



EBULEN CONSULT

SOLAR PV ROOF-MOUNT RACKING FRAME ENGINEERING CERTIFICATE

ANTAI TILT LEG SYSTEM WITH 499 RAIL & LL305 CLAMPS

Prepared for:

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Ref: E22110958

OVERVIEW

This structural engineering certificate is issued for Antai Solar Roof Tilt Leg racking system with 499 rail and non-penetrative roof clamp fixing, which has been assessed against relevant Australian Standards and regulations. The assessment is carried out based on sound engineering methodologies. Assessment specifications and findings are given in the following sections.

AUSTRALIAN STANDARDS

- AS/NZS 1170.0:2002 – Structural design actions, Part 0: General principles
- AS/NZS 1170.1:2002 (R2016) – Structural design actions, Part 1: Permanent, imposed and other actions
- AS/NZS 1170.2:2021 – Structural design actions, Part 2: Wind actions
- AS/NZS 1664:1997 – Aluminum Structures

ASSESSED PV RACKING FRAME PARTS

The following products by Antai Technology Co., Ltd. are assessed against relevant Australian Standards and building regulations based on the specified conditions.

Part Category	Included Parts	Part Material
Rail	ATL-TYN-499	AL 6005-T6
Rail Splice	ATL-TYN-304/54	AL 6005-T6
	ATL-CG-20	AL 6005-T6
Tilt Leg Kit	ATL-TYN-07	AL 6005-T6
	ATL-TYN-57	AL 6005-T6
	ATL-TYN-58	AL 6005-T6
	ATL-TYN-71	AL 6005-T6
	ATL-TYN-329	AL 6005-T6
Inter/End Panel Clamp Kit	ATL-FWNY-09	AL 6005-T6
	ATL-GN-003	AL 6005-T6
	ATL-CG-018	AL 6005-T6
Klip Lock Roof Clamp	ATL-TYN-307/308	AL 6005-T5

ASSESSMENT CONDITIONS

- Solar PV system design life of 25 years
- Wind region A, B, C, D
- Terrain category 2.0, 2.5, 3.0
- Ultimate wind recurrence interval of 200 years
- Maximum average roof height of 20m
- Solar PV panel assessed: 2300mm x 1200mm, 2100mm x 1100mm, 2000mm x 1100mm, 1700mm x 1100mm
- Self-weight of solar PV panel and racking frame is 0.15kPa-0.18kPa
- Solar PV panel is supported by minimum 2 rails
- The clamps have been assessed with the Lysaght Longline 305 roof sheeting
- The clamps capacities are taken from below testing reports: No. 20-0250 by Melbourne Testing Services (MTS) Pty Ltd, dated 22/06/2020
- The racking rail capacity is taken as per the test report: No.XMML23090468_EN by BM Shenghe Testing Technology (Xiamen) Co., Ltd, dated 19/09/2023.
- The pull-out capacity of Antai Tilt Leg kit is taken from Test Report No. XMIN22000964ML03_EN by SGS-CSTC Standards Technical Service Co., Ltd. Xiamen Branch. Dated at 16/09/2022
- Product details are taken from the drawing set provided by Antai Technology Co., Ltd. as listed in the above component table
- Installation to be carried out strictly in accordance with the manufacturer's installation guidelines

IMPORTANT NOTES

- ***This certification is issued based on assessments of solar PV racking frame system and its fixing connection to building roof. It has not considered the structural capacity of building structure and solar PV panel due to uncertainty of generic application. The installer must use the data tables as references only.***
- ***The attached spacing tables must be read in conjunction with foot notes and general notes.***
- ***The certificate shall be read as a whole. Any section, text, image, table extracted from this certification is not valid stand-alone.***
- ***This certification shall be reviewed and revalidated by the structural engineer after two years from the date of issue or if any applicable standard is updated.***

CONCLUSION

The above-mentioned solar PV roof-mount racking frame system by Antai Technology Co., Ltd. is found structurally sound against relevant Australian Standards following the engineering recommendations in this certification. Installation shall be conducted following the manufacturer's guidelines.

