ft)	Test	Report No.	Decking	Clip Thk. (in.)	Clip Spacing (ft)	Screws Each Clip	Ultimate Pressure (psf)	Clip Load (lbs)	Failure Mode
aluminum	0.032	1.604167	UL 580	ATI 10112	plywood	0.023	2	1	105	337	not tested to failure (raised clip)
aluminum	0.032	1.604167	UL 580	ATI-10690	steel	0.024	4	1	105	674	not tested to failure (raised clip)
aluminum	0.032	1.604167	UL 580	ATI-10487	fiber	0.023	2	1	105	337	not tested to failure
steel	0.0239	1.604167	E 1592	01-30699.01	none	0.0299	4	2	60	385	clip yielding
aluminum	0.032	1.604167	E 1592	01-30700.01	none	0.0299	4	2	40	257	seam separation
aluminum	0.032	1.604167	E 1592	T118-05	none	0.033	2	2	57.2	184	clip and seam disengagement
aluminum	0.032	1.604167	E 1592	T119-05	none	0.023	2	2	62.9	202	clip and seam disengagement
aluminum	0.030	1.604167	UL 580	2451.01-109-4	plywood	0.0299	0.333	2	315	168	Seam disengagement

Panel Strengths

MRD 110					
Material	Test Span (ft)	Test Pressure (psf)	Moment (lb-ft)	Seam Moment (lb-ft)	Failure Mode
0.032 Al	4	70	140	235.3	fastener
0.032 Al	2	135.9	68	228.4	clip/seam
24-ga Stl	4	70	140	235.3	seam

MRD 150					
Material	Test Span (ft)	Test Pressure (psf)	Moment (lb-ft)	Seam Moment (lb-ft)	Failure Mode
24-ga Stl	2	105	53	328.1	none
24-ga Stl	2	105	53	328.1	none
24-ga Stl	4	90	180	562.5	clip yield
0.032 Al	4	105	210	656.3	none
0.032 Al	4	70	140	437.5	seam
0.032 Al	2	104	52	325.0	clip/seam
0.032 Al	1	150	19	234.4	seam
0.032 Al	2	135	68	421.9	seam
0.032 Al	0.667	225	13	234.5	seam
0.040 Al	3	105	118	492.2	none

MRD 194					
Material	Test Span (ft)	Test Pressure (psf)	Moment (lb-ft)	Seam Moment (lb-ft)	Failure Mode
0.032 Al	2	105	53	540.4	none
0.032 Al	4	105	210	1080.8	none
0.032 Al	2	105	53	540.4	none
0.032 Al	4	40	80	411.7	seam
0.032 Al	2	57.2	29	294.4	clip/seam
0.032 Al	2	62.9	31	323.7	clip/seam
24-ga Stl	4	60	120	617.6	clip yeild

Panel failure does not appear to be controlled by moment between points of support.
 Seam failure moment is calculated as total moment at rib-pan interface between clips and appears to predict failure pressure. $M_{seam} = p \times (\text{rib width})^2 \times \text{clip spacing}$

Rib-Pan (Seam) Moment (lb-ft)						
	MRD 110		MRD 150		MRD 194	
	0.032" Al	24-ga Stl	0.032" Al	24-ga Stl	0.032" Al	24-ga Stl
Ultimate	228.4	235.3	330.7	562.5	309.1	617.6
Allowable	114.2	117.7	165.4	281.3	154.6	308.8

Values based on average of tests where seam failure was observed. F.S. = 2.0

Screw and Clip Strengths

Screw Pull-Out

5/8" plywood

#10 screw

Ultimate Pullout (lbs) = 390 (based on manufacturer test data)

F.S. = 3.0

$$P_{not}/\Omega = 130 \text{ lbs}$$

1/2" plywood

#10 screw

Ultimate Pullout (lbs) = 350 (based on manufacturer test data)

