1.0 Reference and Address

Report Number	220401269HAN-001S	Original Issued: 28-Apr-2022	Revised: 29-May-2023
Standard(s)	Photovoltaic (PV) Module Safety Qualification - Part 1: Requirements For Construction [UL 61730-1:2017 Ed.1+R:30Apr2020] Photovoltaic (PV) Module Safety Qualification - Part 1: Requirements for Construction [CSA C22.2#61730-1:2019 Ed.2] Photovoltaic (PV) Module Safety Qualification - Part 2: Requirements For Testing [UL 61730-2:2017 Ed.1+R:30Apr2020] Photovoltaic (PV) Module Safety Qualification - Part 2: Requirements for Testing [CSA C22.2#61730-2:2019 Ed.2] Terrestrial Photovoltaic (Pv) Modules - Design Qualification And Type Approval - Part 1: Test Requirements [UL 61215-1:2017 Ed.1] Terrestrial Photovoltaic (PV) Modules - Design Qualification And Type Approval - Part 1-1: Special Requirements For Testing of Crystalline Silicon Photovoltaic (PV) Modules [UL 61215-1-1:2017 Ed.1] Terrestrial Photovoltaic (Pv) Modules - Design Qualification And Type Approval - Part 2: Test Procedures [UL 61215-2:2017 Ed.1]		

Applicant	Toenergy Technology Hangzhou Co Ltd	Manufacturer 1	**Toenergy Technology Hangzhou Co.,Ltd**
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Manufacturer 2	**Toenergy Solar SDN BHD**
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2.0 Product Description	
Product	Crystalline Silicon Photovoltaic (PV) Modules
Brand name	TOENERGY
Description	The product covered by this report are terrestrial used photovoltaic modules which convert elements of the electromagnetic spectrum to DC electrical power. The basic construction consists of a laminated assembly of solar cells, which are interconnected with conductive matrial such as ribbons, and encapsulated within an insulating material. This encapsulated assembly is sandwiched between a rigid transparent top frontsheet and an insulating transparent or white backsheet. The laminated assembly mostly be supported by an anodized Aluminum frame. Field wiring connections to the module are made via a factory installed junction box with polarized mating cables and connectors. The modules include a weatherproof junction box with mating connectors only provided for field-connection. The modules are manufactured from the factory and shipped fully assembled. An installation manual is provided. The modules must be mounted over a fire resistant roof covering material rated for the application. Internal buss ribbon wires, and cross buss ribbon wires are enclosed within the module front cover and back substrate. Bypass diodes are provided inside the junction box. Modules are intended to be installed in accordance with the National Electrical Code, NFPA 70 and Canadian Electrical Code (CEC) respectively.
Models	61798, 61791, 61849 412922, 412923, 412924 TN- followed by 60-; followed by 320, 325, 330, 335 or 340; followed by M. TN- followed by 72-; followed by 380, 385, 390, 395, 400, 405 or 410; followed by M. TN- followed by 60-; followed by 360, 365, 370 or 375; followed by MH. TN- followed by 72-; followed by 430, 435, 440, 445, 450 or 455; followed by MH. TN- followed by MG144-; followed by 525, 530, 535, 540, 545, 550 or 555. TN- followed by MG132-; followed by 480, 485, 490, 495, 500 or 505. TN- followed by MG120-; followed by 435, 440, 445, 450, 455 or 460. TN- followed by MG108-; followed by 390, 395, 400, 405, 410 or 415. 413540, 412918, 412920, 413541, 412919, 412921, 61878

2.0 Product Description

Model Similarity

All Models have similar structure.
61798 with 44 cells (166 mm x 55.3 mm, Mono-Si)
61791 with 44 cells (166 mm x 83 mm, Mono-Si)
61849 with 72 cells (166 mm x 41.5 mm, Mono-Si)
412922 and 61798 are identical expect for the name.
412923 and 61791 are identical expect for the name.
412924 and 61849 are identical expect for the name.
413540 with 44 cells (91 mm x 45.5 mm, Mono-Si)
412918 with 44 cells (91 mm x 45.5 mm, Mono-Si)
412920 and 412918 are identical expect for the name.
413541 with 39 cells (182 mm x 45.5 mm, Mono-Si)
412919 with 39 cells (182 mm x 45.5 mm, Mono-Si)
412921 and 412919 are identical expect for the name.
61878 with 66 cells (182 mm x 91 mm, Mono-Si)
letter 'M' means models with 158.75 x 79.375 cell, letter 'MH' means models with 166 x 83 cell, figures 72 means models with 144 cells, figure 60 means models with 120 cells, letter 'MG' means models with 182 x 91 PREC cell, figures 144 means models with 144 cells, figures 132 means models with 132 cells, figures 120 means models with 120 cells,figures 108 means models with 108 cells, the three figures in the end denote the power output.
Model 61798, 61791, 61849 use transparent backsheet others use white backsheet.

Ratings

Model	Voc (V)±5%	Vpm (V)	Max. system voltage	Ipm (A)	Isc (A)±5%	Max. Power(W)±5%	Maximum Series Fuse, (A)	Protection Class	Total Number of Cells
61798	28.6	24.6	600	3.46	3.72	85	10	II	44
412922	28.6	24.6	600	3.46	3.72	85	10	II	44
61791	29.9	25.7	600	5.26	5.65	135	10	II	44
412923	29.9	25.7	600	5.26	5.65	135	10	II	44
61849	48.9	41.71	600	2.53	2.79	105	10	II	72
412924	48.9	41.71	600	2.53	2.79	105	10	II	72
413540	29.90	25.50	600	1.57	1.65	40	10	II	44
412918	29.90	25.50	600	1.57	1.65	40	10	II	44
412920	29.90	25.50	600	1.57	1.65	40	10	II	44
413541	26.30	22.40	600	2.68	2.84	65	10	II	39
412919	26.30	22.40	600	2.68	2.84	65	10	II	39
412921	26.30	22.40	600	2.68	2.84	65	10	II	39
61878	44.90	38.60	600	6.22	6.76	240	15	II	66
Model	Voc (V)±3%	Vpm (V)	Max. system voltage	Ipm (A)	Isc (A)±5%	Max. Power(W)±3%	Maximum Series Fuse, (A)	Protection Class	Total Number of Cells
TN-60-320M	41	34.5	1500	9.28	9.84	320	20	II	120
TN-60-325M	41.1	34.6	1500	9.4	9.9	325	20	II	120
TN-60-330M	41.2	34.7	1500	9.51	9.96	330	20	II	120
TN-60-335M	41.3	34.8	1500	9.63	10.02	335	20	II	120
TN-60-340M	41.4	34.9	1500	9.75	10.11	340	20	II	120
TN-72-380M	49.1	41.3	1500	9.2	9.79	380	20	II	144
TN-72-385M	49.2	41.4	1500	9.3	9.86	385	20	II	144
TN-72-390M	49.3	41.5	1500	9.4	9.92	390	20	II	144
TN-72-395M	49.4	41.6	1500	9.5	9.97	395	20	II	144
TN-72-400M	49.5	41.7	1500	9.6	10.01	400	20	II	144

2.0 Product Description

	TN-72-405M	49.6	41.8	1500	9.69	10.06	405	20	II	144
	TN-72-410M	49.7	41.9	1500	9.79	10.16	410	20	II	144
	Model	Voc (V)±3%	Vpm (V)	Max. system voltage	Ipm (A)	Isc (A)±3%	Max. Power(W)±3%	Maximum Series Fuse, (A)	Protection Class	Total Number of Cells
	TN-60-360MH	40.4	34.8	1500	10.51	11.31	360	20	II	120
	TN-60-365MH	40.5	34.9	1500	10.58	11.39	365	20	II	120
	TN-60-370MH	40.6	35	1500	10.65	11.46	370	20	II	120
	TN-60-375MH	40.7	35.1	1500	10.72	11.53	375	20	II	120
	TN-72-430MH	48.5	41.7	1500	10.44	11.24	430	20	II	144
	TN-72-435MH	48.6	41.8	1500	10.51	11.31	435	20	II	144
	TN-72-440MH	48.7	41.9	1500	10.58	11.39	440	20	II	144
	TN-72-445MH	48.8	42	1500	10.65	11.46	445	20	II	144
	TN-72-450MH	48.9	42.1	1500	10.72	11.53	450	20	II	144
	TN-72-455MH	49	42.2	1500	10.79	11.6	455	20	II	144
	TN-MG144-555	49.99	41.98	1500	13.22	13.94	555	30	II	144
	TN-MG144-550	49.8	41.85	1500	13.15	13.89	550	30	II	144
	TN-MG144-545	49.61	41.72	1500	13.07	13.82	545	30	II	144
	TN-MG144-540	49.42	41.59	1500	12.99	13.77	540	30	II	144
	TN-MG144-535	49.23	41.46	1500	12.91	13.71	535	30	II	144
	TN-MG144-530	49.04	41.33	1500	12.83	13.65	530	30	II	144
	TN-MG144-525	48.85	41.2	1500	12.75	13.59	525	30	II	144
	TN-MG132-505	45.68	38.45	1500	13.14	13.91	505	30	II	132
	TN-MG132-500	45.51	38.33	1500	13.05	13.86	500	30	II	132
	TN-MG132-495	45.34	38.21	1500	12.96	13.81	495	30	II	132
	TN-MG132-490	45.17	38.09	1500	12.87	13.76	490	30	II	132
	TN-MG132-485	45.00	37.97	1500	12.78	13.71	485	30	II	132
	TN-MG132-480	44.83	37.85	1500	12.69	13.66	480	30	II	132
	TN-MG120-460	41.52	35.01	1500	13.14	13.92	460	30	II	120
	TN-MG120-455	41.36	34.9	1500	13.04	13.87	455	30	II	120
	TN-MG120-450	41.2	34.79	1500	12.94	13.82	450	30	II	120
	TN-MG120-445	41.04	34.68	1500	12.84	13.77	445	30	II	120
	TN-MG120-440	40.88	34.57	1500	12.73	13.72	440	30	II	120
	TN-MG120-435	40.72	34.46	1500	12.63	13.67	435	30	II	120
	TN-MG108-415	37.42	31.5	1500	13.18	13.95	410	30	II	108
	TN-MG108-410	37.30	31.4	1500	13.06	13.95	410	30	II	108
	TN-MG108-405	37.17	31.3	1500	12.94	13.87	405	30	II	108
	TN-MG108-400	37.14	31.2	1500	12.83	13.79	400	30	II	108
	TN-MG108-395	37.01	31.1	1500	12.71	13.7	395	30	II	108
	TN-MG108-390	36.88	31	1500	12.59	13.61	390	30	II	108

2.0 Product Description	
Other Ratings	61798, 412922: 2125x385x35 [mm] (framed) 61791, 412923: 2125x385x35 [mm] (framed) 61849, 412924: 2125x385x35 [mm] (framed) TN-60-xxxM series: 1684x1002x35 [mm] (framed) TN-72-xxxM series: 2008x1002x35 [mm] (framed) TN-60-xxxMH series: 1755x1038x35 [mm] (framed) TN-72-xxxMH series: 2094x1038x35 [mm] (framed) 413540, 413541: 2052x227x35 [mm] (framed) 412918, 412920, 412919, 412921: 2280x227x35 [mm] (framed) 61878: 2115x580x35 [mm] (framed) TN-MG144-XXX series: 2278x1134x30 [mm] (framed) TN-MG132-XXX series: 2094x1134x30 [mm] (framed) TN-MG120-XXX series: 1909x1134x30 [mm] (framed) TN-MG108-XXX series: 1722x1134x30 [mm] (framed) Front side design load = 2400 Pa (model 61798, 61791, 61849, 412922, 412923, 412924, 413540, 412918, 412920, 413541, 412919, 412921, 61878) Back side design load = 2400 Pa (model 61798, 61791, 61849, 412922, 412923, 412924, 413540, 412918, 412920, 413541, 412919, 412921, 61878) Front side design load = 3600 Pa (other model) Back side design load = 1600 Pa (other model) Safety factors = 1.5 Pollution degree: 1 Fire performance: Type 4