Certified by:



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APPENDIX A – INSTALLATION GUIDELINE

Interface Spacing Table for Terrain Category 3 (Unit: mm)													
Wind Region	Panel Tilt Angle Roof Zone	H<5m			5m<H<10m			10m<H<15m			15m<H<20m		
		Φ < 15°	15° ≤ Φ < 25°	25° ≤ Φ ≤ 45°	Φ < 15°	15° ≤ Φ < 25°	25° ≤ Φ ≤ 45°	Φ < 15°	15° ≤ Φ < 25°	25° ≤ Φ ≤ 45°	Φ < 15°	15° ≤ Φ < 25°	25° ≤ Φ ≤ 45°
A	Internal Zone	1227	764	619	1227	764	619	1048	658	533	929	585	475
	Intermediate Zone	783	496	403	783	496	403	673	428	349	599	382	311
	Edge Zone	575	367	299	575	367	299	496	317	259	442	283	231*
	Corner Zone	375	241*	197*	375	241*	197*	324	209*	171*	290	187*	153*
B1	Internal Zone	805	509	414	805	509	414	692	439	358	615	392	319
	Intermediate Zone	521	333	272	521	333	272	450	288	235*	401	257	210*
	Edge Zone	385	247*	202*	385	247*	202*	333	214*	175*	297	192*	157*
	Corner Zone	253	163*	134*	253	163*	134*	219*	142*	116*	196*	127*	104*
B2	Internal Zone	724	459	374	724	459	374	623	397	323	555	354	289
	Intermediate Zone	470	301	246*	470	301	246*	406	261	213*	362	233*	190*
	Edge Zone	348	224*	183*	348	224*	183*	301	194*	159*	269	173*	142*
	Corner Zone	229*	148*	121*	229*	148*	121*	198*	128*	105*	177*	115*	94*
C	Internal Zone	464	297	243*	464	297	243*	401	258	210*	358	230*	188*
	Intermediate Zone	304	196*	160*	304	196*	160*	263	170*	139*	235*	152*	124*
	Edge Zone	226*	146*	120*	226*	146*	120*	196*	127*	104*	175*	113*	93*
	Corner Zone	149*	97*	79*	149*	97*	79*	130*	84*	69*	116*	75*	62*
D	Internal Zone	298	192*	157*	298	192*	157*	258	167*	136*	231*	149*	122*
	Intermediate Zone	197*	127*	104*	197*	127*	104*	170*	110*	90*	152*	99*	81*
	Edge Zone	147*	95*	78*	147*	95*	78*	127*	82*	67*	114*	74*	60*
	Corner Zone	97*	63*	51*	97*	63*	51*	84*	55*	45*	75*	49*	40*

- NOTES:
- * denotes the situations where the wind load is more than 5KPa and the installation safety is compromised.
 - Definition of Terrain Category is given in General Note 1.
 - Notion of Roof Zone is given in General Note 2.
 - Panel tilt angle is given in reference to roof surface
 - The spacing table is based on the fixing condition specified in General Note 6.

Interface Spacing Table for Terrain Category 2.5 (Unit: mm)													
Wind Region	Panel Tilt Angle Roof Zone	H<5m			5m<H<10m			10m<H<15m			15m<H<20m		
		Φ < 15°	15° ≤ Φ < 25°	25° ≤ Φ ≤ 45°	Φ < 15°	15° ≤ Φ < 25°	25° ≤ Φ ≤ 45°	Φ < 15°	15° ≤ Φ < 25°	25° ≤ Φ ≤ 45°	Φ < 15°	15° ≤ Φ < 25°	25° ≤ Φ ≤ 45°
A	Internal Zone	1103	690	560	974	612	497	867	547	445	794	502	409
	Intermediate Zone	707	449	365	627	399	325	560	358	292	514	329	268
	Edge Zone	520	332	271	462	296	242*	414	265	217*	380	244*	200*
	Corner Zone	340	219*	179*	303	195*	160*	272	175*	143*	250	161*	132*
B1	Internal Zone	727	461	375	644	410	334	575	367	299	528	338	275
	Intermediate Zone	472	302	247*	420	269	220*	376	241*	197*	345	222*	182*
	Edge Zone	349	225*	184*	311	200*	164*	279	180*	147*	256	165*	135*
	Corner Zone	230*	148*	121*	205*	132*	108*	184*	119*	97*	169*	109*	90*
B2	Internal Zone	654	416	339	581	370	302	519	332	271	476	305	249
	Intermediate Zone	426	273	223*	379	243*	199*	339	218*	179*	312	201*	164*
	Edge Zone	316	203*	166*	281	181*	148*	252	163*	133*	232*	150*	123*
	Corner Zone	208*	134*	110*	185*	120*	98*	166*	108*	88*	153*	99*	81*
C	Internal Zone	421	270	220*	374	241*	197*	335	216*	176*	308	199*	162*
	Intermediate Zone	276	178*	146*	246*	159*	130*	221*	143*	117*	203*	131*	107*
	Edge Zone	205*	133*	109*	183*	118*	97*	164*	106*	87*	151*	98*	80*
	Corner Zone	136*	88*	72*	121*	78*	64*	109*	70*	58*	100*	65*	53*
D	Internal Zone	271	175*	143*	241*	156*	127*	216*	140*	114*	199*	129*	105*
	Intermediate Zone	179*	115*	95*	159*	103*	84*	143*	93*	76*	132*	85*	70*
	Edge Zone	133*	86*	71*	119*	77*	63*	107*	69*	57*	98*	64*	52*
	Corner Zone	88*	57*	47*	79*	51*	42*	71*	46*	38*	65*	42*	35*

