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Our Ref: 4590-rev1/J.G

28 February 2018

8655 Table Butte Road
Colorado Springs CO CO 80908
United States

S-5-R465 Mini Spacing Certification

Use of S-5-R465 Mini Clamp for Installation of Solar Panels on top of Roof

Gamcorp (Melbourne) Pty Ltd, being Structural Engineers within the meaning of Australian Building Regulations, have carried out a structural design check of S-5-R465 Mini Clamp produced by **S-5! Attachment Solutions**, to be used for Solar System installation on tin roof within Australia. The design check is based on the information and test reports provided by S-5! Attachment Solutions.

We find the Installation of S-5-R465 Mini Roof Clamp for Solar System installation on tin roof for Australian use to be structurally sufficient based on the following conditions:

- Wind loads to AS/NZ1170.2:2011 Wind actions
- Wind region A, B, C, D
- Wind terrain category 2 & 3
- Wind average recurrence interval of 200 years
- Maximum building height 20m
- The maximum assessed PV panel dimensions are 2000mm x 2000mm
- Weight of the PV panel and array frame to be 15 kg/m²
- Clamps to be **S-5-R465 Mini Clamp** to the tin roof
- Refer to Note 1 & Note 2 for the assessed components and test reports provided
- Each PV panel that is installed utilizing a rail, a minimum of 2 rails shall be used in all circumstances
- No PV panel to be installed within 2xs from edges and ridge. "s" is the maximum gap between the underside of the panel and the roof surface when installed on the roof (50mm ≤ s ≤ 300mm)
- Installation of PV array to be done in accordance with the PV installation manual
- The certification **excludes** assessment of roof structure, PV array frames, PV panels, the fixing of roof sheeting to the substructure

Refer to attached summary table for interface spacing

NOTES:

1. **The recommended spacing nominated in this certification is based on the capacity of S-5-R465 Mini Clamp only, not the array frame, not the roof structure, not the fixing of roof sheeting to the substructure, not the PV panels. It is the responsibility of the installer to adopt the most critical spacing.**

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2. **The capacity of S-5-R465 Mini Clamp has been derived from the test report provided by S-5! Attachment Solutions, Test Report No. 17C0720-2, dated May 24, 2017 by MicroBac, following the methodology recommended in Appendix B of AS/NZS 1170.0:2002.**
3. **If any of the above conditions cannot be met, the structural engineer must be notified immediately.**

Construction is to be carried out strictly in accordance with the manufacturers instructions. This work was carried out in accordance with the provisions of Australian Building Regulations and in accordance with sound, widely accepted engineering principles.

Yours faithfully,
Gamcorp (Melbourne) Pty Ltd



Jianzeng Geng

Principal Engineer

MIEAust CPEng NER 3108316

NT Registration: 239858ES

QLD Registration: 18455

VIC Registration: EC 39483

TAS Registration: CC7263



Relationships built on trust

Client: **S-5! Attachment Solutions**
 Project: **S-5-R465 Mini**
 Address: **within Australia**
 Designed: **J.G**

Job: **4590**
 Date: **Feb-18**
 Checked: **J.Z**

S-5-R465 Mini

Solar Panel Dimension 2.0m x 2.0m

Terrain category 2

Table 1(a) Number of clamps along one side of the modular frame using S-5-R465 Mini (For 2-Zone wind cases)
 (Refer to Note 1 for 2-Zone definition) (Terrain Category 2)

Wind Region	Building Height - H (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20			
	D.W & U.W	Central	D.W & U.W	Central	D.W & U.W	Central	D.W & U.W	Central		
A	2	2	2	2	2	2	2	2	2	
B	2	2	3	2	3	2	3	3	3	
C	3	3	4	3	4	3	4	4	4	
D	5	4	6	5	6	5	7	5	5	

Table 1(b) Number of clamps along one side of the modular frame using S-5-R465 Mini (For 4-Zone wind cases) (Terrain Category 2)
 (Refer to Note 2 for 4-Zone definition)
 Cpe = -0.9