3.0 Product Photographs

Photo 1 - Front View of Module 61791

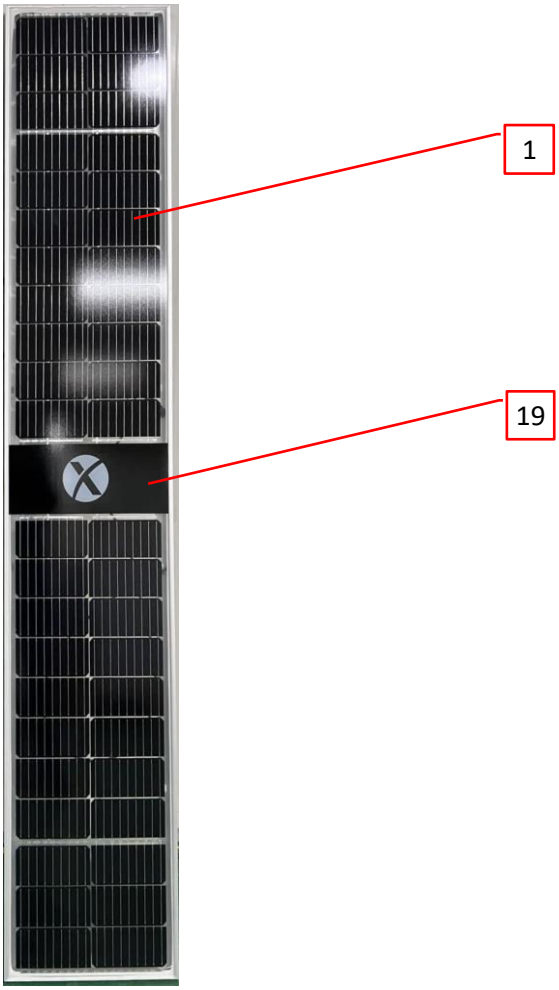
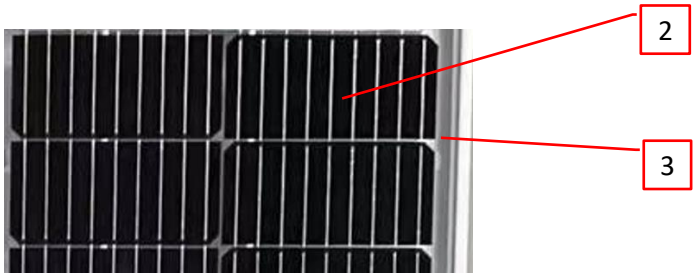
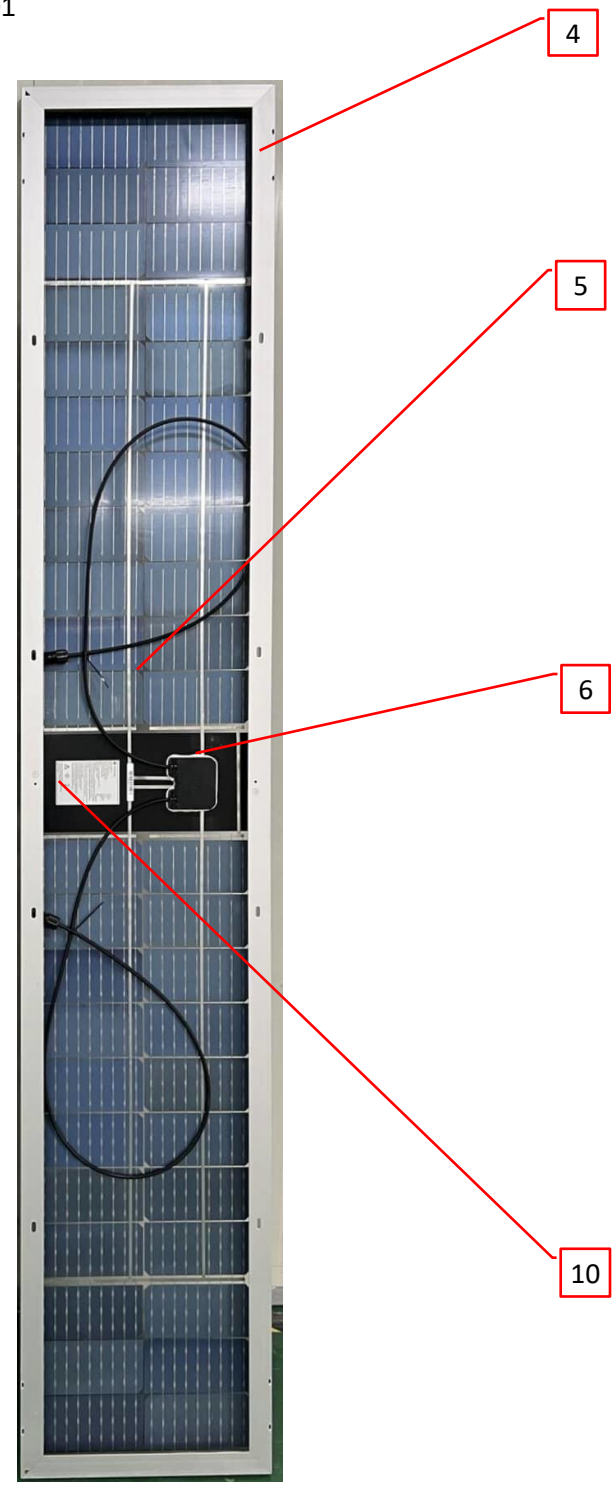


Photo 2 - Close-up View of Module 61791



3.0 Product Photographs

Photo 3 - Rear View of of Module 61791



3.0 Product Photographs

Photo 4 - Detailed View of Junction box and cable

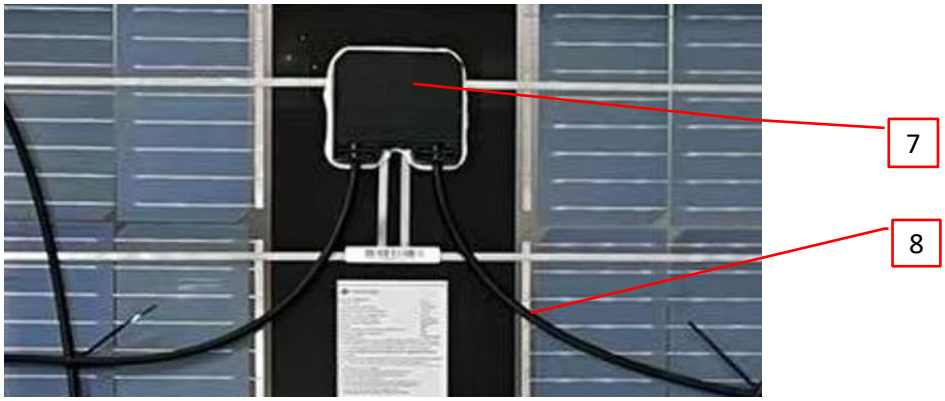
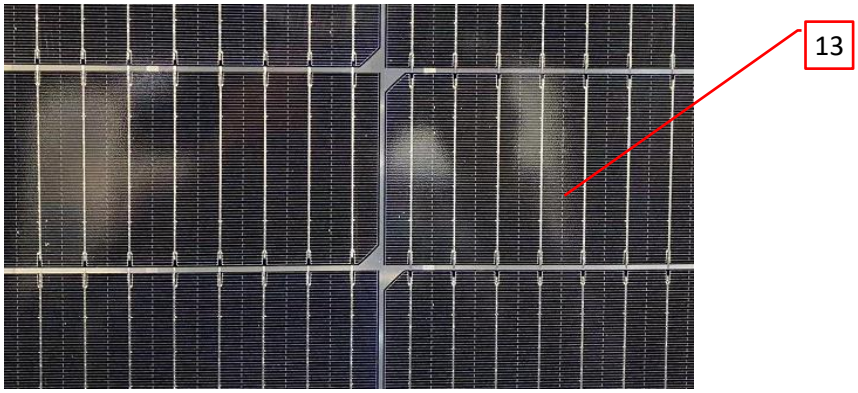


Photo 5 - Detailed View of connector

3.0 Product Photographs

Photo 6 - Close-up View of Monocrystalline Cell



4.0 Critical Components						
Photo #	Item no.[1]	Name	Manufacturer/ trademark[2]	Type / model[2]	Technical data and securement means	Mark(s) of conformity[3]
			Venus Energy (Cambodia) CO.,Ltd	VNS166M-9BB	Mono crystalline silicon 9 busbars could be used as halved cell, thickness 190±30.0μm 61798, 412922 with 44 cells (166 mm x 55.3 mm cell dimensions) . 412922 use WRO mono. 61791, 412923 with 44 cells (166 mm x 83.0 mm cell dimensions) 412923 use WRO mono. 61849 with 72 cells (166 mm x 41.5 mm cell dimensions) 412924 use WRO mono.	NR

4.0 Critical Components						
Photo #	Item no.[1]	Name	Manufacturer/ trademark[2]	Type / model[2]	Technical data and securement means	Mark(s) of conformity[3]
1	1	Cell	Tainergy Tech CO.,Ltd	T1S-00000HE1B	Mono crystalline silicon 9 busbars could be used as halved cell, thickness 190±19.0μm 61798 with 44 cells (166 mm x 55.3 mm cell dimensions). 412922 use WRO mono. 61791 with 44 cells (166 mm x 83.0 mm cell dimensions) 412923 use WRO mono. 61849 with 72 cells (166 mm x 41.5 mm cell dimensions) 412924 use WRO mono. TN-60-xxxMH series with 120 cells . TN-72-xxxMH series with 144 cells (166 mm x 83 mm cell dimensions)	NR
				T1S-xxxxxZ	Mono crystalline silicon 10 busbars could be used as halved cell, thickness 170±17.0μm 182 mm x 91 mm cell dimensions	NR
			Tongwei solar Co.,Ltd.	M1585BPERC	Mono crystalline silicon 5 busbars could be used as halved cell, thickness 190±30μm TN-60-xxxM series with120 cells (158.75mm X 79.375mm cell dimensions) TN-72-xxxM series with144 cells (158.75mm X 79.375mm cell dimensions)	NR
				M182ABPERCBP SE	Mono crystalline silicon 10 busbars could be used as halved cell, thickness 175±17.5μm 413540, 412918, 412920 with 44 cells (91mm X 45.5mm cell dimensions) 412918 use WRO mono. 413541, 412919, 412921 with 39 cells (182mm X 45.5mm cell dimensions) 412919 use WRO mono. 61878 with 66 cells (182mm X 91mm cell dimensions)	NR

