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QAS INTERNATIONAL
ISO 9001:2008
REGISTERED FIRM
Certificate No. AU1222

Gamcorp (Melbourne) Pty Ltd A.C.N 141 076 904 A.B.N 73 015 060 240
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Suite 4, 346 Ferntree Gully Rd, Notting Hill VIC 3168 Tel: 03 9543 2211 Fax: 03 9543 4046

Our Ref: 1418

28 November 2014

Chiko Solar Technology Co., Ltd
NO.878 Cheng Liu Rd.Jiading
District Shanghai, China

Array Frame Engineering Certificate (CK-FT-7R Rail)

Installation of flush mounted solar array frame on tin/tile Roof

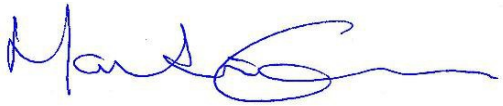
Gamcorp (Melbourne) Pty Ltd, being Structural Engineers within the meaning of Australian Building Regulations, have carried out a structural design check of Chiko solar array frame to be installed flat on the roof within Australia. The design check has been based on the information provided by Shanghai Chiko Solar Technology Co., Ltd.

We find the installation of flush mounted solar array frame on tin/tile roof to be structurally sufficient for Australian use based on the following conditions:

- Wind Loads to AS/NZ 1170.2:2011 Admt 3-2012
- Wind Region A, B, C, D
- Wind Terrain Category 2 & 3
- Wind average recurrence interval of 200 years region A and B
- Wind average recurrence interval of 500 years region C and D
- Maximum Building height 20 m
- Maximum solar panel dimensions 1650×992 to be placed in portrait.
- The existing roof construction shall be verified to ensure its suitability to support the solar array frame.
- Each row of solar panels shall have minimum of two rows of railing fixed to the roof framing
- Solar panels to be certified separately
- Timber rafters to support frame to be joint J4, J3, J2 or J1

Refer to attached summary table for interface spacing.
Construction is to be carried out strictly in accordance with the manufacturers instructions. This work was designed in accordance with the provisions of Australian Building Regulations and in accordance with sound, widely accepted engineering principles.

Yours faithfully,
Gamcorp (Melbourne) Pty Ltd



Martin Gamble
Managing Director
MAICD

Milan Bjelobrk
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RPEQ 12090, RBP EC-38461, NT BPB 139671ES

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Structural Design Documentation

Solar Roof Interface Spacing Tables According to AS/NZS 1170.2-2011 Amdt 3-2012 Within Australia Terrain Category 2

For:

Chiko Solar

Job Number: 1418
Date: 28 November 2014

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Job No: **1418**

Client: **Chiko Solar**

Project: **SolarRoof Interface Spacing Table**

Address: **Within Australia**

Australian Standards

AS 1170. 2011 – Structural Design Actions
Part 0 – General Principles
Part 1 – Permanent imposed and other actions
Part 2 – Wind Actions

AS 1664.1 – Aluminium structures - Limit state design

Wind Terrain Category: WTC2

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 obstruction per obstructions per hectare

Designed: **B.C**

Date: **Nov-14**

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Client: **Chiko Solar** Job: **1418**
Project: **Solar Array Interface Spacing Table** Date: **Nov-14**
Address: **Within Australia**
Designed: **B.C**

Solar Array Interface Spacing Table for Tiled Roof

Type of Rail CK-FT-7R
Type of Interface Roof Tile Hook
Solar Panel Dimension 1650 x 992
Terrain category **2**

Roof Angle (Φ) – Φ < 5°

Wind Region	Building Height – H (m)								
		H≤10			10<H≤15			15<H≤20	
	Max wind Speed	D.W & U.W	Central		D.W & U.W	Central		D.W & U.W	Central
A	43m/s, 154.8 km/h, 96.1 mile/h	**794**	**977**		**716**	**880**		**675**	**829**
B	52 m/s, 190.8 km/h, 118.5 mile/h	**533**	**653**		**481**	**589**		**454**	**556**
C	69.3 m/s, 249 km/h, 154.3 mile/h	**295**	**360**		**267**	**325**		**252**	**307**
D	88.8 m/s, 319.68 km/h, 198.6 mile/h	**181**	**221**		**164**	**200**		**155**	**189**

Roof Angle (Φ) – 5°≤Φ ≤ 30

Wind Region	Building Height – H (m)								
		H≤10			10<H≤15			15<H≤20	
	Max wind Speed	D.W & U.W	Central		D.W & U.W	Central		D.W & U.W	Central
A	43m/s, 154.8 km/h, 96.1 mile/h	**794**	**1154**		**716**	**1038**		**675**	**977**
B	52 m/s, 190.8 km/h, 118.5 mile/h	**533**	**768**		**481**	**693**		**454**	**653**
C	69.3 m/s, 249 km/h, 154.3 mile/h	**295**	**421**		**267**	**381**		**252**	**360**
D	88.8 m/s, 319.68 km/h, 198.6 mile/h	**181**	**258**		**164**	**234**		**155**	**221**