F.S. = 3.0

$$P_{not}/\Omega = 117 \text{ lbs}$$

Screw Pull-Over -- 24 gage steel clip base

#10, 7/16" diameter head/washer

t_1 (in) = 0.0239

F_{tu1} (ksi) = 65

F.S. = 3.0

d_w (in) = 0.4375

$$P_{nov}/\Omega = 340 \text{ lbs}$$

Controlling Spans in Non-HVHZ

MRD 110 -- 24-gauge steel (span in feet)									
Uplift (psf)	Component					Controlling Span			
	1/2" Plywood		5/8" Plywood		Seam Moment	1/2" Plywood		5/8" Plywood	
	1 screw	2 screws	1 screw	2 screws		1 screw	2 screws	1 screw	2 screws
20	6.38	12.76	7.09	14.18	7.00	6.38	7.00	7.00	7.00
25	5.11	10.21	5.67	11.35	5.60	5.11	5.60	5.60	5.60
30	4.25	8.51	4.73	9.45	4.67	4.25	4.67	4.67	4.67
35	3.65	7.29	4.05	8.10	4.00	3.65	4.00	4.00	4.00
40	3.19	6.38	3.55	7.09	3.50	3.19	3.50	3.50	3.50
45	2.84	5.67	3.15	6.30	3.11	2.84	3.11	3.11	3.11
50	2.55	5.11	2.84	5.67	2.80	2.55	2.80	2.80	2.80
55	2.32	4.64	2.58	5.16	2.55	2.32	2.55	2.55	2.55
60	2.13	4.25	2.36	4.73	2.33	2.13	2.33	2.33	2.33
65	1.96	3.93	2.18	4.36	2.15	1.96	2.15	2.15	2.15
70	1.82	3.65	2.03	4.05	2.00	1.82	2.00	2.00	2.00
75	1.70	3.40	1.89	3.78	1.87	1.70	1.87	1.87	1.87
80	1.60	3.19	1.77	3.55	1.75	1.60	1.75	1.75	1.75
85	1.50	3.00	1.67	3.34	1.65	1.50	1.65	1.65	1.65
90	1.42	2.84	1.58	3.15	1.56	1.42	1.56	1.56	1.56
95	1.34	2.69	1.49	2.99	1.47	1.34	1.47	1.47	1.47
100	1.28	2.55	1.42	2.84	1.40	1.28	1.40	1.40	1.40
105	1.22	2.43	1.35	2.70	1.33	1.22	1.33	1.33	1.33
110	1.16	2.32	1.29	2.58	1.27	1.16	1.27	1.27	1.27

MRD 110 -- 0.032" aluminum (span in feet)									
Uplift (psf)	Component					Controlling Span			
	1/2" Plywood		5/8" Plywood		Seam Moment	1/2" Plywood		5/8" Plywood	
	1 screw	2 screws	1 screw	2 screws		1 screw	2 screws	1 screw	2 screws
20	6.38	12.76	7.09	14.18	6.80	6.38	6.80	6.80	6.80
25	5.11	10.21	5.67	11.35	5.44	5.11	5.44	5.44	5.44
30	4.25	8.51	4.73	9.45	4.53	4.25	4.53	4.53	4.53
35	3.65	7.29	4.05	8.10	3.88	3.65	3.88	3.88	3.88
40	3.19	6.38	3.55	7.09	3.40	3.19	3.40	3.40	3.40
45	2.84	5.67	3.15	6.30	3.02	2.84	3.02	3.02	3.02
50	2.55	5.11	2.84	5.67	2.72	2.55	2.72	2.72	2.72
55	2.32	4.64	2.58	5.16	2.47	2.32	2.47	2.47	2.47
60	2.13	4.25	2.36	4.73	2.27	2.13	2.27	2.27	2.27
65	1.96	3.93	2.18	4.36	2.09	1.96	2.09	2.09	2.09
70	1.82	3.65	2.03	4.05	1.94	1.82	1.94	1.94	1.94
75	1.70	3.40	1.89	3.78	1.81	1.70	1.81	1.81	1.81
80	1.60	3.19	1.77	3.55	1.70	1.60	1.70	1.70	1.70
85	1.50	3.00	1.67	3.34	1.60	1.50	1.60	1.60	1.60
90	1.42	2.84	1.58	3.15	1.51	1.42	1.51	1.51	1.51
95	1.34	2.69	1.49	2.99	1.43	1.34	1.43	1.43	1.43
100	1.28	2.55	1.42	2.84	1.36	1.28	1.36	1.36	1.36
105	1.22	2.43	1.35	2.70	1.29	1.22	1.29	1.29	1.29
110	1.16	2.32	1.29	2.58	1.24	1.16	1.24	1.24	1.24