4.0 Critical Components						
Photo #	Item no.[1]	Name	Manufacturer/ trademark[2]	Type / model[2]	Technical data and securement means	Mark(s) of conformity[3]
				M1669BPERC	Mono crystalline silicon 9 busbars could be used as halved cell, thickness 190±30μm TN-60-xxxMH series with120 cells (166mm X 83mm cell dimensions) TN-72-xxxMH series with144 cells (166mm X 83mm cell dimensions)	NR
			ET SOLAR TECHNOLOGY (VIET NAM) COMPANY LIMITED	ECM1010BSE2	Mono crystalline silicon 10 busbars could be used as halved cell, thickness 180±18μm 413540, 412918, 412920 with 44 cells (91mm X 45.5mm cell dimensions) 412918 use WRO mono. 413541, 412919, 412921 with 39 cells (182mm X 45.5mm cell dimensions) 412919 use WRO mono. 61878 with 66 cells (182mm X 91mm cell dimensions)	NR

4.0 Critical Components						
Photo #	Item no.[1]	Name	Manufacturer/ trademark[2]	Type / model[2]	Technical data and securement means	Mark(s) of conformity[3]
2	2	Frontsheet	Anhui Shunshun New Material Technology Co.,Ltd	Coating tempered glass	Coating tempered glass, Thickness 3.2 mm	NR
			Hangzhou Tuneng Photovoltaic Technology Co. , Ltd.	Low iron Tempered glass	Low iron Tempered glass, Thickness 3.2 mm	NR
2	3	Encapsulation	HANGZHOU FIRST APPLIED MATERIAL CO.,LTD. (E326347)	F806P	Ethyl-Vinyl-acetate (EVA), one sheet of clear EVA is provided at frontsheet side and backsheet side, thickness 0.45mm	UR
3	4	Frame	Hangzhou Tanglong Energy Techonoly Co.,Ltd	6063-T5	Assembled by key corners anodized aluminium alloy	NR
			Zhangjiagang City XiechangPV CO.,Ltd	6063-T5	Assembled by key corners anodized aluminium alloy	NR
3	5	Backsheet	Cybrid Technologies Inc. (E333414)	Cynagard 465A(R)	PVDF/Polyester/PET/Fluorine skin film 20um/10um/288um/4um(transparent), total 322um TI=120℃	UR
				Cynagard2X5A®	PVDF/Adhesive/PET/Primer coating 22.5um/10um/250um/4um(WHITE), total 290um TI=120℃	UR
3	6	Adhesive (between Junction Box and backsheet)	LINKTECH SILICONE MATERIAL CO LTD (E502051)	AdheSil 3166	RTI (Elec, Imp, Str)=105℃ White or black color	UR
			HANGZHOU ZHIJIANG SILICONE CHEMICAL CO LTD (E335227)	JS-606	RTI (Elec, Imp, Str)=105℃ White color	UR

4.0 Critical Components						
Photo #	Item no.[1]	Name	Manufacturer/ trademark[2]	Type / model[2]	Technical data and securement means	Mark(s) of conformity[3]
4	7	Junction Box	Zhejiang Forsol Energy Co.,Ltd (E479691)	15T11A	Rated 1000 VDC, 20 A, -40 to 85 °C.	UR
				F303D	Rated 1500 V dc, 20 A dc max.	UR
				F303G	Rated 1500 V dc, 30 A dc max.	UR

4.0 Critical Components						
Photo #	Item no.[1]	Name	Manufacturer/ trademark[2]	Type / model[2]	Technical data and securement means	Mark(s) of conformity[3]
4	8	Cable	Wuxi Xinhongye Wire&cable CO,.LTD (E332548)	PV WIRE	14AWG, DC 1000V, sunlight resistant, 90°C wet or dry.	UL
				PV WIRE	12AWG, DC 1000V, sunlight resistant, 90°C wet or dry.	UL
				PV WIRE	12AWG, DC 2000V, sunlight resistant, 90°C wet or dry.	UL
			CHANGSHU JHOSIN COMMUNICATION TECHNOLOGY CO LTD (E496190)	PV WIRE	14AWG, DC 1000V, sunlight resistant, 90°C wet or dry.	UL
			Ningbo Kibor Wire&Cable Co.,LTD (E470608)	PV WIRE	12AWG, DC 2000V, sunlight resistant, 90°C wet or dry.	UL
5	9	Connector	AMPHENOL INDUSTRIAL OPERATIONS (E339277)	H4CMC2DM/H4 CFC2DM	Rated 1500 V dc, 15A max, IP68, -40 to 85 ℃.	UR
			Staubli Electrical Connectors AG (E343181)	PV-KST4/6II-UR; PV-KBT4/6II-UR	Rated 1000 V dc, 30A max, IP68, -40 to 85 ℃.	UR
			ZHEJIANG FORSOL ENERGY CO LTD (E479692)	SIKE6	Rated 1500 V dc, 35A max, IP68, -40 to 85 ℃.	UR
3	10	Label	AVERY DENNISON (CHINA) CO LTD (MH20558)	50 micron Matte Silver PET TC/S333	application Temperature range: -40℃ to 100 ℃	UR

4.0 Critical Components						
Photo #	Item no.[1]	Name	Manufacturer/ trademark[2]	Type / model[2]	Technical data and securement means	Mark(s) of conformity[3]
3	11	Potting Material (not Shown)	LINKTECH SILICONE MATERIAL CO LTD (E502051)	Encapsil 5202	RTI (Elec, Imp, Str)=105℃, CTI =0, Black or white	UR
			HANGZHOU ZHIJIANG SILICONE CHEMICAL CO LTD (E335227)	JS1184A/JS1184B	RTI (Elec, Imp, Str)=105℃, CTI =0, Black or white	UR
4	12	Bypass Diode (not Shown)	Zhejiang Forsol Energy Co.,Ltd	FSL3045	Peak reverse voltage 45V Rated current 30A, Max. junction temperature: 200℃(t ≤ 1 h).	NR
			SUZHOU GOOD-ARK ELECTRONIC CO., LTD	GFT3050SM	Peak reverse voltage 50V Rated current 30A, Max. junction temperature: 200℃(t ≤ 1 h).	NR
			SUZHOU GOOD-ARK ELECTRONIC CO., LTD	GFT3050SM	Peak reverse voltage 50V Rated current 20A, Max. junction temperature: 200℃(t ≤ 1 h).	NR
				GFT5050CT	Peak reverse voltage 50V Rated current 30A, Max. junction temperature: 200℃(t ≤ 1 h).	NR
			SUZHOU GOOD-ARK ELECTRONIC CO., LTD / ZHEJIANG FORSOL ENERGY Co., Ltd.	MK3050	Peak reverse voltage 50V Rated current 30A, Max. junction temperature: 200℃(t ≤ 1 h).	NR
				MK5050	Peak reverse voltage 50V Rated current 30A, Max. junction temperature: 200℃(t ≤ 1 h).	NR

4.0 Critical Components						
Photo #	Item no.[1]	Name	Manufacturer/ trademark[2]	Type / model[2]	Technical data and securement means	Mark(s) of conformity[3]
6	13	Cell Connector	Yaoheng Technology Co.,Ltd	0.6x0.16mm	TU1 (99.97%) base plated with solder material Sn60Pb40, Coating thickness 15±5μm.	NR
				0.16x1.2mm	TU1 (99.97%) base plated with solder material Sn60Pb40, Coating thickness 15±5μm.	NR
				ф0.35	TU1 (99.97%) base plated with solder material Sn60Pb40, Coating thickness 15±5μm.	NR
				Φ0.3mm	TU1 (99.97%) base plated with solder material Sn60Pb40, Coating thickness 15±5μm.	NR
			Hangzhou Fuyangchanghe Newenergy Technologies Company Limited	0.6x0.16mm	TU1 (99.97%) base plated with solder material Sn60Pb40, Coating thickness 15±5μm.	NR
1	14	String Connector (not Shown)	Yaoheng Technology Co.,Ltd.	0.3×5.0mm/0.2×5.0mm	TU1 (99.97%) base plated with solder material Sn60Pb40, Coating thickness 15±5μm. Used on model 61798, 61849 and 61791	NR
				0.6x0.35mm	TU1 (99.97%) base plated with solder material Sn63Pb37, Coating thickness 15±5μm.	NR
				0.3×6.0mm/0.3×4.0mm	TU1 (99.97%) base plated with solder material Sn60Pb40, Coating thickness 15±5μm.	NR
			Hangzhou Fuyangchanghe Newenergy Technologies Company Limited.	0.3×5.0mm/0.2×5.0mm	TU1 (99.97%) base plated with solder material Sn60Pb40, Coating thickness 15±5μm.	NR

4.0 Critical Components						
Photo #	Item no.[1]	Name	Manufacturer/ trademark[2]	Type / model[2]	Technical data and securement means	Mark(s) of conformity[3]
2	15	Adhesive for Frame (not Shown)	LINKTECH SILICONE MATERIAL CO LTD (E502051)	AdheSil 3166	RTI (Elec, Imp, Str)=105℃ White or black color	UR
			3M COMPANY INDUSTRIAL ADHESIVES & TAPES DIV (MH17478)	RP45	1.1mm VHB Tapes Color: Gray temperature:-35℃~90℃	UR
			HANGZHOU ZHIJIANG SILICONE CHEMICAL CO LTD (E335227)	JS-606	RTI (Elec, Imp, Str)=105℃ White color	UR
1	16	Fixing Tape (not Shown)	3M COMPANY (E230409)	UV-1	Polyethylene terephthalate film tapes, Color: clear Used to fix the cells before laminate.	UR
1	17	Insulation Sheet (not Shown)	Cybrid Technologies Inc. (E333414)	Cynagard 465A(R)	PVDF/Polyester/PET/Fluorine skin film 20um/10um/288um/4um(transparent), total 322um TI=120℃	UR
				Cynagard 115F	Ethylene Vinyl Acetate (EVA)Fluorine resin//Polyethylene Terephthalate film (PET)/Fluorine resin, Photovoltaic Backsheets, thickness:0.179-0.512mm	UR

4.0 Critical Components						
Photo #	Item no.[1]	Name	Manufacturer/ trademark[2]	Type / model[2]	Technical data and securement means	Mark(s) of conformity[3]
6	18	Flux (not Shown)	Singapore Asahi Chemical and Solder Industries Pte Ltd	SF105	Liquid, in which the cell interconnector and string connector are immersed to enhance the soldering quality.	NR
			Asahi solder technology (Wuxi) Co. , Ltd.		Liquid, in which the cell interconnector and string connector are immersed to enhance the soldering quality.	NR
1	19	Decorate Sheet	JIANGSU YUXING FILM TECHNOLOGY CO LTD (E212271)	Cy28	RTI (Elec, Imp, Str)=105℃ black color	UR

NOTES:

1) Not all item numbers are indicated (called out) in the photos, as their location is obvious.

2) “Various“ means any type, from any manufacturer that complies with the "Technical data and securement means" and meets the "Mark(s) of conformity" can be used.

3) Indicates specific marks to be verified, which assures the agreed level of surveillance for the component. "NR" - indicates Unlisted and only visual examination is necessary. "See 5.0" indicates Unlisted components or assemblies to be evaluated periodically refer to section 5.0 for details.

4) Specific components combination requirements refer ILL5, ILL 6, ILL6A, ILL7 in section 7.

5.0 Critical Unlisted CEC Components

No Unlisted CEC components are used in this report.

6.0 Critical Features

Recognized Component - A component part, which has been previously evaluated by an accredited certification body with restrictions and must be evaluated as part of the basic product considering the restrictions as specified by the Conditions of Acceptability.

Listed Component - A component part, which has been previously Listed or Certified by an accredited Certification Organization with no restrictions and is used in the intended application within its ratings.

Unlisted Component - A part that has not been previously evaluated to the appropriate designated component standard. It may also be a Listed or Recognized component that is being used outside of its evaluated Listing or component recognition.