Solar Array Interface spacing Table for Tin Roof

Type of Rail CK-FT-7R
Type of Interface Tin Roof L Hook
Solar Panel Dimension 1650 x 992
Terrain category **2**

Roof Angle (Φ) – Φ < 5°

Wind Region	Building Height – H (m)								
		H≤10			10<H≤15			15<H≤20	
	Max wind Speed	D.W & U.W	Central		D.W & U.W	Central		D.W & U.W	Central
A	43m/s, 154.8 km/h, 96.1 mile/h	**952**	**1170**		**859**	**1054**		**810**	**993**
B	52 m/s, 190.8 km/h, 118.5 mile/h	**642**	**786**		**580**	**710**		**547**	**669**
C	69.3 m/s, 249 km/h, 154.3 mile/h	**213**	**260**		**193**	**235**		**182**	**222**
D	88.8 m/s, 319.68 km/h, 198.6 mile/h	**131**	**160**		**119**	**144**		**112**	**136**

Roof Angle (Φ) – 5°≤Φ ≤ 30

Wind Region	Building Height – H (m)								
		H≤10			10<H≤15			15<H≤20	
	Max wind Speed	D.W & U.W	Central		D.W & U.W	Central		D.W & U.W	Central
A	43m/s, 154.8 km/h, 96.1 mile/h	**952**	**1380**		**859**	**1243**		**810**	**1170**
B	52 m/s, 190.8 km/h, 118.5 mile/h	**642**	**925**		**580**	**834**		**547**	**786**
C	69.3 m/s, 249 km/h, 154.3 mile/h	**213**	**305**		**193**	**276**		**182**	**260**
D	88.8 m/s, 319.68 km/h, 198.6 mile/h	**131**	**187**		**119**	**169**		**112**	**160**

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Client: **Chiko Solar** Job: **1418**
Project: **Solar Array Interface Spacing Table** Date: **Nov-14**
Address: **Within Australia**
Designed: **B.C**

General Notes

Note 1 — All holes must be pre drilled, with minimum screw embedment of 35 mm into timber.

Note 2 — The width of Timber purlins shall not be less than 35mm

Note 3 — Recommended screws

Metal Purlins/Battens	**Fasteners to use**
1.2 mm and Above	14g 10 TPI Teks (Buildex screws)
Wood purlins and Rafter	**Fasteners to use**
Pine and Hardwood (35mm embedment and above)	14g 10 TPI (T17s) (Buildex screws)

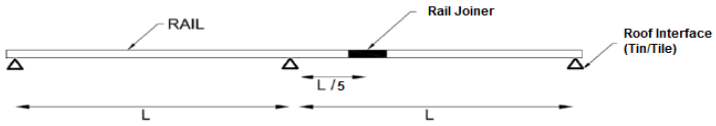
Note 4 — Roof Tile Hook must be fixed with minimum of three 14g 10 TPI Teks (Buildex screws)

Note 5 — Following components are satisfied to use according to AS1170.2011

Components	**Part Number**	Description
Tile Hook	CK-FTH-01	Tile Roof Interface
Tin Roof L Hook	CK-FTH-013	Tin Roof Interface
Rail	CK-FT-7R	Aluminium Rail
Rail Joiner	CK-FT-SK	Rail Connector
End Clamp	CK-FTE_40	Panel to rail fixing
Mid Clamp	CK-FTM-40	Panel to rail fixing
Roof Tile Screw		14g 10 TPI screws

Note 6 — 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 obstruction per obstructions per hectare.

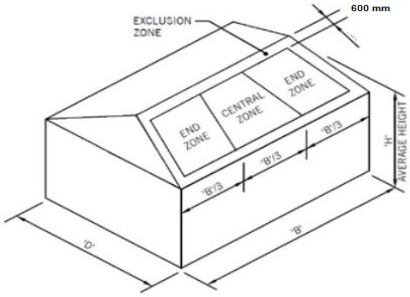
Note 7 — Rail Joiner connection must placed at the fifth of the length of the interface spacing. No rail joiner should be placed at the centre of spacing or over the rail support.

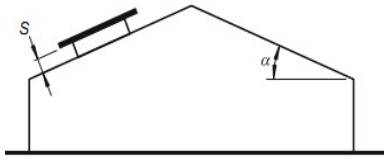


Note 8 — For the definition of Downwind, Upwind end and middle, refer attached figure D9 from AS/NZS 1170.2-2011 Amdt 2-2012.

Note 9 — Figure 1: Shows location of the Upwind/Central & Downwind end.

