



Starling Madison Lofquist, Inc.

Consulting Structural and Forensic Engineers

5224 South 39th Street, Phoenix, Arizona 85040
tel: (602) 438-2500 fax: (602) 438-2505 www.smleng.com

IronRidge
1435 Baechtel Rd.
Willits, CA 95490

December 9, 2013

Attn: Mr. William Kim, Chief Executive Officer

Subject: IronRidge Roof Flush Mounting System
Standing Seam Metal Roof Clamps by S-5 Innovations, Colorado Springs, CO

Dear Sir:

We have analyzed the structural aspects of using the S-5 Roof Clamps on the IronRidge Roof Flush Mounting System. The clamp model numbers addressed in the analysis are S-5-U, S-5-S & S-5-E. We have determined that, for the configurations and criteria described below, the clamp attachments are in compliance with the applicable sections of the following Reference Documents:

- Codes: ASCE/SEI 7-05 Min. Design Loads for Buildings & Other Structures
International Building Code, 2006 & 2009 Editions
AISI Standard, North American Specification for Design of Cold Formed Steel Structural Members, 2001 Edition.
- Other: AC428, Acceptance Criteria for Modular Framing Systems Used to Support PV Modules, dated Effective March 1, 2011 by ICC-ES
Aluminum Design Manual, 2005 Edition
Test Reports by Microbac Laboratories, Inc. Boulder, CO, for S-5 Innovations:
Report 0804-00059-1, dated April 14, 2008
Report 1203-00158-3, dated April 11, 2012
Report 0811-00087-1, dated November 17, 2008

The aluminum alloy S-5 clamps are configured to fit over the standing seam on light gage steel roof systems. The clamp is held in place by two screws, installed to a specified torque, securing the clamp to the seam. Details of the clamps may be seen on the S-5 web site, www.s-5.com. The L-foot for the IronRidge Roof Flush Mounting System is installed on top of the clamp.

The clamps are capable of resisting the wind induced uplift (normal to seam) loads on the IronRidge Roof Flush Mounting System by direct shear on the screws.

The snow load induced downslope (parallel to seam) loads are resisted by the two screws developing a moment (couple) to resist the eccentric applied loads.

The load tables appended to this letter show the maximum allowable spacing of the S-5 clamp for various combinations of clamp type, roofing type, wind loading, snow loading and roof slope.

The loads in the test reports have not been independently verified and remain the responsibility of Microbac Laboratories and S-5 Innovations. The effect of the clamp attachment on the roof warranty is also beyond the scope of this analysis and remains the responsibility of S-5 Innovations.

A Factor of Safety of 3.0 has been applied to the average failure (ultimate) test loads in accordance with section E4 of the AISI Standard.

Please feel free to contact me at your convenience if you have any questions.

Respectfully yours,

Tres J. Warner, P.E.
Design Division Manager



TABLE A - Roofing Systems:

Jacobi, JACOBIFALZ 38, 0.75mm (22 gage) Steel, S-5-S Connector

Axt & Mitchell, Design Span HP, 22 gage Steel, S-5-U Connector

Firestone (Una-Clad) UC-4, 24 gage Steel, S-5-S Connector

Firestone (Una-Clad) UC-3, 24 gage Steel, S-5-E Connector

A-1	Max Allowable S-5 Clamp Spacing (inches) for Wind Speed = 90 mph									
	Ground Snow Load									
Slope	0	10	20	30	40	50	60	70	80	90
0	152	146	125	106	82	67	57	49	43	39
5	150	127	74	60	47	38	32	28	25	22
10	156	90	52	43	33	27	23	20	17	16
15	154	70	41	34	26	21	18	16	14	12
20	142	63	37	31	24	20	17	14	13	11
25	132	59	36	29	23	19	16	14	12	11
30	115	58	36	30	23	19	16	14	13	11
35	108	58	37	31	25	20	17	15	13	12
40	103	60	39	33	27	22	19	17	15	13
45	98	63	43	37	30	26	22	19	17	16