Controlling Spans in Non-HVHZ

MRD 150 -- 24-gauge steel (span in feet)									
Uplift (psf)	Component					Controlling Span			
	1/2" Plywood		5/8" Plywood		Seam Moment	1/2" Plywood		5/8" Plywood	
	1 screw	2 screws	1 screw	2 screws		1 screw	2 screws	1 screw	2 screws
20	4.68	9.36	5.20	10.40	9.00	4.68	9.00	5.20	9.00
25	3.74	7.49	4.16	8.32	7.20	3.74	7.20	4.16	7.20
30	3.12	6.24	3.47	6.93	6.00	3.12	6.00	3.47	6.00
35	2.67	5.35	2.97	5.94	5.14	2.67	5.14	2.97	5.14
40	2.34	4.68	2.60	5.20	4.50	2.34	4.50	2.60	4.50
45	2.08	4.16	2.31	4.62	4.00	2.08	4.00	2.31	4.00
50	1.87	3.74	2.08	4.16	3.60	1.87	3.60	2.08	3.60
55	1.70	3.40	1.89	3.78	3.27	1.70	3.27	1.89	3.27
60	1.56	3.12	1.73	3.47	3.00	1.56	3.00	1.73	3.00
65	1.44	2.88	1.60	3.20	2.77	1.44	2.77	1.60	2.77
70	1.34	2.67	1.49	2.97	2.57	1.34	2.57	1.49	2.57
75	1.25	2.50	1.39	2.77	2.40	1.25	2.40	1.39	2.40
80	1.17	2.34	1.30	2.60	2.25	1.17	2.25	1.30	2.25
85	1.10	2.20	1.22	2.45	2.12	1.10	2.12	1.22	2.12
90	1.04	2.08	1.16	2.31	2.00	1.04	2.00	1.16	2.00
95	0.99	1.97	1.09	2.19	1.90	0.99	1.90	1.09	1.90
100	0.94	1.87	1.04	2.08	1.80	0.94	1.80	1.04	1.80
105	0.89	1.78	0.99	1.98	1.71	0.89	1.71	0.99	1.71
110	0.85	1.70	0.95	1.89	1.64	0.85	1.64	0.95	1.64

MRD 150 -- 0.032" aluminum (span in feet)									
Uplift (psf)	Component					Controlling Span			
	1/2" Plywood		5/8" Plywood		Seam Moment	1/2" Plywood		5/8" Plywood	
	1 screw	2 screws	1 screw	2 screws		1 screw	2 screws	1 screw	2 screws
20	4.68	9.36	5.20	10.40	5.29	4.68	5.29	5.20	5.29
25	3.74	7.49	4.16	8.32	4.23	3.74	4.23	4.16	4.23
30	3.12	6.24	3.47	6.93	3.53	3.12	3.53	3.47	3.53
35	2.67	5.35	2.97	5.94	3.02	2.67	3.02	2.97	3.02
40	2.34	4.68	2.60	5.20	2.65	2.34	2.65	2.60	2.65
45	2.08	4.16	2.31	4.62	2.35	2.08	2.35	2.31	2.35
50	1.87	3.74	2.08	4.16	2.12	1.87	2.12	2.08	2.12
55	1.70	3.40	1.89	3.78	1.92	1.70	1.92	1.89	1.92
60	1.56	3.12	1.73	3.47	1.76	1.56	1.76	1.73	1.76
65	1.44	2.88	1.60	3.20	1.63	1.44	1.63	1.60	1.63
70	1.34	2.67	1.49	2.97	1.51	1.34	1.51	1.49	1.51
75	1.25	2.50	1.39	2.77	1.41	1.25	1.41	1.39	1.41
80	1.17	2.34	1.30	2.60	1.32	1.17	1.32	1.30	1.32
85	1.10	2.20	1.22	2.45	1.25	1.10	1.25	1.22	1.25
90	1.04	2.08	1.16	2.31	1.18	1.04	1.18	1.16	1.18
95	0.99	1.97	1.09	2.19	1.11	0.99	1.11	1.09	1.11
100	0.94	1.87	1.04	2.08	1.06	0.94	1.06	1.04	1.06
105	0.89	1.78	0.99	1.98	1.01	0.89	1.01	0.99	1.01
110	0.85	1.70	0.95	1.89	0.96	0.85	0.96	0.95	0.96

Controlling Spans in Non-HVHZ

MRD 194 -- 24-gauge steel (span in feet)									
Uplift (psf)	Component					Controlling Span			
	1/2" Plywood		5/8" Plywood		Seam Moment	1/2" Plywood		5/8" Plywood	
	1 screw	2 screws	1 screw	2 screws		1 screw	2 screws	1 screw	2 screws
20	3.65	7.29	4.05	8.10	6.00	3.65	6.00	4.05	6.00
25	2.92	5.83	3.24	6.48	4.80	2.92	4.80	3.24	4.80
30	2.43	4.86	2.70	5.40	4.00	2.43	4.00	2.70	4.00
35	2.08	4.17	2.32	4.63	3.43	2.08	3.43	2.32	3.43
40	1.82	3.65	2.03	4.05	3.00	1.82	3.00	2.03	3.00
45	1.62	3.24	1.80	3.60	2.67	1.62	2.67	1.80	2.67
50	1.46	2.92	1.62	3.24	2.40	1.46	2.40	1.62	2.40
55	1.33	2.65	1.47	2.95	2.18	1.33	2.18	1.47	2.18
60	1.22	2.43	1.35	2.70	2.00	1.22	2.00	1.35	2.00
65	1.12	2.24	1.25	2.49	1.85	1.12	1.85	1.25	1.85
70	1.04	2.08	1.16	2.32	1.71	1.04	1.71	1.16	1.71
75	0.97	1.94	1.08	2.16	1.60	0.97	1.60	1.08	1.60
80	0.91	1.82	1.01	2.03	1.50	0.91	1.50	1.01	1.50
85	0.86	1.72	0.95	1.91	1.41	0.86	1.41	0.95	1.41
90	0.81	1.62	0.90	1.80	1.33	0.81	1.33	0.90	1.33
95	0.77	1.54	0.85	1.71	1.26	0.77	1.26	0.85	1.26
100	0.73	1.46	0.81	1.62	1.20	0.73	1.20	0.81	1.20
105	0.69	1.39	0.77	1.54	1.14	0.69	1.14	0.77	1.14
110	0.66	1.33	0.74	1.47	1.09	0.66	1.09	0.74	1.09