Wind Region	Building Height - H (m)															
	H≤5				5<H≤10				10<H≤15				15<H≤20			
	Corner	Edge	Inter-mediate	Intenal	Corner	Edge	Inter-mediate	Intenal	Corner	Edge	Inter-mediate	Intenal	Corner	Edge	Inter-mediate	Intenal
A	2	2	2	2	3	2	2	2	3	2	2	2	3	2	2	2
B	3	2	2	2	4	3	2	2	4	3	2	2	5	3	2	2
C	5	3	3	2	6	4	3	2	6	4	3	2	7	5	4	2
D	7	5	4	3	9	6	5	3	10	7	5	3	10	7	5	4

Table 1(c) Number of clamps along one side of the modular frame using S-5-R465 Mini (For 4-Zone wind cases) (Terrain Category 2)
 Cpe = -1.3

Wind Region	Building Height - H (m)															
	H≤5				5<H≤10				10<H≤15				15<H≤20			
	Corner	Edge	Inter-mediate	Intenal	Corner	Edge	Inter-mediate	Intenal	Corner	Edge	Inter-mediate	Intenal	Corner	Edge	Inter-mediate	Intenal
A	3	2	2	2	4	3	2	2	4	3	2	2	4	3	2	2
B	5	3	3	2	6	4	3	2	6	4	3	2	6	4	3	2
C	7	5	4	3	8	6	4	3	9	6	5	3	9	6	5	3
D	10	7	5	4	13	8	6	4	14	9	7	5	15	10	7	5

Table 2(a) Clamp spacing with a rail support: (assume the module frame supported by two rails using S-5-R465 Mini)
 (For 2-Zone wind cases) (Terrain Category 2)

Wind Region	Building Height – H (m)									
	H≤5		5<H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Central	D.W & U.W	Central	D.W & U.W	Central	D.W & U.W	Central		
A	1.73	2.14	1.41	1.74	1.27	1.56	1.19	1.47		
B	1.15	1.41	0.94	1.15	0.85	1.04	0.80	0.98		
C	0.74	0.91	0.61	0.75	0.55	0.67	0.52	0.64		
D	0.47	0.57	0.39	0.47	0.35	0.43	0.33	0.40		

Table 2(b) Clamp spcing with a rail support: (assume the module frame supported by two rails using S-5-R465 Mini) (Terrain Category 2)
(For 4-Zone wind cases)

C_{pe} = -0.9

Wind Region	Building Height - H (m)															
	H≤5				5<H≤10				10<H≤15				15<H≤20			
	Corner	Edge	Inter-mediate	Intenal	Corner	Edge	Inter-mediate	Intenal	Corner	Edge	Inter-mediate	Intenal	Corner	Edge	Inter-mediate	Intenal
A	1.05	1.62	2.23	3.56	0.86	1.32	1.81	2.85	0.78	1.19	1.63	2.55	0.73	1.12	1.53	2.39
B	0.71	1.08	1.47	2.29	0.58	0.89	1.20	1.86	0.53	0.80	1.08	1.67	0.50	0.75	1.02	1.57
C	0.46	0.70	0.94	1.45	0.38	0.57	0.77	1.19	0.34	0.52	0.70	1.07	0.32	0.49	0.66	1.01
D	0.29	0.44	0.59	0.90	0.24	0.36	0.49	0.74	0.22	0.33	0.44	0.67	0.21	0.31	0.42	0.63

Table 2(c) Clamp spcing with a rail support: (assume the module frame supported by two rails using S-5-R465 Mini) (Terrain Category 2)
(For 4-Zone wind cases)

C_{pe} = -1.3

Wind Region	Building Height - H (m)															
	H≤5				5<H≤10				10<H≤15				15<H≤20			
	Corner	Inter-mediate	Edge	Intenal	Corner	Inter-mediate	Edge	Intenal	Corner	Inter-mediate	Edge	Intenal	Corner	Inter-mediate	Edge	Intenal
A	0.71	1.09	1.49	2.33	0.59	0.90	1.22	1.89	0.53	0.81	1.10	1.69	0.50	0.76	1.03	1.59
B	0.48	0.73	0.99	1.53	0.40	0.60	0.81	1.25	0.36	0.55	0.74	1.13	0.34	0.52	0.69	1.06
C	0.32	0.48	0.64	0.98	0.26	0.39	0.53	0.81	0.24	0.36	0.48	0.73	0.22	0.34	0.45	0.69
D	0.20	0.30	0.41	0.62	0.17	0.25	0.34	0.51	0.15	0.23	0.30	0.46	0.14	0.21	0.29	0.43