A-2	Max Allowable S-5 Clamp Spacing (inches) for Wind Speed = 100 mph									
	Ground Snow Load									
Slope	0	10	20	30	40	50	60	70	80	90
0	136	136	125	106	82	67	57	49	43	39
5	135	127	74	60	47	38	32	28	25	22
10	139	90	52	43	33	27	23	20	17	16
15	129	70	41	34	26	21	18	16	14	12
20	120	63	37	31	24	20	17	14	13	11
25	113	59	36	29	23	19	16	14	12	11
30	99	58	36	30	23	19	16	14	13	11
35	94	58	37	31	25	20	17	15	13	12
40	90	60	39	33	27	22	19	17	15	13
45	86	63	43	37	30	26	22	19	17	16

A-3	Max Allowable S-5 Clamp Spacing (inches) for Wind Speed = 110 mph									
	Ground Snow Load									
Slope	0	10	20	30	40	50	60	70	80	90
0	132	132	125	106	82	67	57	49	43	39
5	126	126	74	60	47	38	32	28	25	22
10	130	90	52	43	33	27	23	20	17	16
15	121	70	41	34	26	21	18	16	14	12
20	114	63	37	31	24	20	17	14	13	11
25	107	59	36	29	23	19	16	14	12	11
30	94	58	36	30	23	19	16	14	13	11
35	89	58	37	31	25	20	17	15	13	12
40	86	60	39	33	27	22	19	17	15	13
45	82	63	43	37	30	26	22	19	17	16

A-4	Max Allowable S-5 Clamp Spacing (inches) for Wind Speed = 120 mph									
	Ground Snow Load									
Slope	0	10	20	30	40	50	60	70	80	90
0	113	113	113	106	82	67	57	49	43	39
5	106	106	74	60	47	38	32	28	25	22
10	110	90	52	43	33	27	23	20	17	16
15	104	70	41	34	26	21	18	16	14	12
20	98	63	37	31	24	20	17	14	13	11
25	93	59	36	29	23	19	16	14	12	11
30	82	58	36	30	23	19	16	14	13	11
35	79	58	37	31	25	20	17	15	13	12
40	76	60	39	33	27	22	19	17	15	13
45	73	63	43	37	30	26	22	19	17	16

A-5	Max Allowable S-5 Clamp Spacing (inches) for Wind Speed = 130 mph									
	Ground Snow Load									
Slope	0	10	20	30	40	50	60	70	80	90
0	95	95	95	95	82	67	57	49	43	39
5	90	90	74	60	47	38	32	28	25	22
10	95	90	52	43	33	27	23	20	17	16
15	90	70	41	34	26	21	18	16	14	12
20	86	63	37	31	24	20	17	14	13	11
25	82	59	36	29	23	19	16	14	12	11
30	72	58	36	30	23	19	16	14	13	11
35	69	58	37	31	25	20	17	15	13	12
40	67	60	39	33	27	22	19	17	15	13
45	65	63	43	37	30	26	22	19	17	16

Notes:

1. Wind Exposure: C
2. Mean Roof Height: 30 ft
3. Roof Zone 1
4. Occupancy Category I
5. Maximum Panel Dimension: 67.5 in
6. Panel Orientation: Portrait

Table B - Roofing Systems:

ASC Building Products, Skyline, 26 gage Steel, S-5-U Connector

Coated Metals Group, Ultra-Span, 24 gage G-90 Steel, S-5-U Connector

ASC Profiles, Span Seam A, 24 gage Steel, S-5-S Connector

ASC Profiles, Snap Seam A, 22 gage Steel, S-5-S Connector

ASC Profiles, Design Span HP/Sterling, 22 gage Steel (Zincalume), S-5-S Connector

ASC Profiles, Span Seam, 22 gage Steel (Zincalume), S-5-U Connector

B-1	Max Allowable S-5 Clamp Spacing (inches) for Wind Speed = 90 mph									
	Ground Snow Load									
Slope	0	10	20	30	40	50	60	70	80	90
0	145	145	101	83	64	52	44	38	34	30
5	131	99	57	47	37	30	25	22	19	17
10	132	70	41	33	26	21	18	15	14	12
15	121	55	32	26	20	17	14	12	11	10
20	111	49	29	24	19	15	13	11	10	9
25	103	46	28	23	18	15	13	11	10	9
30	90	45	28	23	18	15	13	11	10	9
35	85	45	29	24	19	16	14	12	10	9
40	80	47	31	26	21	17	15	13	12	11
45	77	49	34	29	24	20	17	15	14	12