MRD 194 -- 0.032" aluminum (span in feet)									
Uplift (psf)	Component					Controlling Span			
	1/2" Plywood		5/8" Plywood		Seam Moment	1/2" Plywood		5/8" Plywood	
	1 screw	2 screws	1 screw	2 screws		1 screw	2 screws	1 screw	2 screws
20	3.65	7.29	4.05	8.10	3.00	3.00	3.00	3.00	3.00
25	2.92	5.83	3.24	6.48	2.40	2.40	2.40	2.40	2.40
30	2.43	4.86	2.70	5.40	2.00	2.00	2.00	2.00	2.00
35	2.08	4.17	2.32	4.63	1.72	1.72	1.72	1.72	1.72
40	1.82	3.65	2.03	4.05	1.50	1.50	1.50	1.50	1.50
45	1.62	3.24	1.80	3.60	1.34	1.34	1.34	1.34	1.34
50	1.46	2.92	1.62	3.24	1.20	1.20	1.20	1.20	1.20
55	1.33	2.65	1.47	2.95	1.09	1.09	1.09	1.09	1.09
60	1.22	2.43	1.35	2.70	1.00	1.00	1.00	1.00	1.00
65	1.12	2.24	1.25	2.49	0.92	0.92	0.92	0.92	0.92
70	1.04	2.08	1.16	2.32	0.86	0.86	0.86	0.86	0.86
75	0.97	1.94	1.08	2.16	0.80	0.80	0.80	0.80	0.80
80	0.91	1.82	1.01	2.03	0.75	0.75	0.75	0.75	0.75
85	0.86	1.72	0.95	1.91	0.71	0.71	0.71	0.71	0.71
90	0.81	1.62	0.90	1.80	0.67	0.67	0.67	0.67	0.67
95	0.77	1.54	0.85	1.71	0.63	0.63	0.63	0.63	0.63
100	0.73	1.46	0.81	1.62	0.60	0.60	0.60	0.60	0.60
105	0.69	1.39	0.77	1.54	0.57	0.57	0.57	0.57	0.57
110	0.66	1.33	0.74	1.47	0.55	0.55	0.55	0.55	0.55

Results for 24-gauge panels show that the wider MRD150 panel is stronger than the MRD110. The likely reason for this is due to the limited test data for the steel panels. Limit the MRD150 strength to that of MRD150.

Non-HVHZ 24-Gauge Steel Allowable Span									
Uplift Pressure (psf)	MRD 110			MRD 150			MRD 194		
	1 Screw		2 Screws	1 Screw		2 Screws	1 Screw		2 Screws
	1/2" Plywood	5/8" Plywood	1/2" & 5/8" Plywood	1/2" Plywood	5/8" Plywood	1/2" & 5/8" Plywood	1/2" Plywood	5/8" Plywood	1/2" & 5/8" Plywood
20	6'-4"	7'-0"	7'-0"	4'-8"	5'-2"	7'-0"	3'-7"	4'-0"	6'-0"
25	5'-1"	5'-7"	5'-7"	3'-8"	4'-2"	5'-7"	2'-11"	3'-2"	4'-9"
30	4'-3"	4'-8"	4'-8"	3'-1"	3'-5"	4'-8"	2'-5"	2'-8"	4'-0"
35	3'-7"	4'-0"	4'-0"	2'-8"	2'-11"	4'-0"	2'-1"	2'-2"	3'-5"
40	3'-2"	3'-6"	3'-6"	2'-4"	2'-7"	3'-6"	1'-9"	2'-0"	3'-0"
45	2'-10"	3'-1"	3'-1"	2'-1"	2'-3"	3'-1"	1'-7"	1'-9"	2'-8"
50	2'-6"	2'-9"	2'-9"	1'-10"	2'-1"	2'-9"	1'-5"	1'-7"	2'-4"
55	2'-3"	2'-6"	2'-6"	1'-8"	1'-10"	2'-6"	1'-3"	1'-5"	2'-2"
60	2'-1"	2'-4"	2'-4"	1'-7"	1'-8"	2'-4"	1'-2"	1'-4"	2'-0"
65	1'-11"	2'-1"	2'-1"	1'-5"	1'-7"	2'-1"	1'-1"	1'-2"	1'-10"
70	1'-9"	2'-0"	2'-0"	1'-4"	1'-4"	2'-0"	1'-0"	1'-1"	1'-8"
75	1'-8"	1'-10"	1'-10"	1'-3"	1'-4"	1'-10"	0'-11"	1'-0"	1'-7"
80	1'-7"	1'-9"	1'-9"	1'-2"	1'-3"	1'-9"	0'-10"	1'-0"	1'-6"
85	1'-6"	1'-7"	1'-7"	1'-1"	1'-2"	1'-7"	0'-10"	0'-11"	1'-5"
90	1'-5"	1'-6"	1'-6"	1'-0"	1'-1"	1'-6"	0'-9"	0'-10"	1'-4"
95	1'-4"	1'-5"	1'-5"	0'-11"	1'-1"	1'-5"	0'-9"	0'-10"	1'-3"
100	1'-3"	1'-4"	1'-4"	0'-11"	1'-0"	1'-4"	0'-8"	0'-9"	1'-2"
105	1'-2"	1'-4"	1'-4"	0'-10"	0'-11"	1'-4"	0'-8"	0'-9"	1'-1"
110	1'-2"	1'-3"	1'-3"	0'-10"	0'-10"	1'-3"	0'-7"	0'-8"	1'-1"