Flush mounted arrays:





Panel Must be installed flat to the roof

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Client: **Chiko Solar** Job: **1418**
Project: **Solar Array Interface Spacing Table** Date: **Nov-14**
Address: **Within Australia**
Designed: **B.C**

Note 10	Figure 2: National Wind Map, which shows different wind regions

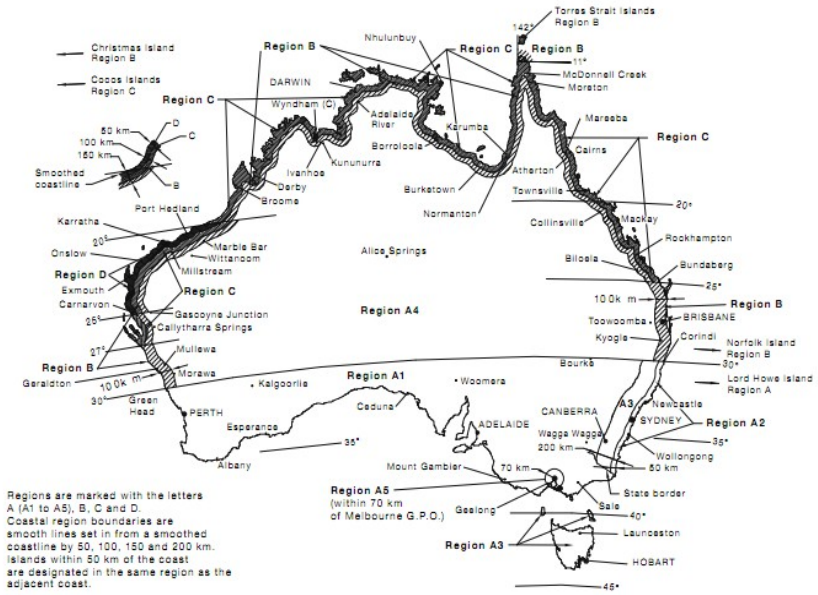

FIGURE 3.1(A) WIND REGIONS

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Structural Design Documentation

Solar Roof Interface Spacing Tables According to AS/NZS 1170.2-2011 Amdt 3-2012 Within Australia Terrain Category 3

For:

Chiko Solar

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CONSULT AUSTRALIA
Representing Engineering Excellence

Job Number: 1418
Date: 28 November 2014

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Client: **Chiko Solar**

Project: **SolarRoof Interface Spacing Table**

Address: **Within Australia**

Australian Standards

AS 1170. 2011 – Structural Design Actions
Part 0 – General Principles
Part 1 – Permanent imposed and other actions
Part 2 – Wind Actions

AS 1664.1 – Aluminium structures - Limit state design

Wind Terrain Category: WTC3

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.

Designed: **B.C**

Date: **Nov-14**

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Client: **Chiko Solar** Job: **1418**
Project: **Solar Array Interface Spacing Table** Date: **Nov-14**
Address: **Within Australia**
Designed: **B.C**

Solar Array Interface Spacing Table for Tiled Roof

Type of Rail CK-FT-7R
Type of Interface Roof Tile Hook
Solar Panel Dimension 1650 x 992
Terrain category **3**

Roof Angle (Φ) – Φ < 5°

Wind Region	Building Height – H (m)								
		H≤10			10<H≤15			15<H≤20	
	Max wind Speed	D.W & U.W	Central		D.W & U.W	Central		D.W & U.W	Central
A	43m/s, 154.8 km/h, 96.1 mile/h	**1185**	**1468**		**1019**	**1258**		**906**	**1117**
B	52 m/s, 190.8 km/h, 118.5 mile/h	**788**	**969**		**680**	**835**		**606**	**743**
C	69.3 m/s, 249 km/h, 154.3 mile/h	**432**	**529**		**374**	**457**		**335**	**408**
D	88.8 m/s, 319.68 km/h, 198.6 mile/h	**265**	**323**		**230**	**280**		**205**	**250**

Roof Angle (Φ) – 5°≤Φ ≤ 30

Wind Region	Building Height – H (m)								
		H≤10			10<H≤15			15<H≤20	
	Max wind Speed	D.W & U.W	Central		D.W & U.W	Central		D.W & U.W	Central
A	43m/s, 154.8 km/h, 96.1 mile/h	**1185**	**1641**		**1019**	**1492**		**906**	**1321**
B	52 m/s, 190.8 km/h, 118.5 mile/h	**788**	**1145**		**680**	**984**		**606**	**876**
C	69.3 m/s, 249 km/h, 154.3 mile/h	**432**	**621**		**374**	**537**		**335**	**479**
D	88.8 m/s, 319.68 km/h, 198.6 mile/h	**265**	**378**		**230**	**328**		**205**	**293**