Critical Features/Components - An essential part, material, subassembly, system, software, or accessory of a product that has a direct bearing on the product's conformance to applicable requirements of the product standard.

Construction Details - For specific construction details, reference should be made to the photographs and descriptions. All dimensions are approximate unless specified as exact or within a tolerance. In addition to the specific construction details described in this Report, the following general requirements also apply.

1. Spacing - At the wiring terminals, a minimum of 8.0mm* through air and 3.4mm over surface spacing is provided between uninsulated live parts of opposite polarity (the negative and positive load terminals) for model with 600V system voltage.a minimum of 19.4mm* through air and 10.4mm over surface spacing is provided between uninsulated live parts of opposite polarity (the negative and positive load terminals) for model with 1500V system voltage.
   At the module edges, a minimum of 8.0mm* through air and 3.4mm over surface spacing is provided between the live parts including cells and interconnecting ribbons and the edges of the laminate before attachment of the frame for model with 600v system voltage.
   A minimum of 19.4mm* through air and 10.4mm over surface spacing is provided between the live parts including cells and interconnecting ribbons and the edges of the laminate before attachment of the frame for model with 1500v system voltage.
   There are no grounded metal parts within the wiring compartment.

   Live parts are internal to the module and insulated inside the encapsulant and, polymeric superstrate and
2. Mechanical Assembly -Components are mechanically secured or soldered in place and otherwise prevented from shifting or rotating
3. Corrosion Protection - All ferrous metal parts are protected against corrosion by painting, plating or the equivalent.
4. Accessibility of Live Parts -No uninsulated live parts are accessible
5. Grounding - All exposed dead-metal parts (frame) are electrically bonded to the intended grounding terminal. Each module is clearly identified with the appropriate ground connection point as such with a ground symbol marking. The means of grounding is specified in the installation instructions which is provided with the modules. Refer to Illustration 4 seciton 7.0 for grounding methold.
6. Polarized Connection - Modules are provided with leads identified by the symbols (+) for Positive lead and (-) for negative lead on the lead. Each connector is polarized and cannot be joined to create an improper connection.
7. Internal Wiring - Internal wiring is routed away from sharp or moving parts. Internal wiring leads terminating in soldered connections are made mechanically secure prior to soldering. Recognized Component separable (quick disconnect) connectors of the positive detent type, closed loop connectors, or other types specifically described in the text of this report are also acceptable as internal wiring terminals. At points where internal wiring passes through metal walls or partitions, the wiring insulation is protected against abrasion or damage by plastic bushings or grommets.
8. Schematics - Refer to Illustration 1, 1A, 1B, 1C, 1D, 1E, 1F, 2, 2A, 2B, 2C, 2D, 2E, 2F of seciton 7.0.

6.0 Critical Features

9. Markings - Markings shall include:
   1) name or registered brand name of applicant
   2) type or model number designation
   3) serial number
   4) date and place of manufacture; alternatively serial number assuring traceability of date and place of manufacture
   5) polarity of terminals or leads;
   6) electrical ratings including:
      (a) Nominal Pmp, Maximum Power including manufacturing tolerance
      (b) Nominal Voc, Open-circuit voltage including manufacturing tolerance
      (c) Nominal Vmp, Voltage at Max Power
      (d) Nominal Isc, Short-circuit current including manufacturing tolerance
      (e) Nominal Imp, Current at Max Power
      (f) “Maximum system voltage” or ”Vsys”
      (g) “Maximum overcurrent protection rating”
   7) class of protection against electrical shock
   8) All electrical data shall be shown as relative to standard test conditions (STC) (1 000 W/m2, (25 ± 2) °C, AM 1,5 according to IEC 60904-3).
   9) Field-wiring connections proper AWG size, minimum insulation temperature, and intended use wire
   10) Following statement "System Fire Class Rating: See Installation Instructions for Installation
   11) Following statement "See module installation instructions for appropriate mating connectors"
   12) Module fire performance
   13) Intended Max. load in lb/ft2

   Additional markings include, but are not part of label:
   1) Connectors are marked to identify the positive and negative polarity
   2) Connectors limitation stating, "Do Not Disconnect Under Load"
   3) Ground marking

10. Cautionary Markings - Warning, Hazard or Cautionary markings are to be in both English and French. “This unit produces electricity if exposed to light.Do not disconnect under load. Cette unité produit de l'électricité si elle est exposée à la lumière.Ne débranchez pas en charge.”and others Refer to Illustration 8, 8A, 8B and 8C of seciton 7.0.

6.0 Critical Features

11. Installation, Operating and Safety Instructions - Instructions for installation and use of this product are provided by the applicant as required by the standard.

1) Installation instructions describing the methods of electrical and mechanical installation.

2) Electrical Ratings to include Isc, Voc, Imp, Vmp, Max System Voltage, the current rating of overcurrent protection, manufacturer's stated tolerance for Voc, Isc and maximum power output Pmax under standard test conditions, temperature coefficient for voltage at open-circuit, temperature coefficient for maximum power, temperature coefficient for short-circuit current.

3) Specific instructions for roof mounting.

4) A list containing the date of the first edition of these instructions and the dates of any and all subsequent revisions, amendments, and tech notes related to these instructions.

5) The following statement or the equivalent:

a) "The fire rating of this module is valid only when mounted in the manner specified in the mechanical mounting instructions."

b) "The module is considered to be in compliance with UL 61730-1 only when the module is mounted in the manner specified by the mounting instructions below."

c) "A module with exposed conductive parts is considered to be in compliance with UL 61730-1 only when it is electrically grounded in accordance with the instructions presented below and the requirements of the National Electrical Code."

d) "Any module without a frame (laminate) shall not be considered to comply with the requirements of UL 61730-1 unless the module is mounted with hardware that has been tested and evaluated with the module under this standard or by a field Inspection certifying that the installed module complies with the requirements of UL 61730-1".

e) A list containing the revision history.

6) Mechanical Installation instructions on:

a) The minimum mechanical means to be used for securement of the module

b) A statement that the assembly is to be mounted over a fire resistant roof covering

c) A statement (or equivalent) that modules shall be mounted with a certified mounting system and complete with requirements to achieve the specified System Fire Class Rating

7) A statement advising that artificially concentrated sunlight shall not be directed on the module.

8) The following statement or the equivalent: "Under normal conditions, a photovoltaic module is likely to experience conditions that produce more current and/or voltage than reported at standard test conditions. The requirements of the National Electrical Code (NEC) in Article 690 shall be followed to address these increased outputs. In installations not under the requirements of the NEC, the values of Isc and Voc marked on this module should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor ampacities, overcurrent device ratings, and size of controls connected to the PV output."

9) The information concerning the bypass diodes: diode type, voltage rating, current rating and diode configuration.

10) Series fuse (overcurrent protection) rating.

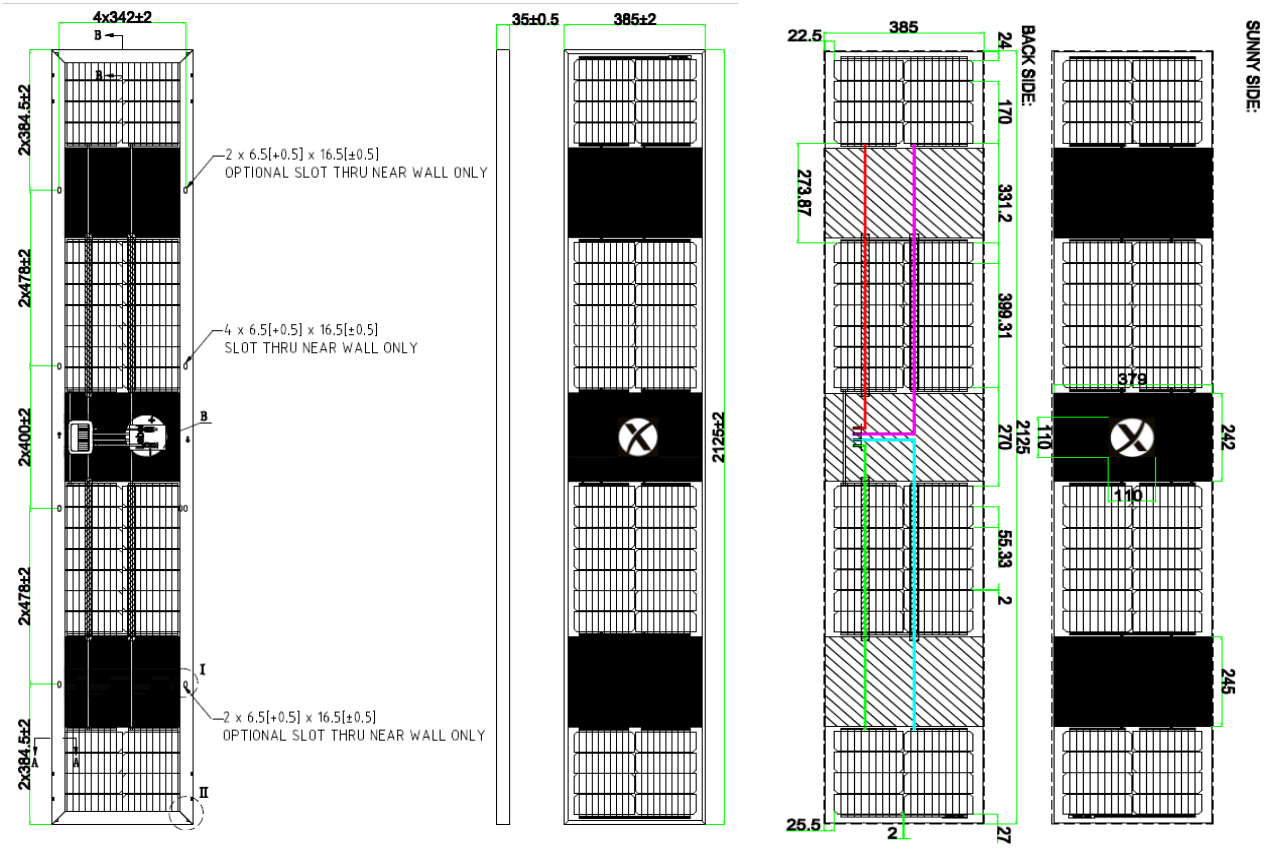
11) Manufacturer's stated tolerance for Voc, Isc and maximum power output Pmax under standard test conditions

12) List of each distinct PV connector incuding model name, manufacturer contact information, allowable mating connector manufacturer and model number(s).

13) Grounding Means.