Non-HVHZ 0.032" Aluminum Allowable Span									
Uplift Pressure (psf)	MRD 110			MRD 150			MRD 194		
	1 Screw		2 Screws	1 Screw		2 Screws	1 Screw		2 Screws
	1/2" Plywood	5/8" Plywood	1/2" & 5/8" Plywood	1/2" Plywood	5/8" Plywood	1/2" & 5/8" Plywood	1/2" Plywood	5/8" Plywood	1/2" & 5/8" Plywood
20	6'-4"	6'-9"	6'-9"	4'-8"	5'-2"	5'-3"	3'-0"	3'-0"	3'-0"
25	5'-1"	5'-5"	5'-5"	3'-8"	4'-2"	4'-2"	2'-4"	2'-4"	2'-4"
30	4'-3"	4'-6"	4'-6"	3'-1"	3'-5"	3'-6"	2'-0"	2'-0"	2'-0"
35	3'-7"	3'-10"	3'-10"	2'-8"	2'-11"	3'-0"	1'-8"	1'-8"	1'-8"
40	3'-2"	3'-4"	3'-4"	2'-4"	2'-7"	2'-7"	1'-6"	1'-6"	1'-6"
45	2'-10"	3'-0"	3'-0"	2'-1"	2'-3"	2'-4"	1'-4"	1'-4"	1'-4"
50	2'-6"	2'-8"	2'-8"	1'-10"	2'-1"	2'-1"	1'-2"	1'-2"	1'-2"
55	2'-3"	2'-5"	2'-5"	1'-8"	1'-10"	1'-11"	1'-1"	1'-1"	1'-1"
60	2'-1"	2'-3"	2'-3"	1'-6"	1'-8"	1'-9"	1'-0"	1'-0"	1'-0"
65	1'-11"	2'-1"	2'-1"	1'-5"	1'-7"	1'-7"	0'-11"	0'-11"	0'-11"
70	1'-9"	2'-0"	2'-0"	1'-4"	1'-4"	1'-6"	0'-10"	0'-10"	0'-10"
75	1'-8"	1'-9"	1'-9"	1'-3"	1'-4"	1'-5"	0'-9"	0'-9"	0'-9"
80	1'-7"	1'-8"	1'-8"	1'-2"	1'-3"	1'-3"	0'-9"	0'-9"	0'-9"
85	1'-6"	1'-7"	1'-7"	1'-1"	1'-2"	1'-2"	0'-8"	0'-8"	0'-8"
90	1'-5"	1'-6"	1'-6"	1'-0"	1'-1"	1'-2"	0'-8"	0'-8"	0'-8"
95	1'-4"	1'-5"	1'-5"	0'-11"	1'-1"	1'-1"	0'-7"	0'-7"	0'-7"
100	1'-3"	1'-4"	1'-4"	0'-11"	1'-0"	1'-0"	0'-7"	0'-7"	0'-7"
105	1'-2"	1'-3"	1'-3"	0'-10"	0'-11"	1'-0"	0'-6"	0'-6"	0'-6"
110	1'-2"	1'-2"	1'-2"	0'-10"	0'-11"	0'-11"	0'-6"	0'-6"	0'-6"