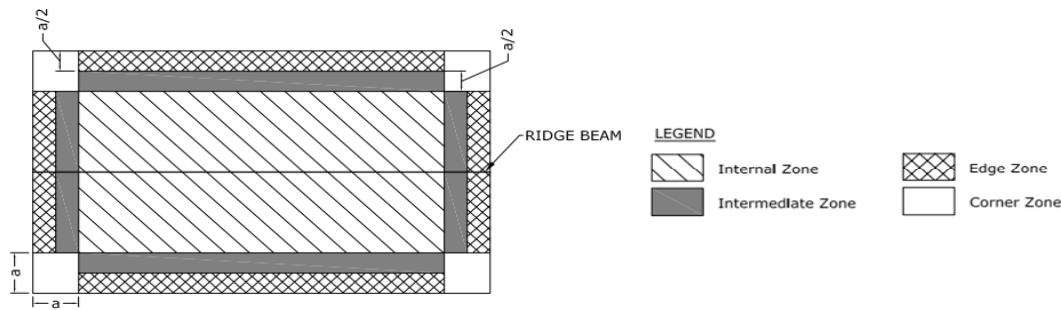
Table 3 Clamp spacing with a 30 degree tilted rail support (2 rails assumed for one row of panels) using S-5-R465 Mini (Terrain Category 2)

Wind Region	Building Height - H (m)															
	H≤5				5<H≤10				10<H≤15				15<H≤20			
	Corner	Inter-mediate	Edge	Intenal	Corner	Inter-mediate	Edge	Intenal	Corner	Inter-mediate	Edge	Intenal	Corner	Inter-mediate	Edge	Intenal
A	0.50	0.77	1.04	1.60	0.42	0.63	0.85	1.30	0.38	0.57	0.77	1.18	0.35	0.54	0.72	1.11
B	0.34	0.52	0.70	1.06	0.28	0.43	0.57	0.87	0.26	0.39	0.52	0.79	0.24	0.36	0.49	0.74
C	0.22	0.34	0.45	0.69	0.19	0.28	0.37	0.57	0.17	0.25	0.34	0.51	0.16	0.24	0.32	0.48
D	0.14	0.21	0.29	0.43	0.12	0.18	0.24	0.36	0.11	0.16	0.22	0.32	0.10	0.15	0.20	0.31

General Notes

Note 1 For the definition of Downwind, Upwind end and central, refer figure D9 from AS/NZS 1170.2-2011.

Note 2 Roof Zone defination



Note 3 Terrain category 2 (TC2) refers to open terrain, including grassland, with well-scattered obstructions having heights generally from 1.5 m to 5 m, with no more than two obstructions per hectare.

Terrain category 3 (TC3) refers to numerous closely spaced obstructions having heights generally from 3 m to 10 m. For example suburban housing or light industrial estates. Refer clause 4.2.1 of AS/NZS 1170.2-2011 Amdt 3-2013 for definition of Terrain category 3.



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Client: **S-5! Attachment Solutions**
 Project: **S-5-R465 Mini**
 Address: **within Australia**
 Designed: **J.G**

Job: **4590**
 Date: **Feb-18**
 Checked: **J.Z**

S-5-R465 Mini

Solar Panel Dimension 2.0m x 2.0m

Terrain category 3

Table 1(a) Number of clamps along one side of the modular frame using S-5-R465 Mini (For 2-Zone wind cases)
 (Refer to Note 1 for 2-Zone definition) (Terrain Category 3)