B-2	Max Allowable S-5 Clamp Spacing (inches) for Wind Speed = 100 mph									
	Ground Snow Load									
Slope	0	10	20	30	40	50	60	70	80	90
0	115	115	101	83	64	52	44	38	34	30
5	106	99	57	47	37	30	25	22	19	17
10	109	70	41	33	26	21	18	15	14	12
15	101	55	32	26	20	17	14	12	11	10
20	94	49	29	24	19	15	13	11	10	9
25	88	46	28	23	18	15	13	11	10	9
30	77	45	28	23	18	15	13	11	10	9
35	73	45	29	24	19	16	14	12	10	9
40	70	47	31	26	21	17	15	13	12	11
45	67	49	34	29	24	20	17	15	14	12

B-3	Max Allowable S-5 Clamp Spacing (inches) for Wind Speed = 110 mph									
	Ground Snow Load									
Slope	0	10	20	30	40	50	60	70	80	90
0	106	106	101	83	64	52	44	38	34	30
5	99	99	57	47	37	30	25	22	19	17
10	102	70	41	33	26	21	18	15	14	12
15	95	55	32	26	20	17	14	12	11	10
20	89	49	29	24	19	15	13	11	10	9
25	84	46	28	23	18	15	13	11	10	9
30	73	45	28	23	18	15	13	11	10	9
35	70	45	29	24	19	16	14	12	10	9
40	67	47	31	26	21	17	15	13	12	11
45	64	49	34	29	24	20	17	15	14	12

B-4	Max Allowable S-5 Clamp Spacing (inches) for Wind Speed = 120 mph									
	Ground Snow Load									
Slope	0	10	20	30	40	50	60	70	80	90
0	88	88	88	83	64	52	44	38	34	30
5	83	83	57	47	37	30	25	22	19	17
10	86	70	41	33	26	21	18	15	14	12
15	81	55	32	26	20	17	14	12	11	10
20	77	49	29	24	19	15	13	11	10	9
25	73	46	28	23	18	15	13	11	10	9
30	64	45	28	23	18	15	13	11	10	9
35	61	45	29	24	19	16	14	12	10	9
40	59	47	31	26	21	17	15	13	12	11
45	57	49	34	29	24	20	17	15	14	12

B-5	Max Allowable S-5 Clamp Spacing (inches) for Wind Speed = 130 mph									
	Ground Snow Load									
Slope	0	10	20	30	40	50	60	70	80	90
0	74	74	74	74	64	52	44	38	34	30
5	70	70	57	47	37	30	25	22	19	17
10	74	70	41	33	26	21	18	15	14	12
15	70	55	32	26	20	17	14	12	11	10
20	67	49	29	24	19	15	13	11	10	9
25	64	46	28	23	18	15	13	11	10	9
30	56	45	28	23	18	15	13	11	10	9
35	54	45	29	24	19	16	14	12	10	9
40	53	47	31	26	21	17	15	13	12	11
45	104	70	48	41	33	28	24	22	19	17

Notes:

1. Wind Exposure: C
2. Mean Roof Height: 30 ft
3. Roof Zone 1
4. Occupancy Category I
5. Maximum Panel Dimension: 67.5 in
6. Panel Orientation: Portrait

Table C - Roofing Systems:

Axt & Mitchell, Design Span HP, 24 gage Steel, S-5-U Connector

Vic West CA, Tradition 100-4, 24 gage Steel, S-5-U Connector

Coated Metals Group, Ultra-Seam, 24 gage G-90 Steel, S-5-E Connector

Coated Metals Group, Ultra-Snap Panel, 24 gage Steel, S-5-S Connector

ASC Profiles, Span Seam, 24 gage Steel (Zincalume), S-5-U Connector

C-1	<i>Max Allowable S-5 Clamp Spacing (inches) for Wind Speed = 90 mph</i>									
	<i>Ground Snow Load</i>									
<i>Slope</i>	<i>0</i>	<i>10</i>	<i>20</i>	<i>30</i>	<i>40</i>	<i>50</i>	<i>60</i>	<i>70</i>	<i>80</i>	<i>90</i>
<i>0</i>	110	110	77	63	49	40	34	29	26	23
<i>5</i>	100	75	44	36	28	23	19	17	15	13
<i>10</i>	101	53	31	25	20	16	14	12	10	9
<i>15</i>	92	42	24	20	15	13	11	9	8	7
<i>20</i>	85	37	22	18	14	12	10	9	8	7
<i>25</i>	78	35	21	18	14	11	10	8	7	7
<i>30</i>	68	34	21	18	14	11	10	8	7	7
<i>35</i>	64	35	22	18	15	12	10	9	8	7
<i>40</i>	61	36	23	20	16	13	11	10	9	8
<i>45</i>	58	38	26	22	18	15	13	12	10	9