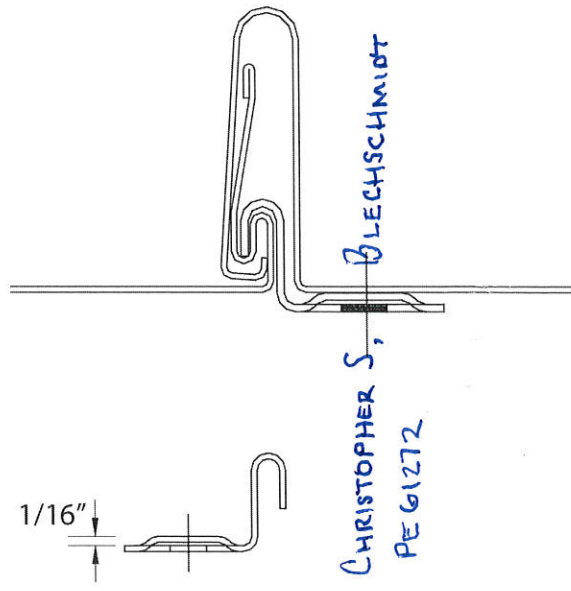
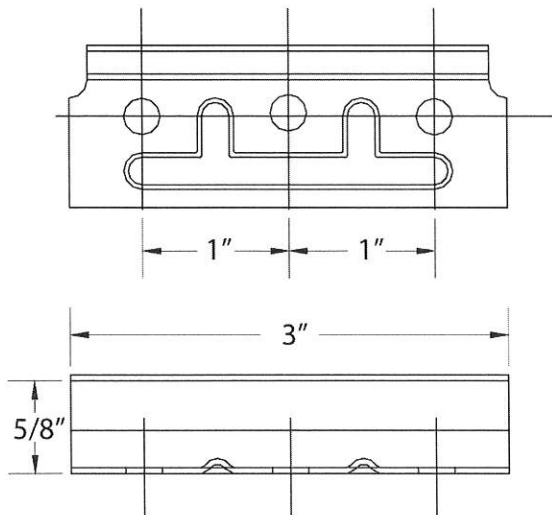
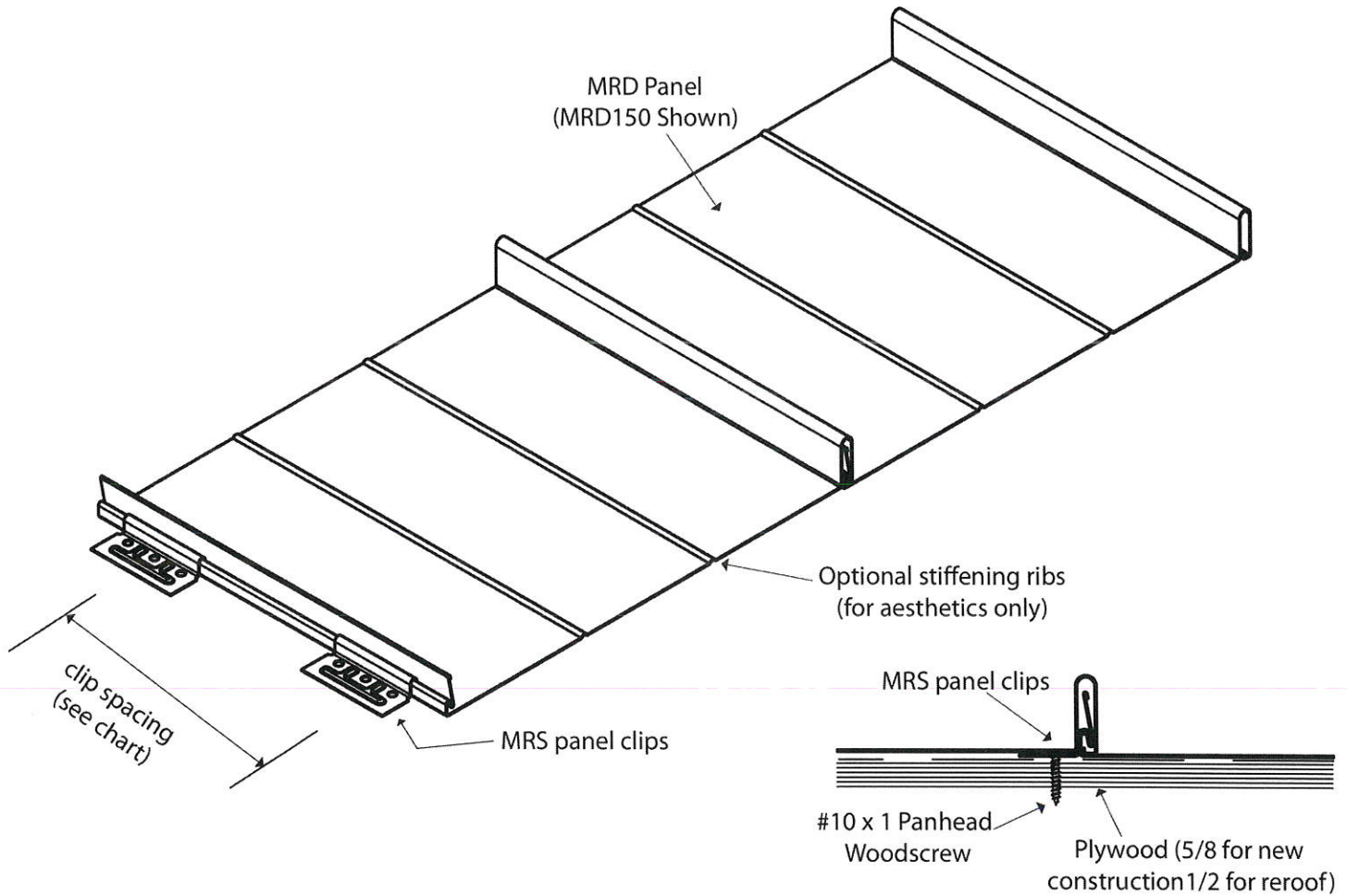
Test Report References