Wind Region	Building Height - H (m)									
	H ≤ 5		5 < H ≤ 10		10 < H ≤ 15		15 < H ≤ 20			
	D.W & U.W	Central	D.W & U.W	Central	D.W & U.W	Central	D.W & U.W	Central		
A	2	2	2	2	2	2	2	2	2	
B	2	2	2	2	2	2	2	2	2	
C	3	2	3	2	3	3	3	3	3	
D	4	3	4	3	5	4	5	4	4	

Table 1(b) Number of clamps along one side of the modular frame using S-5-R465 Mini (For 4-Zone wind cases)

(Terrain Category 3)

(Refer to Note 2 for 4-Zone definition)

Cpe = -0.9

Wind Region	Building Height - H (m)															
	H≤5				5<H≤10				10<H≤15				15<H≤20			
	Corner	Edge	Inter-mediate	Intenal	Corner	Edge	Inter-mediate	Intenal	Corner	Edge	Inter-mediate	Intenal	Corner	Edge	Inter-mediate	Intenal
A	2	2	2	2	2	2	2	2	2	2	2	2	3	2	2	2
B	3	2	2	2	3	2	2	2	3	2	2	2	4	2	2	2
C	4	3	2	2	4	3	2	2	5	3	3	2	5	4	3	2
D	6	4	3	2	6	4	3	2	7	5	4	3	8	5	4	3

Table 1(c) Number of clamps along one side of the modular frame using S-5-R465 Mini (For 4-Zone wind cases)

(Terrain Category 3)

Cpe = -1.3

Wind Region	Building Height - H (m)															
	H≤5				5<H≤10				10<H≤15				15<H≤20			
	Corner	Edge	Inter-mediate	Intenal	Corner	Edge	Inter-mediate	Intenal	Corner	Edge	Inter-mediate	Intenal	Corner	Edge	Inter-mediate	Intenal
A	3	2	2	2	3	2	2	2	3	2	2	2	3	2	2	2
B	4	3	2	2	4	3	2	2	4	3	2	2	5	3	3	2
C	6	4	3	2	6	4	3	2	7	4	3	2	7	5	4	3
D	9	6	5	3	9	6	5	3	10	7	5	4	11	8	6	4

Table 2(a) Clamp spacing with a rail support: (assume the module frame supported by two rails using S-5-R465 Mini)
 (For 2-Zone wind cases) (Terrain Category 3)

Wind Region	Building Height – H (m)									
	H≤5		5<H≤10		10<H≤15		15<H≤20			
	D.W & U.W	Central	D.W & U.W	Central	D.W & U.W	Central	D.W & U.W	Central		
A	2.12	2.64	2.12	2.64	1.81	2.25	1.61	1.99		
B	1.40	1.72	1.40	1.72	1.20	1.48	1.07	1.32		
C	0.90	1.10	0.90	1.10	0.78	0.95	0.69	0.85		
D	0.57	0.69	0.57	0.69	0.49	0.60	0.44	0.53		

Table 2(b) Clamp spcing with a rail support: (assume the module frame supported by two rails using S-5-R465 Mini) (Terrain Category 3)
 (For 4-Zone wind cases)

C_{pe} = -0.9

Wind Region	Building Height - H (m)															
	H≤5				5<H≤10				10<H≤15				15<H≤20			
	Corner	Edge	Inter-mediate	Intenal	Corner	Edge	Inter-mediate	Intenal	Corner	Edge	Inter-mediate	Intenal	Corner	Edge	Inter-mediate	Intenal
A	1.28	1.99	2.75	4.46	1.28	1.99	2.75	4.46	1.10	1.70	2.34	3.76	0.98	1.51	2.07	3.30
B	0.86	1.31	1.79	2.83	0.86	1.31	1.79	2.83	0.74	1.13	1.54	2.41	0.66	1.01	1.37	2.13
C	0.56	0.85	1.15	1.78	0.56	0.85	1.15	1.78	0.48	0.73	0.99	1.52	0.43	0.65	0.88	1.35
D	0.35	0.53	0.72	1.10	0.35	0.53	0.72	1.10	0.31	0.46	0.62	0.95	0.27	0.41	0.55	0.84