C-2	<i>Max Allowable S-5 Clamp Spacing (inches) for Wind Speed = 100 mph</i>									
	<i>Ground Snow Load</i>									
<i>Slope</i>	<i>0</i>	<i>10</i>	<i>20</i>	<i>30</i>	<i>40</i>	<i>50</i>	<i>60</i>	<i>70</i>	<i>80</i>	<i>90</i>
<i>0</i>	87	87	77	63	49	40	34	29	26	23
<i>5</i>	80	75	44	36	28	23	19	17	15	13
<i>10</i>	83	53	31	25	20	16	14	12	10	9
<i>15</i>	77	42	24	20	15	13	11	9	8	7
<i>20</i>	71	37	22	18	14	12	10	9	8	7
<i>25</i>	67	35	21	18	14	11	10	8	7	7
<i>30</i>	59	34	21	18	14	11	10	8	7	7
<i>35</i>	56	35	22	18	15	12	10	9	8	7
<i>40</i>	53	36	23	20	16	13	11	10	9	8
<i>45</i>	51	38	26	22	18	15	13	12	10	9

C-3	<i>Max Allowable S-5 Clamp Spacing (inches) for Wind Speed = 110 mph</i>									
	<i>Ground Snow Load</i>									
<i>Slope</i>	<i>0</i>	<i>10</i>	<i>20</i>	<i>30</i>	<i>40</i>	<i>50</i>	<i>60</i>	<i>70</i>	<i>80</i>	<i>90</i>
<i>0</i>	81	81	77	63	49	40	34	29	26	23
<i>5</i>	75	75	44	36	28	23	19	17	15	13
<i>10</i>	77	53	31	25	20	16	14	12	10	9
<i>15</i>	72	42	24	20	15	13	11	9	8	7
<i>20</i>	68	37	22	18	14	12	10	9	8	7
<i>25</i>	64	35	21	18	14	11	10	8	7	7
<i>30</i>	56	34	21	18	14	11	10	8	7	7
<i>35</i>	53	35	22	18	15	12	10	9	8	7
<i>40</i>	51	36	23	20	16	13	11	10	9	8
<i>45</i>	49	38	26	22	18	15	13	12	10	9

C-4	<i>Max Allowable S-5 Clamp Spacing (inches) for Wind Speed = 120 mph</i>									
	<i>Ground Snow Load</i>									
<i>Slope</i>	<i>0</i>	<i>10</i>	<i>20</i>	<i>30</i>	<i>40</i>	<i>50</i>	<i>60</i>	<i>70</i>	<i>80</i>	<i>90</i>
<i>0</i>	67	67	67	63	49	40	34	29	26	23
<i>5</i>	63	63	44	36	28	23	19	17	15	13
<i>10</i>	66	53	31	25	20	16	14	12	10	9
<i>15</i>	62	42	24	20	15	13	11	9	8	7
<i>20</i>	58	37	22	18	14	12	10	9	8	7
<i>25</i>	55	35	21	18	14	11	10	8	7	7
<i>30</i>	49	34	21	18	14	11	10	8	7	7
<i>35</i>	47	35	22	18	15	12	10	9	8	7
<i>40</i>	45	36	23	20	16	13	11	10	9	8
<i>45</i>	43	38	26	22	18	15	13	12	10	9

C-5	Max Allowable S-5 Clamp Spacing (inches) for Wind Speed = 130 mph									
	Ground Snow Load									
Slope	0	10	20	30	40	50	60	70	80	90
0	56	56	56	56	49	40	34	29	26	23
5	53	53	44	36	28	23	19	17	15	13
10	56	53	31	25	20	16	14	12	10	9
15	53	42	24	20	15	13	11	9	8	7
20	51	37	22	18	14	12	10	9	8	7
25	49	35	21	18	14	11	10	8	7	7
30	43	34	21	18	14	11	10	8	7	7
35	41	35	22	18	15	12	10	9	8	7
40	40	36	23	20	16	13	11	10	9	8
45	39	38	26	22	18	15	13	12	10	9