Standard	Report Number	Laboratory	Laboratory Location
ASTM E 1592-94	01-30696.01	Architectural Testing	York, PA
ASTM E 1592-94	01-30695.01	Architectural Testing	York, PA
ASTM E 1592-01	T121-05	Farabaugh Engineering & Testing	McKeepsport, PA
UL 580 (issued 11/4/91)	91NK17127	Underwriter Laboratories	Northbrook, IL
UL 580 (issued 11/11/91)	91NK14158	Underwriter Laboratories	Northbrook, IL
UL 580 (issued 10/15/92)	ATI-11112	Architectural Testing	York, PA
UL 580 (issued 10/16/92)	ATI-20388	Architectural Testing	York, PA
ASTM E 1592-94	01-30698.01	Architectural Testing	York, PA
ASTM E 1592-94	01-30697.01	Architectural Testing	York, PA
ASTM E 1592-01	T120-05	Farabaugh Engineering & Testing	McKeepsport, PA
TAS 125-03	66445.01-109-18	Architectural Testing	McKeepsport, PA
UL 580 (issued 7/21/92)	ATI-10112	Architectural Testing	York, PA
UL 580 (issued 8/21/92)	ATI-10690	Architectural Testing	York, PA
UL 580 (issued 10/15/92)	ATI-10487	Architectural Testing	York, PA
ASTM E 1592-94	01-30699.01	Architectural Testing	York, PA
ASTM E 1592-94	01-30700.01	Architectural Testing	York, PA
ASTM E 1592-01	T118-05	Farabaugh Engineering & Testing	McKeepsport, PA
ASTM E 1592-01	T119-05	Farabaugh Engineering & Testing	McKeepsport, PA
UL 580 (revised 7-9-09)	C2451.01-109-44	Architectural Testing, Inc.	York, PA

DUTCH SEAM



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Christopher S. Blechschmidt
5-2-18

Published panel width dimensions are to be considered as nominal dimensions. Variations in overall coverage may occur at installation due to typical manipulating of panels during attachment to the roof assembly.

"FLAT" ANCHOR CLIPS
MRS903 - 22 ga. stainless steel
MRS904 - 24 ga. galvanized steel
Clips designed for use with wafer (pancake) headed screws.