- NOTES:
- * denotes the situations where the wind load is more than 5KPa and the installation safety is compromised.
 - Definition of Terrain Category is given in General Note 1.
 - Notion of Roof Zone is given in General Note 2.
 - Panel tilt angle is given in reference to roof surface
 - The spacing table is based on the fixing condition specified in General Note 6.

Interface Spacing Table for Terrain Category 2 (Unit: mm)													
Wind Region	Panel Tilt Angle Roof Zone	H<5m			5m<H<10m			10m<H<15m			15m<H<20m		
		Φ < 15°	15° ≤ Φ < 25°	25° ≤ Φ ≤ 45°	Φ < 15°	15° ≤ Φ < 25°	25° ≤ Φ ≤ 45°	Φ < 15°	15° ≤ Φ < 25°	25° ≤ Φ ≤ 45°	Φ < 15°	15° ≤ Φ < 25°	25° ≤ Φ ≤ 45°
A	Internal Zone	998	627	509	811	513	417	730	463	377	687	436	355
	Intermediate Zone	642	408	333	525	336	274	474	303	248*	447	286	234*
	Edge Zone	473	303	247*	388	249	204*	351	226*	184*	331	213*	174*
	Corner Zone	310	200*	163*	255	165*	135*	231*	149*	122*	218*	141*	115*
B1	Internal Zone	660	419	342	539	345	281	487	311	254	459	294	240*
	Intermediate Zone	429	275	225*	353	227*	185*	319	205*	168*	301	194*	158*
	Edge Zone	318	205*	167*	262	169*	138*	237*	153*	125*	223*	144*	118*
	Corner Zone	209*	135*	111*	173*	112*	91*	156*	101*	83*	148*	96*	78*
B2	Internal Zone	594	379	309	487	311	254	439	282	230*	414	266	217*
	Intermediate Zone	388	249	203*	319	205*	168*	288	186*	152*	272	175*	143*
	Edge Zone	288	185*	152*	237*	153*	125*	214*	138*	113*	202*	131*	107*
	Corner Zone	190*	123*	100*	156*	101*	83*	142*	92*	75*	134*	87*	71*
C	Internal Zone	383	246*	201*	315	203*	166*	285	183*	150*	269	173*	142*
	Intermediate Zone	252	162*	133*	207*	134*	110*	188*	121*	99*	177*	115*	94*
	Edge Zone	187*	121*	99*	155*	100*	82*	140*	91*	74*	132*	86*	70*
	Corner Zone	124*	80*	66*	102*	66*	54*	93*	60*	49*	87*	57*	46*
D	Internal Zone	247*	159*	130*	203*	131*	108*	184*	119*	97*	174*	112*	92*
	Intermediate Zone	163*	105*	86*	134*	87*	71*	122*	79*	65*	115*	74*	61*
	Edge Zone	121*	79*	64*	100*	65*	53*	91*	59*	48*	86*	56*	46*
	Corner Zone	80*	52*	43*	66*	43*	35*	60*	39*	32*	57*	37*	30*

NOTES:

- * denotes the situations where the wind load is more than 5KPa and the installation safety is compromised.
- Definition of Terrain Category is given in General Note 1.
- Notion of Roof Zone is given in General Note 2.
- Panel tilt angle is given in reference to roof surface
- The spacing table is based on the fixing condition specified in General Note 6.