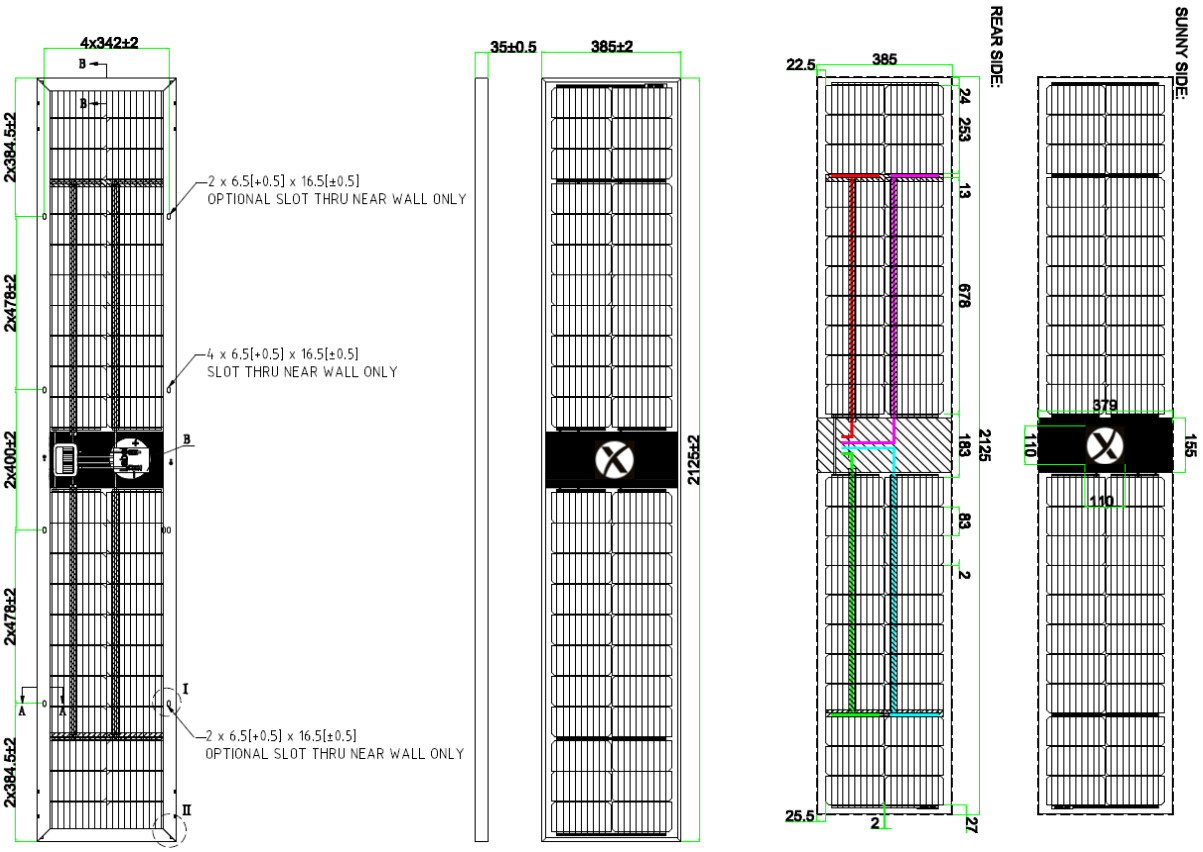
7.0 Illustrations

Illustration 1 - Schematic Diagram of module 61798 (Unit: mm)



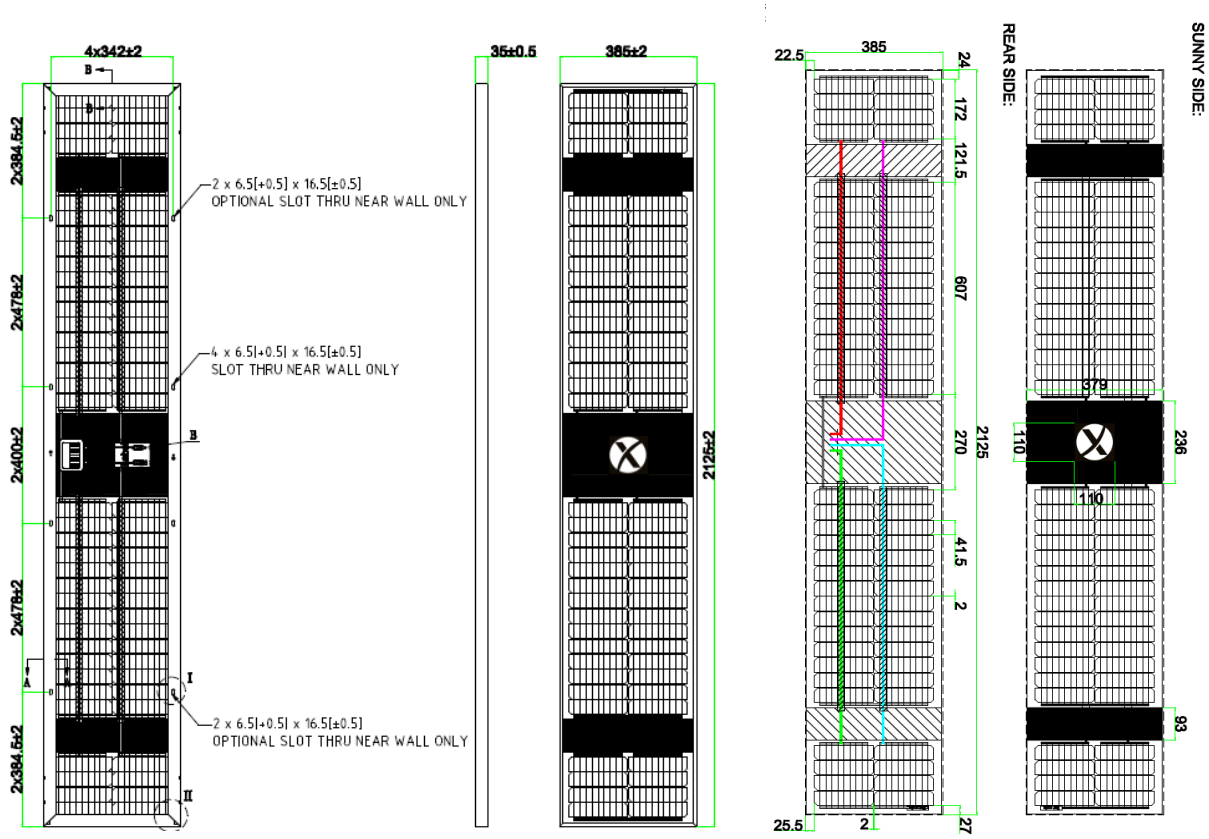
7.0 Illustrations

Illustration 1A - Schematic Diagram of module 61791 (Unit: mm)



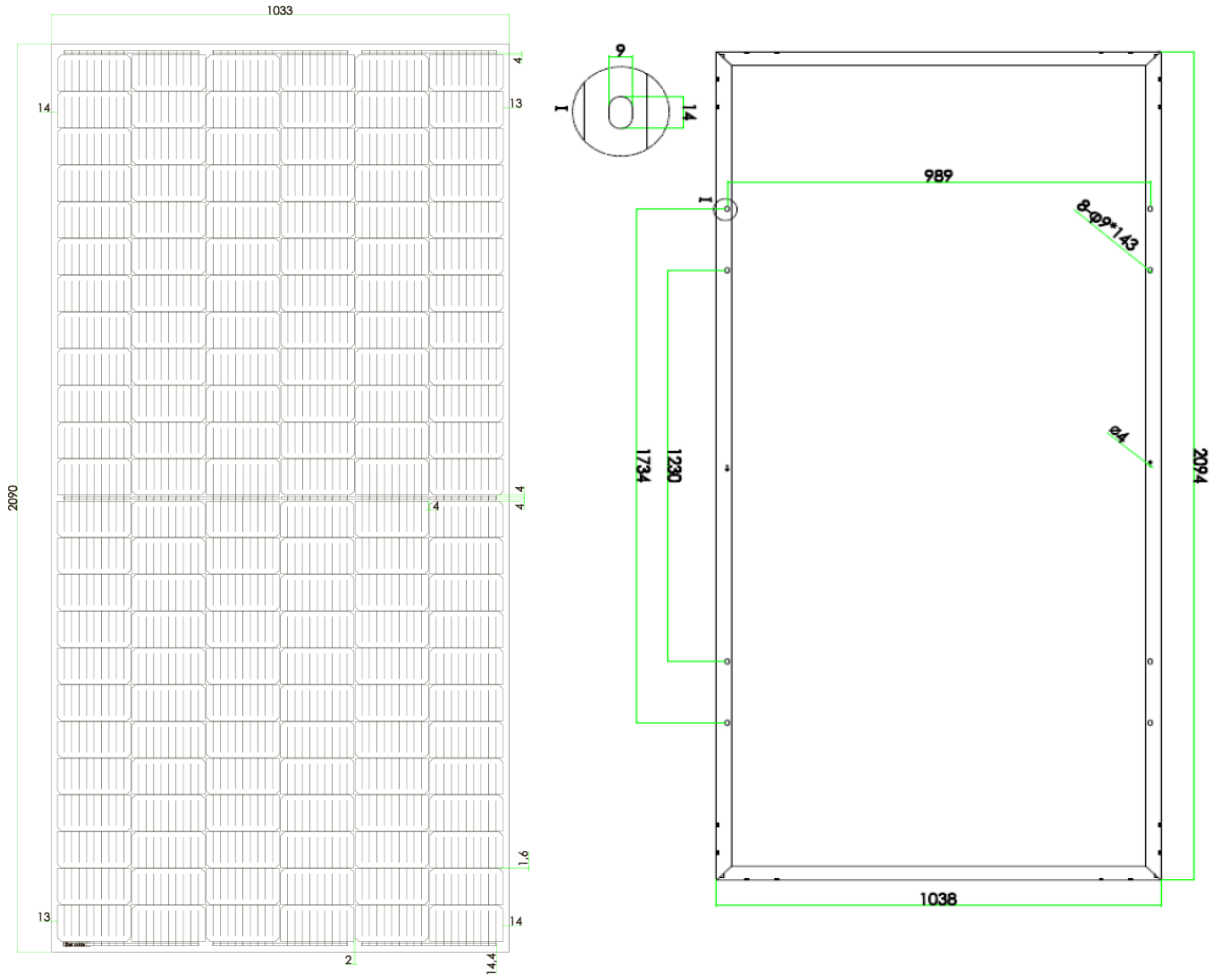
7.0 Illustrations

Illustration 1B - Schematic Diagram of module 61849 (Unit: mm)