Notes:

1. Wind Exposure: C
2. Mean Roof Height: 30 ft
3. Roof Zone 1
4. Occupancy Category I
5. Maximum Panel Dimension: 67.5 in
6. Panel Orientation: Portrait

Table D - Roofing System:

ASC Profiles, Design Span HP/Sterling, 24 gage Steel (Zincalume), S-5-S Connector

D-1	Max Allowable S-5 Clamp Spacing (inches) for Wind Speed = 90 mph									
	Ground Snow Load									
Slope	0	10	20	30	40	50	60	70	80	90
0	78	78	54	45	35	28	24	21	18	16
5	71	53	31	25	20	16	14	12	10	9
10	71	38	22	18	14	11	10	8	7	7
15	65	30	17	14	11	9	8	7	6	5
20	60	26	16	13	10	8	7	6	5	5
25	56	25	15	12	10	8	7	6	5	5
30	48	24	15	12	10	8	7	6	5	5
35	46	24	15	13	10	9	7	6	6	5
40	43	25	17	14	11	9	8	7	6	6
45	41	27	18	16	13	11	9	8	7	7

D-2	Max Allowable S-5 Clamp Spacing (inches) for Wind Speed = 100 mph									
	Ground Snow Load									
Slope	0	10	20	30	40	50	60	70	80	90
0	62	62	54	45	35	28	24	21	18	16
5	57	53	31	25	20	16	14	12	10	9
10	58	38	22	18	14	11	10	8	7	7
15	54	30	17	14	11	9	8	7	6	5
20	51	26	16	13	10	8	7	6	5	5
25	47	25	15	12	10	8	7	6	5	5
30	41	24	15	12	10	8	7	6	5	5
35	39	24	15	13	10	9	7	6	6	5
40	38	25	17	14	11	9	8	7	6	6
45	36	27	18	16	13	11	9	8	7	7

D-3	Max Allowable S-5 Clamp Spacing (inches) for Wind Speed = 110 mph									
	Ground Snow Load									
Slope	0	10	20	30	40	50	60	70	80	90
0	57	57	54	45	35	28	24	21	18	16
5	53	53	31	25	20	16	14	12	10	9
10	55	38	22	18	14	11	10	8	7	7
15	51	30	17	14	11	9	8	7	6	5
20	48	26	16	13	10	8	7	6	5	5
25	45	25	15	12	10	8	7	6	5	5
30	39	24	15	12	10	8	7	6	5	5
35	38	24	15	13	10	9	7	6	6	5
40	36	25	17	14	11	9	8	7	6	6
45	35	27	18	16	13	11	9	8	7	7

D-4	Max Allowable S-5 Clamp Spacing (inches) for Wind Speed = 120 mph									
	Ground Snow Load									
Slope	0	10	20	30	40	50	60	70	80	90
0	47	47	47	45	35	28	24	21	18	16
5	44	44	31	25	20	16	14	12	10	9
10	46	38	22	18	14	11	10	8	7	7
15	44	30	17	14	11	9	8	7	6	5
20	41	26	16	13	10	8	7	6	5	5
25	39	25	15	12	10	8	7	6	5	5
30	34	24	15	12	10	8	7	6	5	5
35	33	24	15	13	10	9	7	6	6	5
40	32	25	17	14	11	9	8	7	6	6
45	31	27	18	16	13	11	9	8	7	7

D-5	Max Allowable S-5 Clamp Spacing (inches) for Wind Speed = 130 mph									
	Ground Snow Load									
Slope	0	10	20	30	40	50	60	70	80	90
0	40	40	40	40	35	28	24	21	18	16
5	38	38	31	25	20	16	14	12	10	9
10	40	38	22	18	14	11	10	8	7	7
15	38	30	17	14	11	9	8	7	6	5
20	36	26	16	13	10	8	7	6	5	5
25	34	25	15	12	10	8	7	6	5	5
30	30	24	15	12	10	8	7	6	5	5
35	29	24	15	13	10	9	7	6	6	5
40	28	25	17	14	11	9	8	7	6	6
45	27	27	18	16	13	11	9	8	7	7

Notes:

1. Wind Exposure: C
2. Mean Roof Height: 30 ft
3. Roof Zone 1
4. Occupancy Category I
5. Maximum Panel Dimension: 67.5 in
6. Panel Orientation: Portrait