General Notes

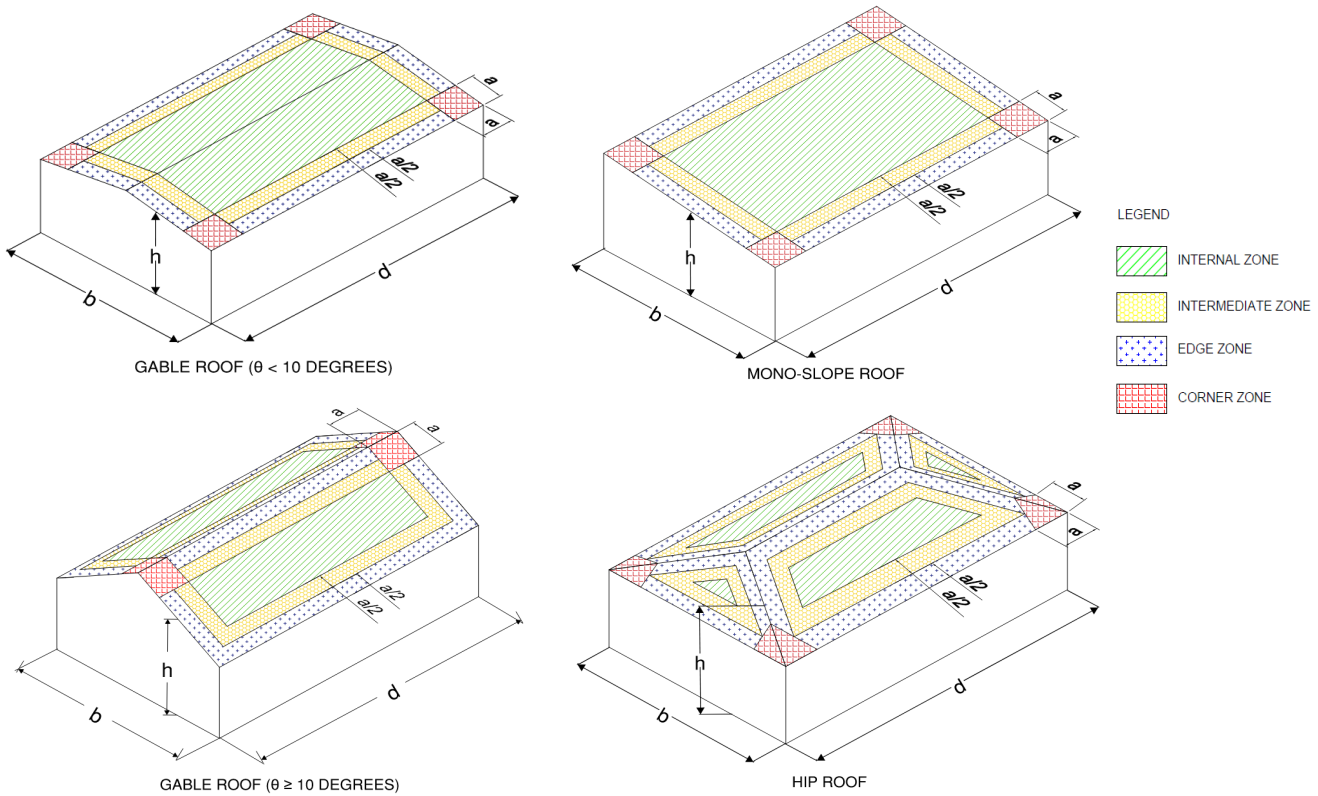
Note 1 Terrain Category 3 (TC 3) denotes terrain with numerous closely spaced obstructions having heights generally from 3m to 10m. The minimum density of obstructions shall be at least the equivalent of 10 house-size obstructions per hectare.

Terrain Category 2.5 (TC 2.5) denotes terrain with some trees or isolated obstructions, terrain in developing outer urban areas with scattered houses, or large acreage developments with more than two and less than 10 buildings per hectare.

Terrain Category 2 (TC 2) denotes open terrain, including grassland, with well-scattered obstructions having heights generally from 1.5m to 5m, with no more than two obstructions per hectare.

Refer to AS/NZS 1170.2:2021 - 4.2.1 for Terrain Category definitions.

Note 2 Notion of Roof Zone examples are shown in the following figures.



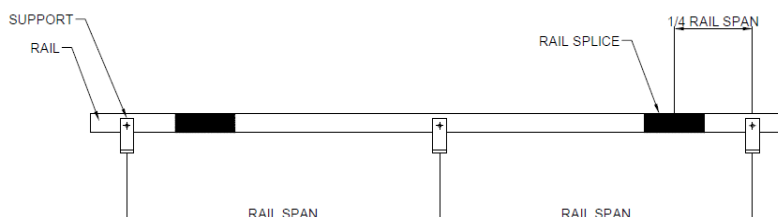
Refer to AS/NZS 1170.2:2021 – Chapter 5.4.4 for more accurate Roof Zone notion and cases.