Table 2(c) Clamp spcing with a rail support: (assume the module frame supported by two rails using S-5-R465 Mini) (Terrain Category 3)
 (For 4-Zone wind cases)

C_{pe} = -1.3

Wind Region	Building Height - H (m)															
	H≤5				5<H≤10				10<H≤15				15<H≤20			
	Corner	Inter-mediate	Edge	Intenal	Corner	Inter-mediate	Edge	Intenal	Corner	Inter-mediate	Edge	Intenal	Corner	Inter-mediate	Edge	Intenal
A	0.87	1.33	1.82	2.87	0.87	1.33	1.82	2.87	0.75	1.15	1.56	2.45	0.67	1.02	1.39	2.16
B	0.58	0.89	1.21	1.87	0.58	0.89	1.21	1.87	0.51	0.77	1.04	1.61	0.45	0.69	0.93	1.43
C	0.38	0.58	0.78	1.19	0.38	0.58	0.78	1.19	0.33	0.50	0.67	1.03	0.30	0.45	0.60	0.92
D	0.24	0.37	0.49	0.75	0.24	0.37	0.49	0.75	0.21	0.32	0.43	0.65	0.19	0.28	0.38	0.58

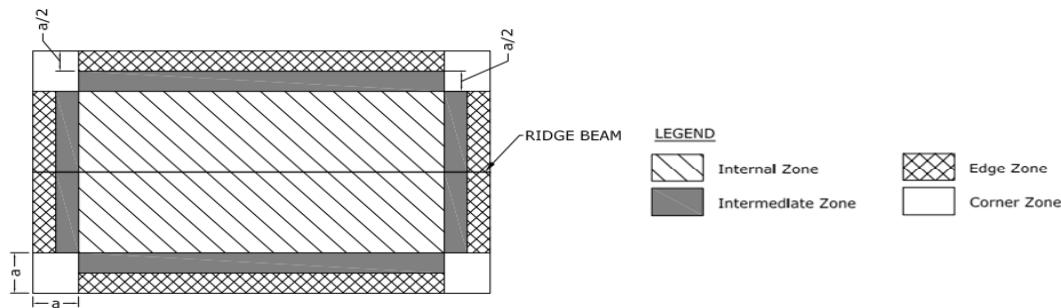
Table 3 Clamp spacing with a 30 degree tilted rail support (2 rails assumed for one row of panels) using S-5-R465 Mini (Terrain Category 3)

Wind Region	Building Height – H (m)															
	H≤5				5<H≤10				10<H≤15				15<H≤20			
	Corner	Inter-mediate	Edge	Intenal	Corner	Inter-mediate	Edge	Intenal	Corner	Inter-mediate	Edge	Intenal	Corner	Inter-mediate	Edge	Intenal
A	0.61	0.93	1.26	1.96	0.61	0.93	1.26	1.96	0.53	0.80	1.09	1.68	0.47	0.72	0.97	1.49
B	0.41	0.62	0.84	1.29	0.41	0.62	0.84	1.29	0.36	0.54	0.73	1.12	0.32	0.48	0.65	0.99
C	0.27	0.41	0.55	0.83	0.27	0.41	0.55	0.83	0.23	0.35	0.47	0.72	0.21	0.32	0.42	0.64
D	0.17	0.26	0.35	0.53	0.17	0.26	0.35	0.53	0.15	0.22	0.30	0.46	0.13	0.20	0.27	0.41

General Notes

Note 1 For the definition of Downwind, Upwind end and central, refer figure D9 from AS/NZS 1170.2-2011.

Note 2 Roof Zone defination



Note 3 Terrain category 2 (TC2) refers to open terrain, including grassland, with well-scattered obstructions having heights generally from 1.5 m to 5 m, with no more than two obstructions per hectare.

Terrain category 3 (TC3) refers to numerous closely spaced obstructions having heights generally from 3 m to 10 m. For example suburban housing or light industrial estates. Refer clause 4.2.1 of AS/NZS 1170.2-2011 Amdt 3-2013 for definition of Terrain category 3.