Solar Array Interface spacing Table for Tin Roof

Type of Rail CK-FT-7R
Type of Interface Tin Roof L Hook
Solar Panel Dimension 1650 x 992
Terrain category **3**

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Wind Region	Building Height – H (m)								
		H≤10			10<H≤15			15<H≤20	
	Max wind Speed	D.W & U.W	Central		D.W & U.W	Central		D.W & U.W	Central
A	43m/s, 154.8 km/h, 96.1 mile/h	**1270**	**1380**		**1219**	**1441**		**1085**	**1336**
B	52 m/s, 190.8 km/h, 118.5 mile/h	**949**	**1168**		**819**	**1006**		**730**	**896**
C	69.3 m/s, 249 km/h, 154.3 mile/h	**312**	**382**		**271**	**331**		**242**	**295**
D	88.8 m/s, 319.68 km/h, 198.6 mile/h	**191**	**233**		**166**	**202**		**149**	**181**

Roof Angle (Φ) – 5°≤Φ ≤ 30

Wind Region	Building Height – H (m)								
		H≤10			10<H≤15			15<H≤20	
	Max wind Speed	D.W & U.W	Central		D.W & U.W	Central		D.W & U.W	Central
A	43m/s, 154.8 km/h, 96.1 mile/h	**1270**	**1490**		**1219**	**1480**		**1085**	**1410**
B	52 m/s, 190.8 km/h, 118.5 mile/h	**949**	**1379**		**819**	**1186**		**730**	**1055**
C	69.3 m/s, 249 km/h, 154.3 mile/h	**312**	**449**		**271**	**388**		**242**	**346**
D	88.8 m/s, 319.68 km/h, 198.6 mile/h	**191**	**273**		**166**	**237**		**149**	**212**

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Client: **Chiko Solar** Job: **1418**
Project: **Solar Array Interface Spacing Table** Date: **Nov-14**
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Designed: **B.C**

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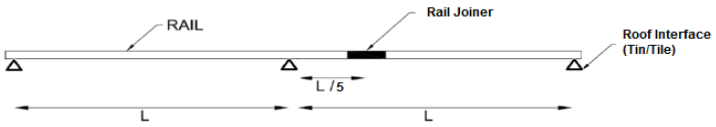

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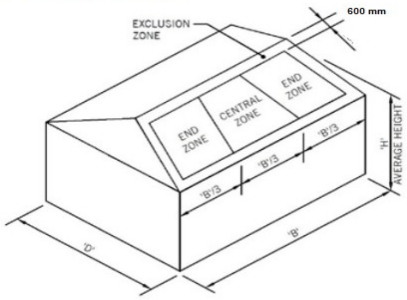
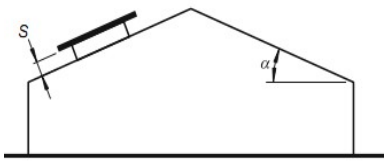
Flush mounted arrays:





Panel Must be installed flat to the roof

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Note 10	Figure 2: National Wind Map, which shows different wind regions

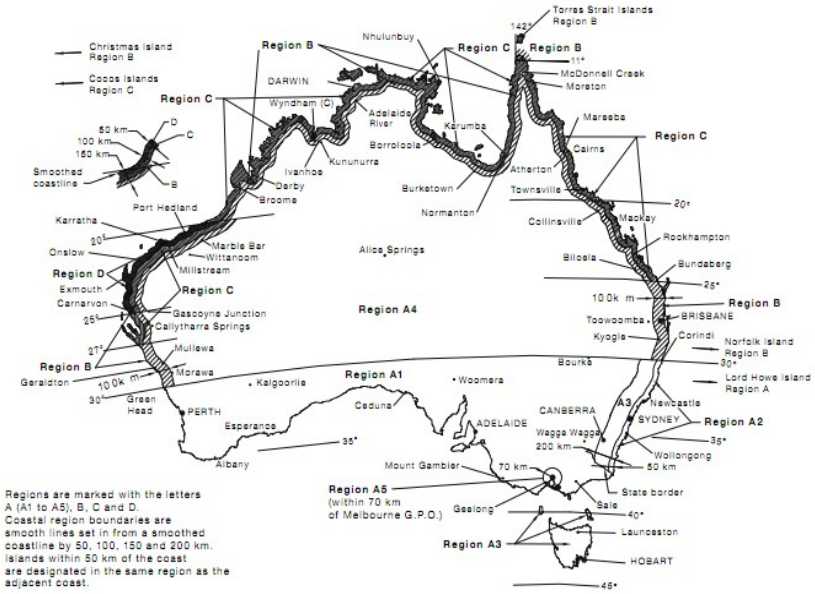

FIGURE 3.1(A) WIND REGIONS