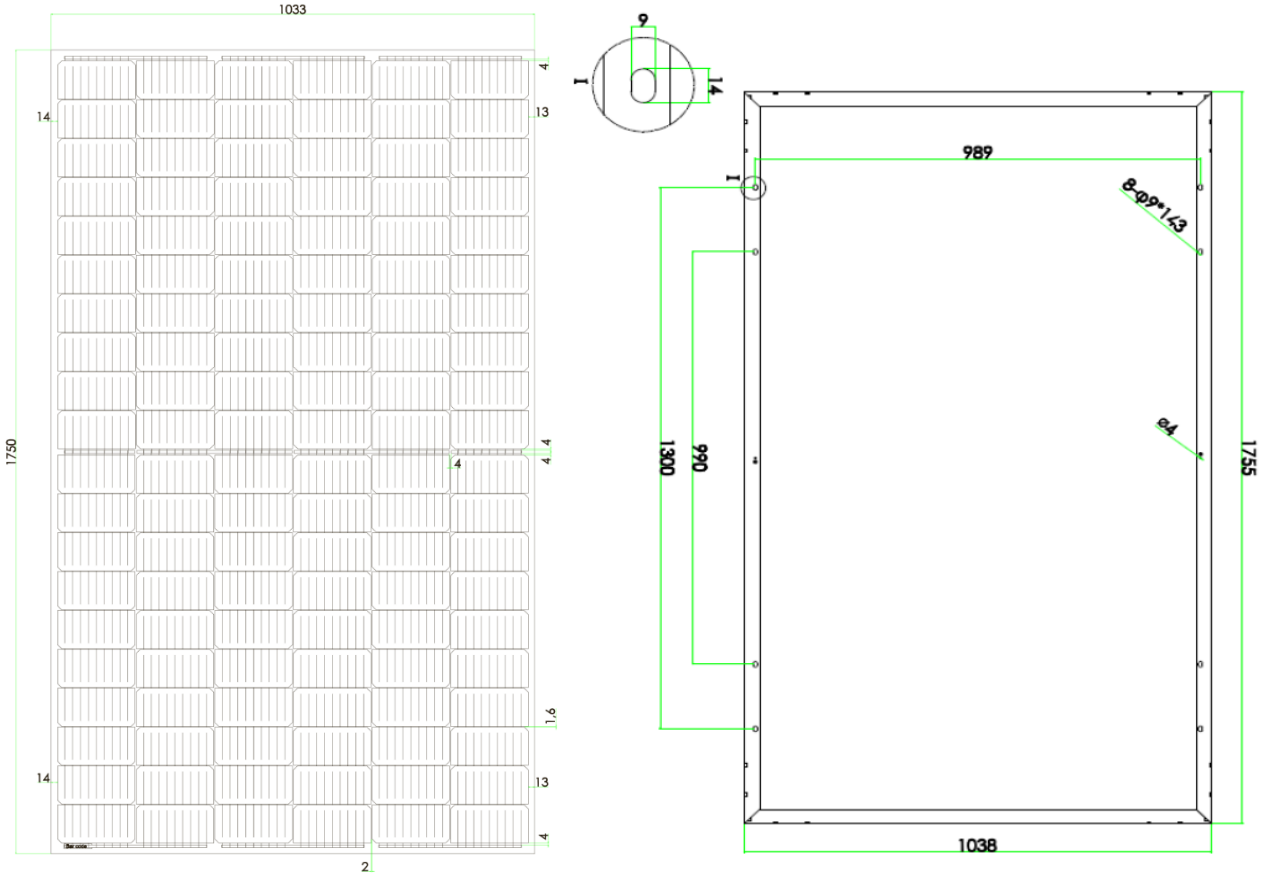
7.0 Illustrations

Illustration 1C - Schematic Diagram of module TN-72-XXXMH series (Unit: mm)



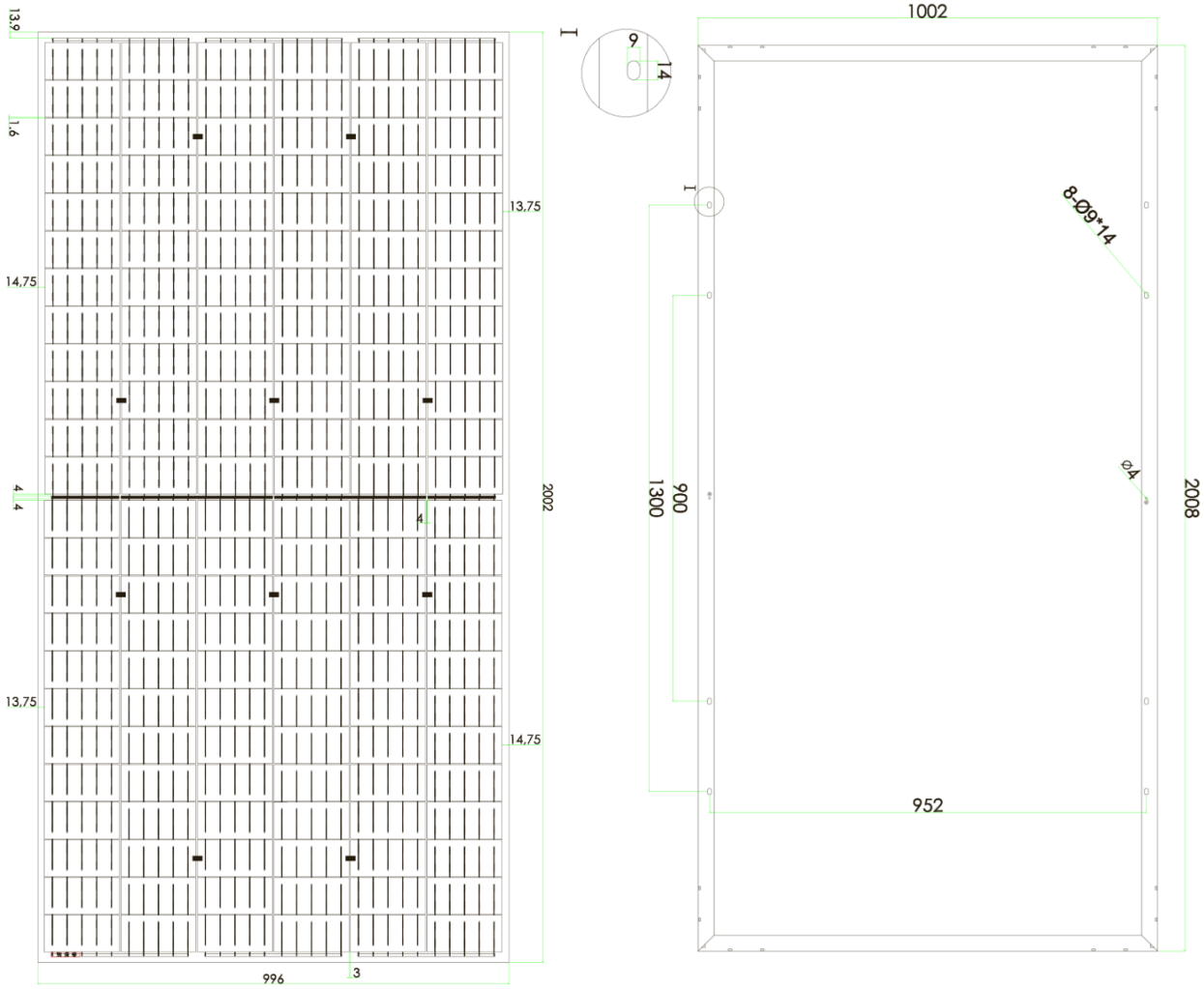
7.0 Illustrations

Illustration 1D - Schematic Diagram of module TN-60-XXXMH series (Unit: mm)



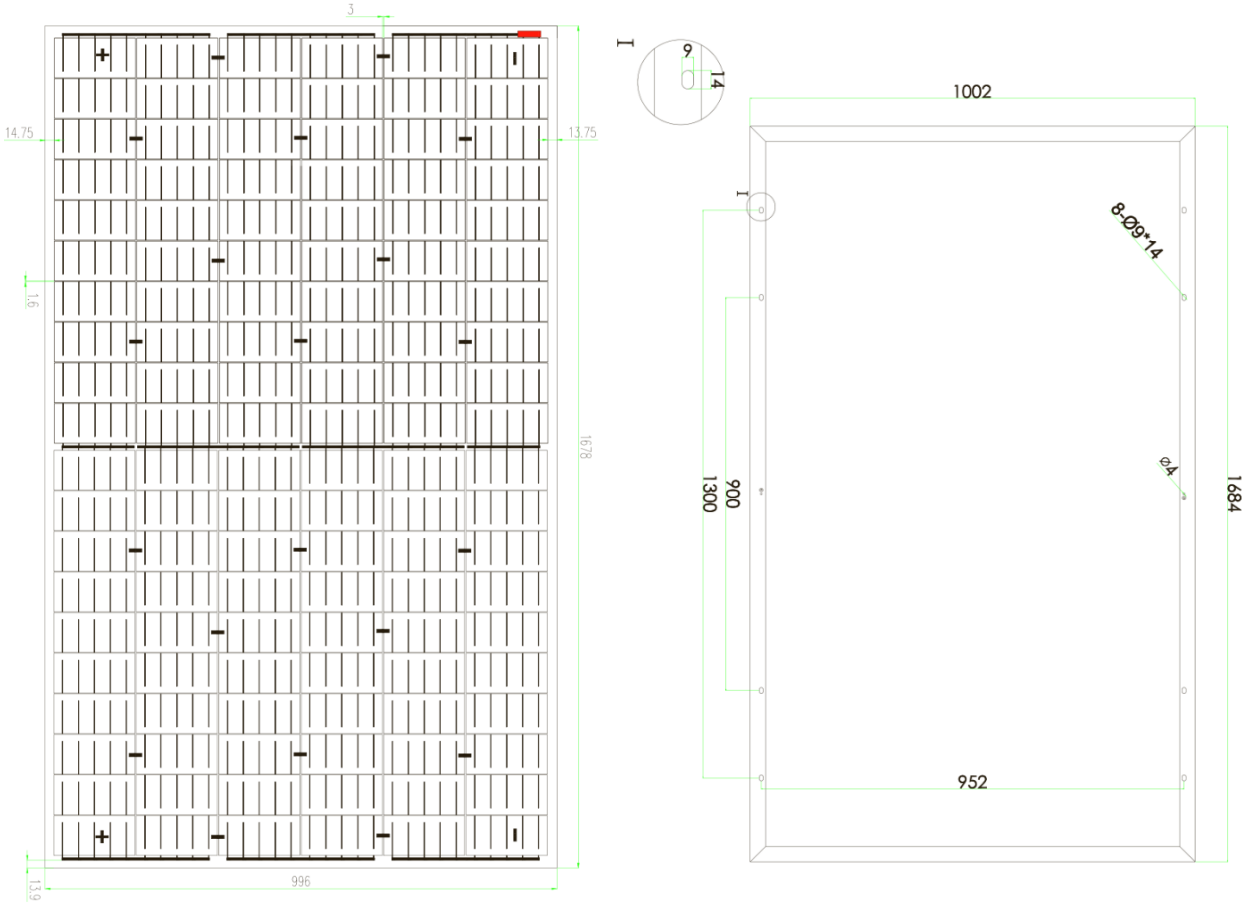
7.0 Illustrations

Illustration 1E - Schematic Diagram of moduleTN-72-XXXM series (Unit: mm)



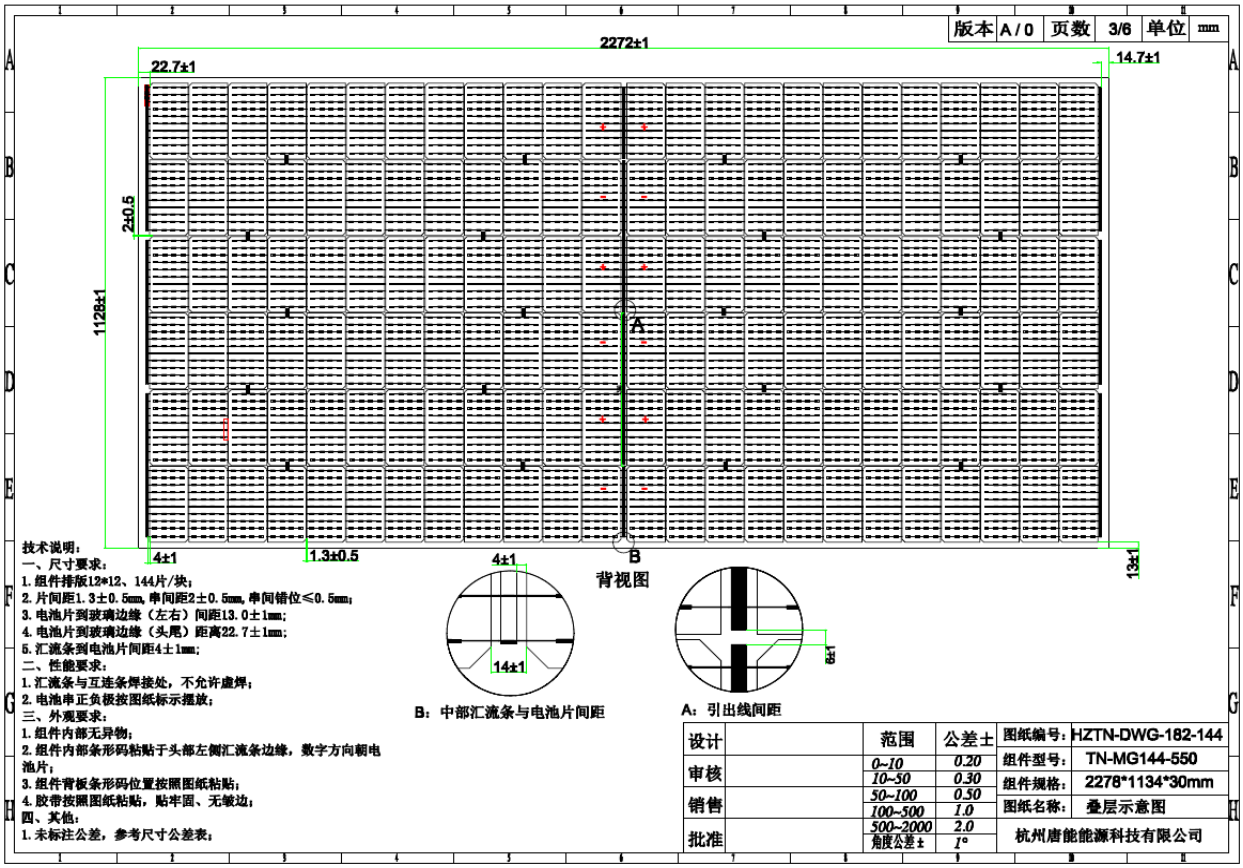
7.0 Illustrations

Illustration 1F - Schematic Diagram of moduleTN-60-XXXM series (Unit: mm)