Non-HVHZ 24-Gauge Steel Allowable Spans									
Uplift Pressure (psf)	MRD 110			MRD 150			MRD 194		
	1 Screw		2 Screws	1 Screw		2 Screws	1 Screw		2 Screws
	1/2" Plywood	5/8" Plywood	1/2" & 5/8" Plywood	1/2" Plywood	5/8" Plywood	1/2" & 5/8" Plywood	1/2" Plywood	5/8" Plywood	1/2" & 5/8" Plywood
20	6'-4"	7'-0"	7'-0"	4'-8"	5'-2"	7'-0"	3'-7"	4'-0"	6'-0"
25	5'-1"	5'-7"	5'-7"	3'-8"	4'-2"	5'-7"	2'-11"	3'-2"	4'-9"
30	4'-3"	4'-8"	4'-8"	3'-1"	3'-5"	4'-8"	2'-5"	2'-8"	4'-0"
35	3'-7"	4'-0"	4'-0"	2'-8"	2'-11"	4'-0"	2'-1"	2'-2"	3'-5"
40	3'-2"	3'-6"	3'-6"	2'-4"	2'-7"	3'-6"	1'-9"	2'-0"	3'-0"
45	2'-10"	3'-1"	3'-1"	2'-1"	2'-3"	3'-1"	1'-7"	1'-9"	2'-8"
50	2'-6"	2'-9"	2'-9"	1'-10"	2'-1"	2'-9"	1'-5"	1'-7"	2'-4"
55	2'-3"	2'-6"	2'-6"	1'-8"	1'-10"	2'-6"	1'-3"	1'-5"	2'-2"
60	2'-1"	2'-4"	2'-4"	1'-7"	1'-8"	2'-4"	1'-2"	1'-4"	2'-0"
65	1'-11"	2'-1"	2'-1"	1'-5"	1'-7"	2'-1"	1'-1"	1'-2"	1'-10"
70	1'-9"	2'-0"	2'-0"	1'-4"	1'-4"	2'-0"	1'-0"	1'-1"	1'-8"
75	1'-8"	1'-10"	1'-10"	1'-3"	1'-4"	1'-10"	0'-11"	1'-0"	1'-7"
80	1'-7"	1'-9"	1'-9"	1'-2"	1'-3"	1'-9"	0'-10"	1'-0"	1'-6"
85	1'-6"	1'-7"	1'-7"	1'-1"	1'-2"	1'-7"	0'-10"	0'-11"	1'-5"
90	1'-5"	1'-6"	1'-6"	1'-0"	1'-1"	1'-6"	0'-9"	0'-10"	1'-4"
95	1'-4"	1'-5"	1'-5"	0'-11"	1'-1"	1'-5"	0'-9"	0'-10"	1'-3"
100	1'-3"	1'-4"	1'-4"	0'-11"	1'-0"	1'-4"	0'-8"	0'-9"	1'-2"
105	1'-2"	1'-4"	1'-4"	0'-10"	0'-11"	1'-4"	0'-8"	0'-9"	1'-1"
110	1'-2"	1'-3"	1'-3"	0'-10"	0'-10"	1'-3"	0'-7"	0'-8"	1'-1"

Non-HVHZ 0.032" Aluminum Allowable Spans									
Uplift Pressure (psf)	MRD 110			MRD 150			MRD 194		
	1 Screw		2 Screws	1 Screw		2 Screws	1 Screw		2 Screws
	1/2" Plywood	5/8" Plywood	1/2" & 5/8" Plywood	1/2" Plywood	5/8" Plywood	1/2" & 5/8" Plywood	1/2" Plywood	5/8" Plywood	1/2" & 5/8" Plywood
20	6'-4"	6'-9"	6'-9"	4'-8"	5'-2"	5'-3"	3'-0"	3'-0"	3'-0"
25	5'-1"	5'-5"	5'-5"	3'-8"	4'-2"	4'-2"	2'-4"	2'-4"	2'-4"
30	4'-3"	4'-6"	4'-6"	3'-1"	3'-5"	3'-6"	2'-0"	2'-0"	2'-0"
35	3'-7"	3'-10"	3'-10"	2'-8"	2'-11"	3'-0"	1'-8"	1'-8"	1'-8"
40	3'-2"	3'-4"	3'-4"	2'-4"	2'-7"	2'-7"	1'-6"	1'-6"	1'-6"
45	2'-10"	3'-0"	3'-0"	2'-1"	2'-3"	2'-4"	1'-4"	1'-4"	1'-4"
50	2'-6"	2'-8"	2'-8"	1'-10"	2'-1"	2'-1"	1'-2"	1'-2"	1'-2"
55	2'-3"	2'-5"	2'-5"	1'-8"	1'-10"	1'-11"	1'-1"	1'-1"	1'-1"
60	2'-1"	2'-3"	2'-3"	1'-6"	1'-8"	1'-9"	1'-0"	1'-0"	1'-0"
65	1'-11"	2'-1"	2'-1"	1'-5"	1'-7"	1'-7"	0'-11"	0'-11"	0'-11"
70	1'-9"	2'-0"	2'-0"	1'-4"	1'-4"	1'-6"	0'-10"	0'-10"	0'-10"
75	1'-8"	1'-9"	1'-9"	1'-3"	1'-4"	1'-5"	0'-9"	0'-9"	0'-9"
80	1'-7"	1'-8"	1'-8"	1'-2"	1'-3"	1'-3"	0'-9"	0'-9"	0'-9"
85	1'-6"	1'-7"	1'-7"	1'-1"	1'-2"	1'-2"	0'-8"	0'-8"	0'-8"
90	1'-5"	1'-6"	1'-6"	1'-0"	1'-1"	1'-2"	0'-8"	0'-8"	0'-8"
95	1'-4"	1'-5"	1'-5"	0'-11"	1'-1"	1'-1"	0'-7"	0'-7"	0'-7"
100	1'-3"	1'-4"	1'-4"	0'-11"	1'-0"	1'-0"	0'-7"	0'-7"	0'-7"
105	1'-2"	1'-3"	1'-3"	0'-10"	0'-11"	1'-0"	0'-6"	0'-6"	0'-6"
110	1'-2"	1'-2"	1'-2"	0'-10"	0'-11"	0'-11"	0'-6"	0'-6"	0'-6"

Christopher S. Blacksmith

5-2-18

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