To determine the zone dimension "a", follow the steps:

- 1) Determine building height (h), building length (b) and building width (d).
- 2) Determine (h/d) and (h/b)
- 3) If (h/b) or (h/d) ≥ 0.2 , a is the minimum of 0.2b or 0.2d
- 4) If (h/b) and (h/d) < 0.2 , a is equal to 2h

Note: "h" represents the average roof height. Average roof height = (pitch height - gutter height)/2

Note 3 To ensure the fixing spacing in above tables are valid, rail splice connectors must not be installed at the support point or at the middle span point between two adjacent supports. It is recommended to install the connector at 1/4 span points from the supports.



Note 4 Number of panel clamps required per panel for installation when the tilting angle is **less than 15 degrees**:

		TC3			TC2.5			TC2		
		H≤10m	10m<H≤15m	15m<H≤20m	H≤10m	10m<H≤15m	15m<H≤20m	H≤10m	10m<H≤15m	15m<H≤20m
Region A	Internal	4	4	4	4	4	4	4	4	4
	Intermediate	4	4	4	4	4	4	4	4	4
	Edge	4	4	4	4	6	6	6	6	6
	Corner	6	6	6	6	8	8	8	8	8
Region B1&B2	Internal	4	4	4	4	4	4	4	4	4
	Intermediate	4	4	6	6	6	6	6	6	6
	Edge	6	6	6	8	8	8	8	8	8
Region C	Internal	4	6	6	6	6	6	6	8	8
	Intermediate	6	8	8	8	8	10	10	10	10
	Edge	8	10	10	10	NA	NA	NA	NA	NA
	Corner	NA	NA	NA	NA	NA	NA	NA	NA	NA
Region D	Internal	6	8	8	8	8	8	10	10	10
	Intermediate	10	NA	NA	NA	NA	NA	NA	NA	NA
	Edge	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Corner	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

1. NA denotes the situations where an excessive amount of panel clamps are required and the installation is no longer practical.
2. A site-specific engineering assessment must be carried out to determine the number of panel clamps required for situations not covered in this table.

Number of panel clamps required per panel for installation with tilting angle **up to 45 degrees**:

		TC3			TC2.5			TC2		
		H≤10m	10m<H≤15m	15m<H≤20m	H≤10m	10m<H≤15m	15m<H≤20m	H≤10m	10m<H≤15m	15m<H≤20m
Region A	Internal	4	4	4	4	4	6	6	6	6
	Intermediate	6	6	6	6	6	8	8	8	8
	Edge	6	8	8	8	8	10	10	10	10
	Corner	10	NA	NA	NA	NA	NA	NA	NA	NA
Region B1&B2	Internal	6	6	6	6	8	8	8	8	10
	Intermediate	8	10	10	10	10	NA	NA	NA	NA
	Edge	10	NA	NA	NA	NA	NA	NA	NA	NA
Region C	Internal	8	10	10	10	10	NA	NA	NA	NA
	Intermediate	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Edge	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Corner	NA	NA	NA	NA	NA	NA	NA	NA	NA
Region D	Internal	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Intermediate	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Edge	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Corner	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

1. NA denotes the situations where an excessive amount of panel clamps are required and the installation is no longer practical.
2. A site-specific engineering assessment must be carried out to determine the number of panel clamps required for situations not covered in this table.

Note 5 The provided installation spacing tables are based on maximum PV panel size of 2300mm x 1200mm with 2 rails per panel array. For other panel sizes and more rails, refer the below table for adjustment factors based on the given spacing tables.

Maximum Panel Size	Number of Rails	Spacing Adjustment Factor
2300x1200	3 rails	120%
2300x1200	4 rails	160%
2100x1100	2 rails	109%
2100x1100	3 rails	131%
2100x1100	4 rails	175%
2000x1100	2 rails	115%
2000x1100	3 rails	138%
2000x1100	4 rails	176%
1700x1100	2 rails	130%
1700x1100	3 rails	162%
1700x1100	4 rails	214%

Note: The maximum allowable fixing spacing shall not exceed 1400mm after applying the adjustment factors.

Note 6 The clamps capacities are taken from testing report No.20-0250 by Melbourne Testing Services Pty Ltd, dated 22/06/2020. This test was carried out using Lysaght Longline 305 Non-penetrative roof sheeting clamps. Other roof sheeting products are not covered in this assessment. **The clamps must be mounted over purlins and lapped roof sheeting ribs. No clamp is allowed to be installed on full roof sheeting ribs.**

Note 7 All above-mentioned adjustment factors from different notes shall not be applied together to determine the final installation spacing. Factors from each note shall be applied independently. For multiple installation conditions change, please seek for the engineer's advice.