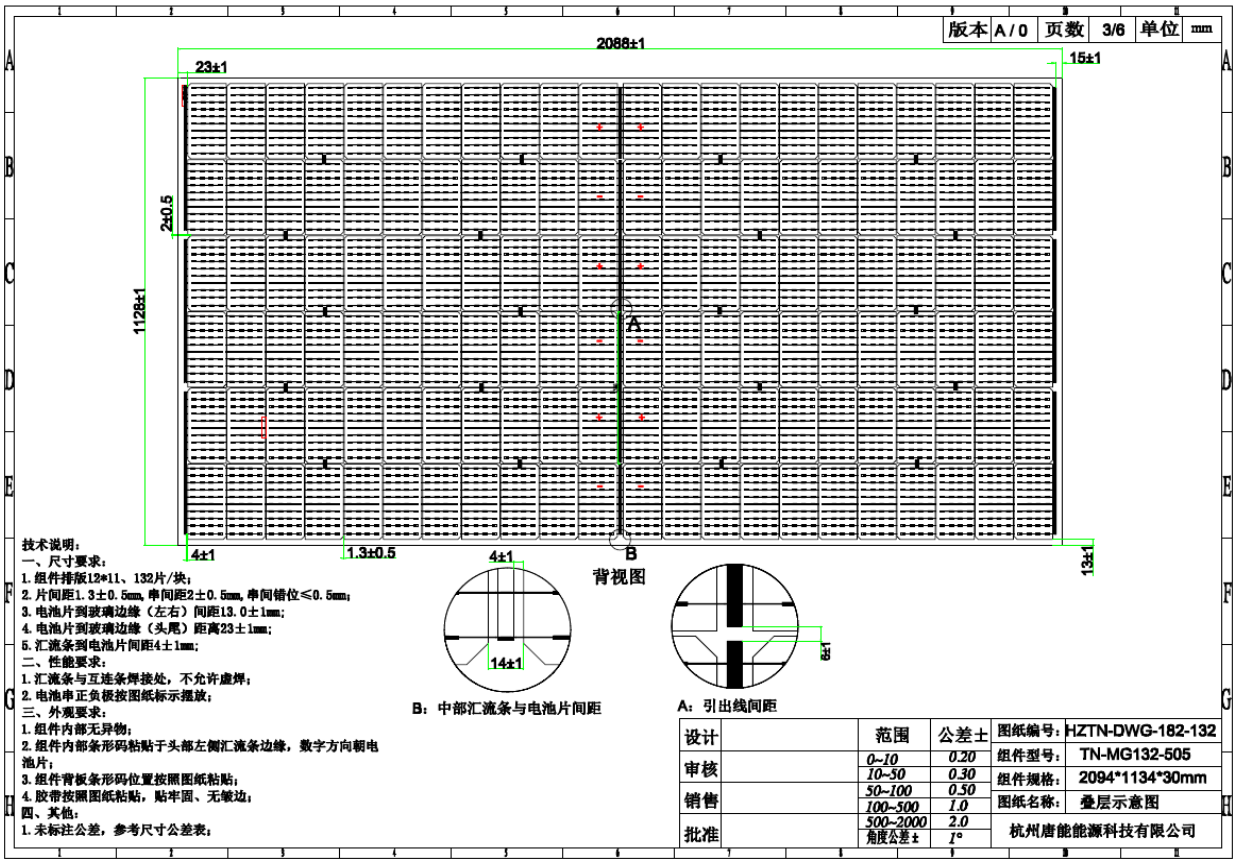
7.0 Illustrations

Illustration 1G - Schematic Diagram of module TN-MG144-XXX series (Unit: mm)



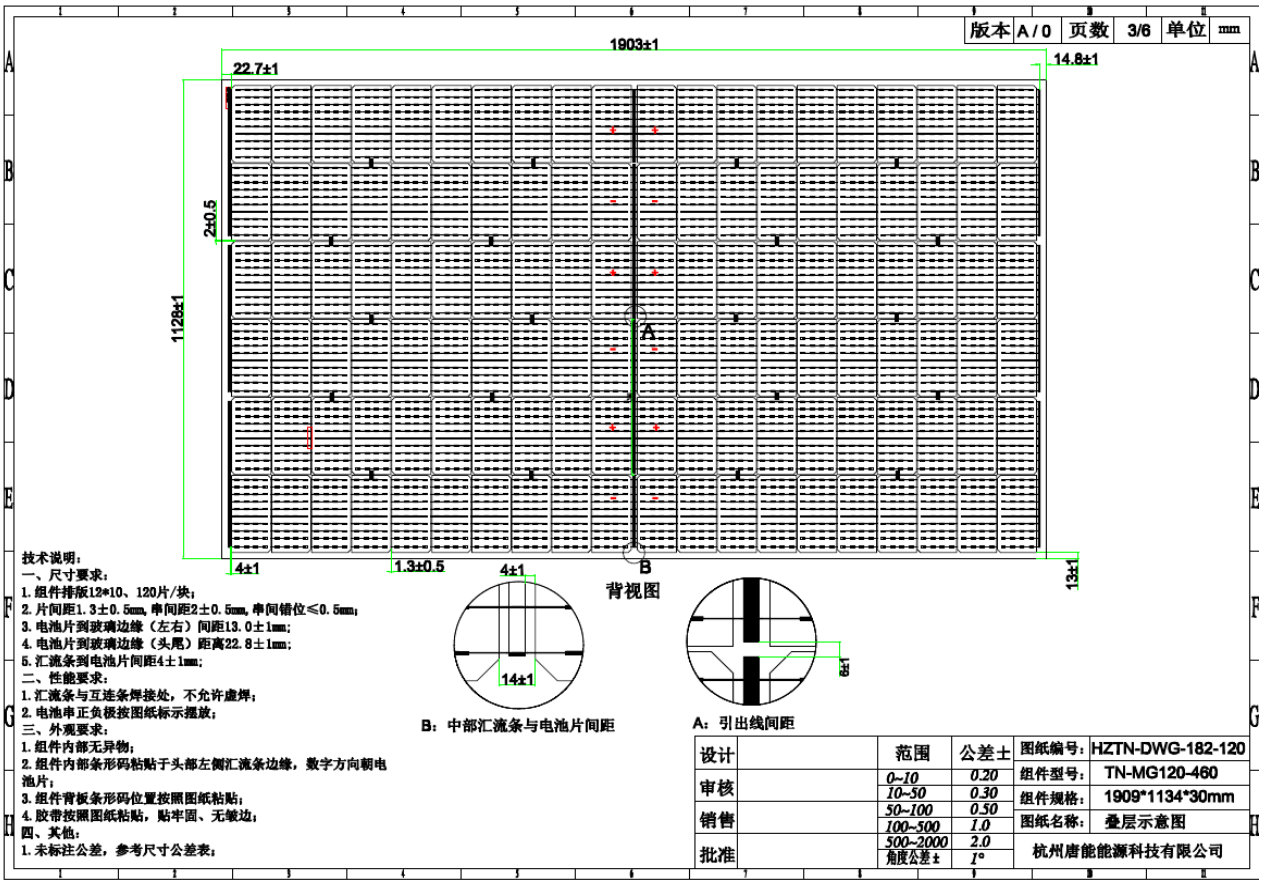
7.0 Illustrations

Illustration 1H - Schematic Diagram of module TN-MG132-XXX series (Unit: mm)



7.0 Illustrations

Illustration 1I - Schematic Diagram of module TN-MG120-XXX series (Unit: mm)



7.0 Illustrations

Illustration 1J - Schematic Diagram of module TN-MG108-XXX series (Unit: mm)

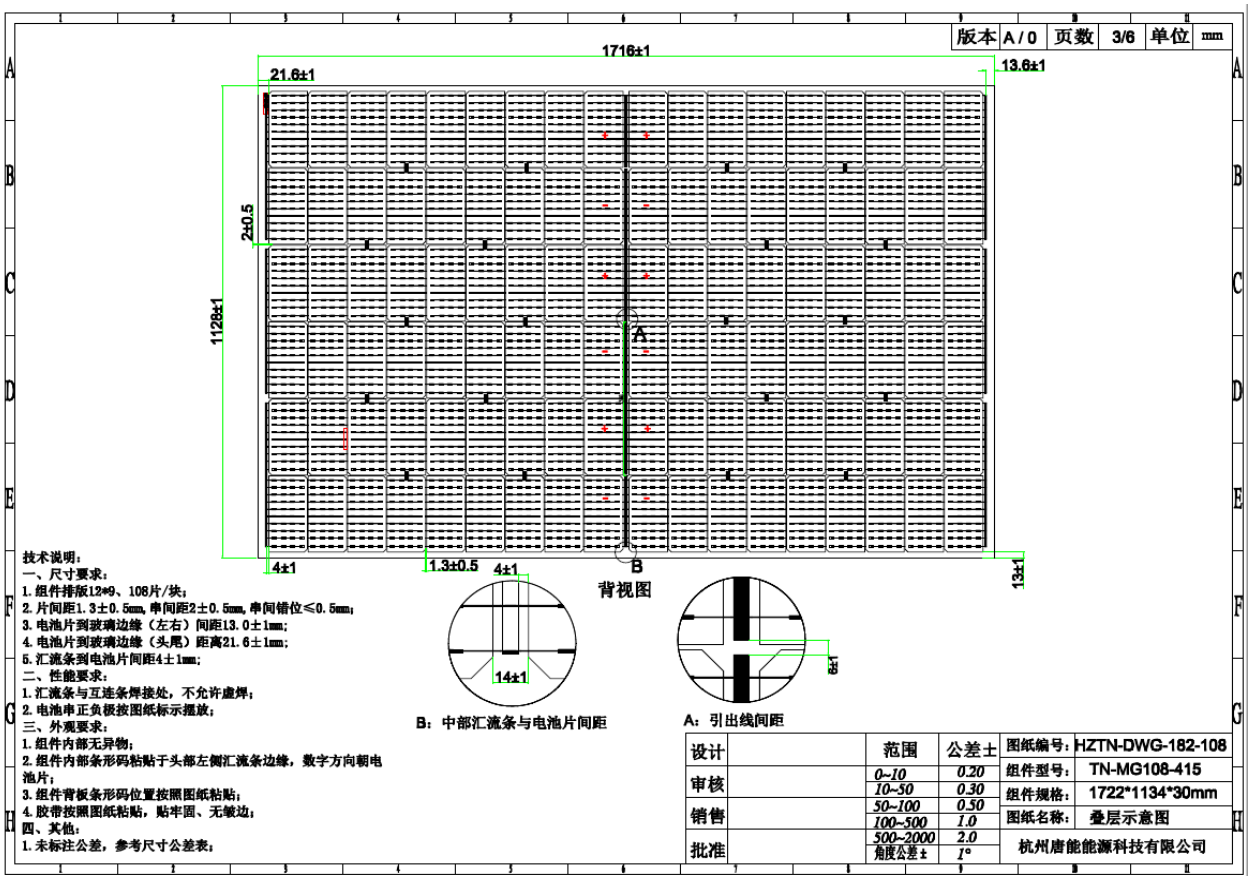
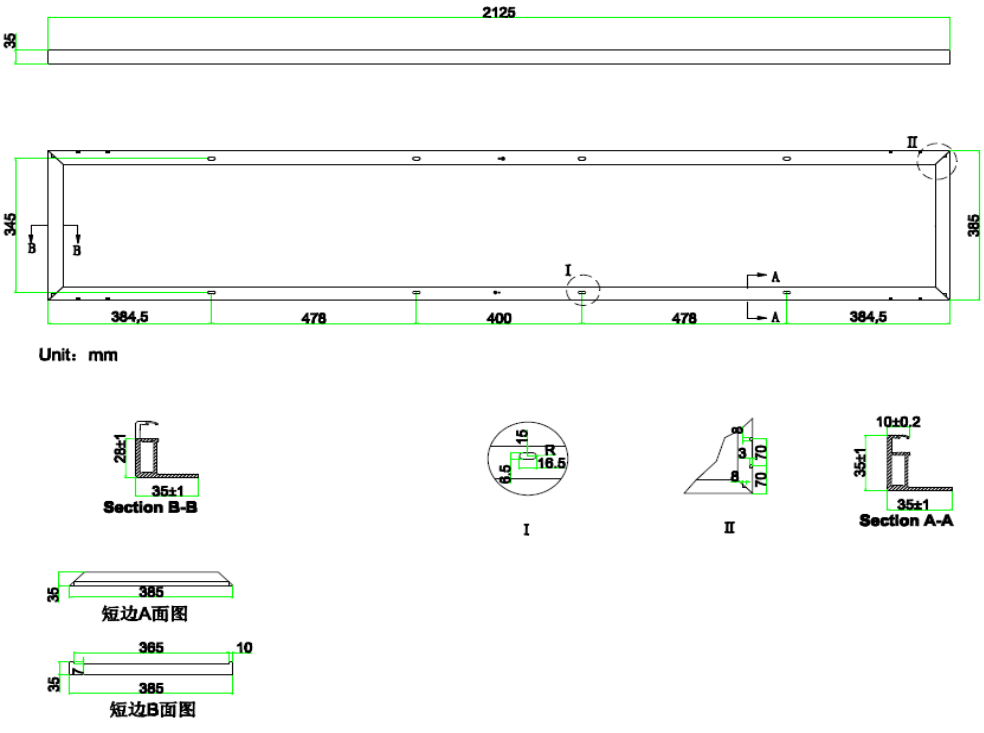
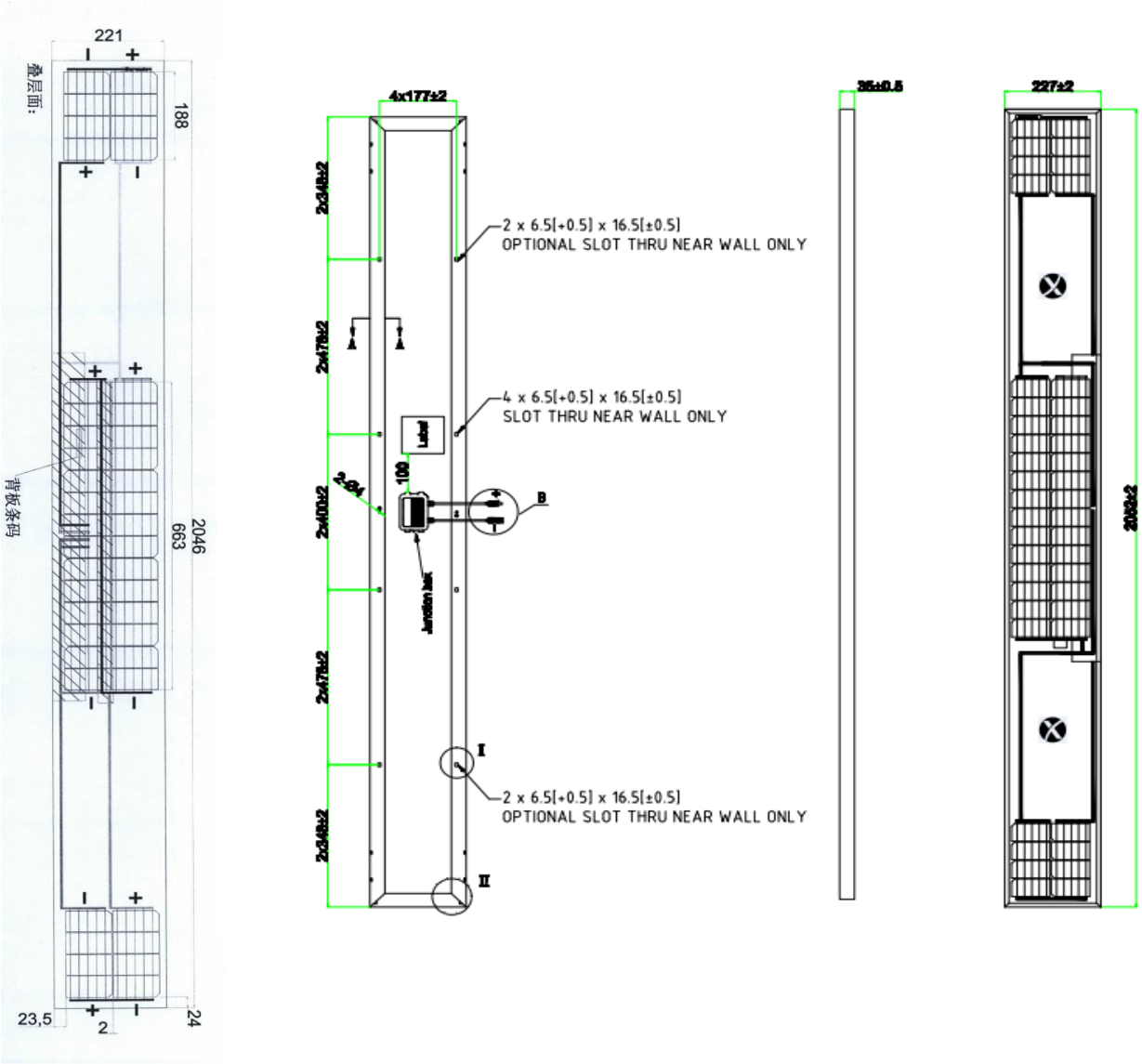


Illustration 1K - Alternate Schematic Diagram of module 61798, 61791, 61849, 412922, 412923, 412924 (Unit: mm)



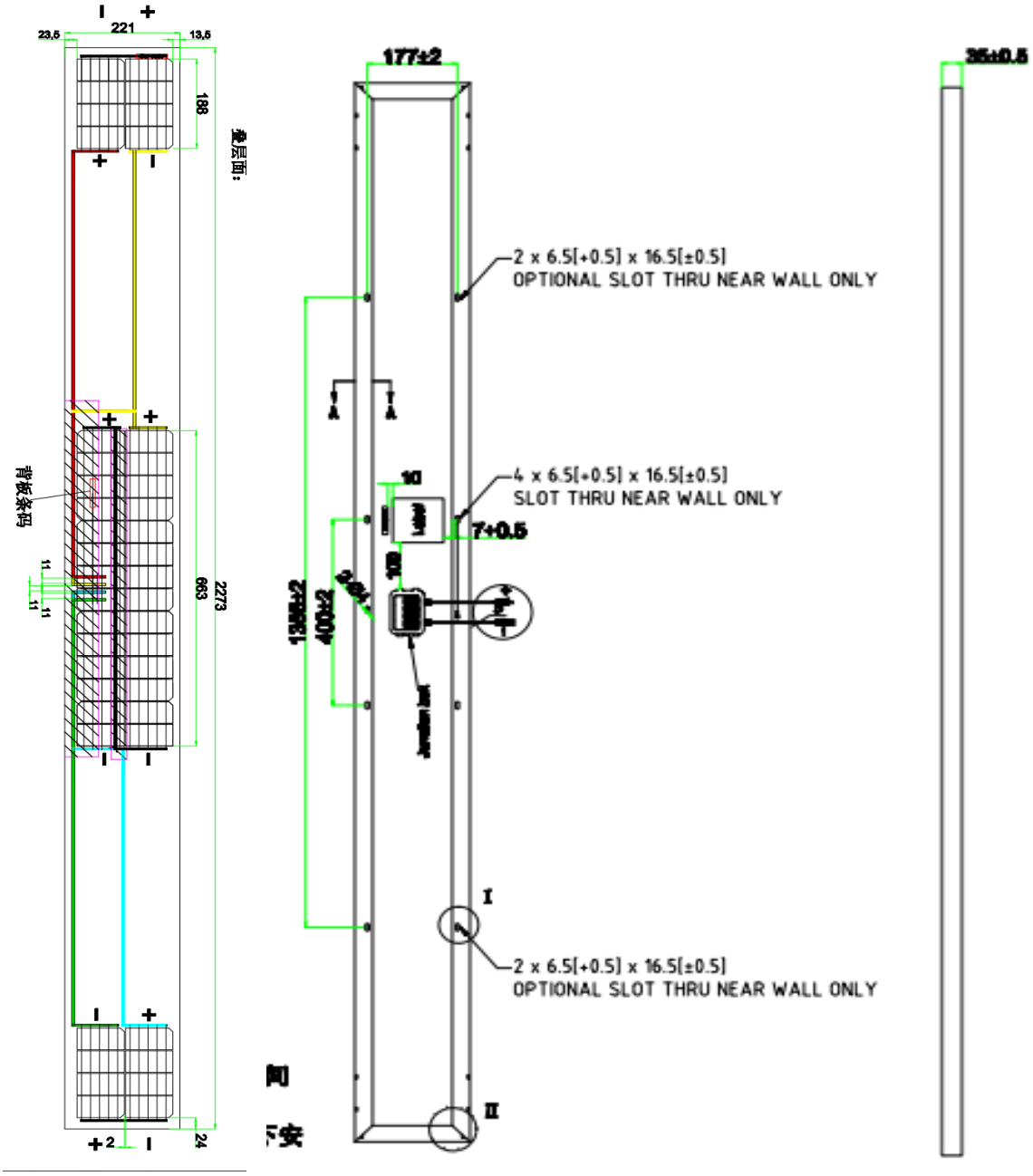
7.0 Illustrations

Illustration 1L - Schematic Diagram of module 413540 (Unit: mm)



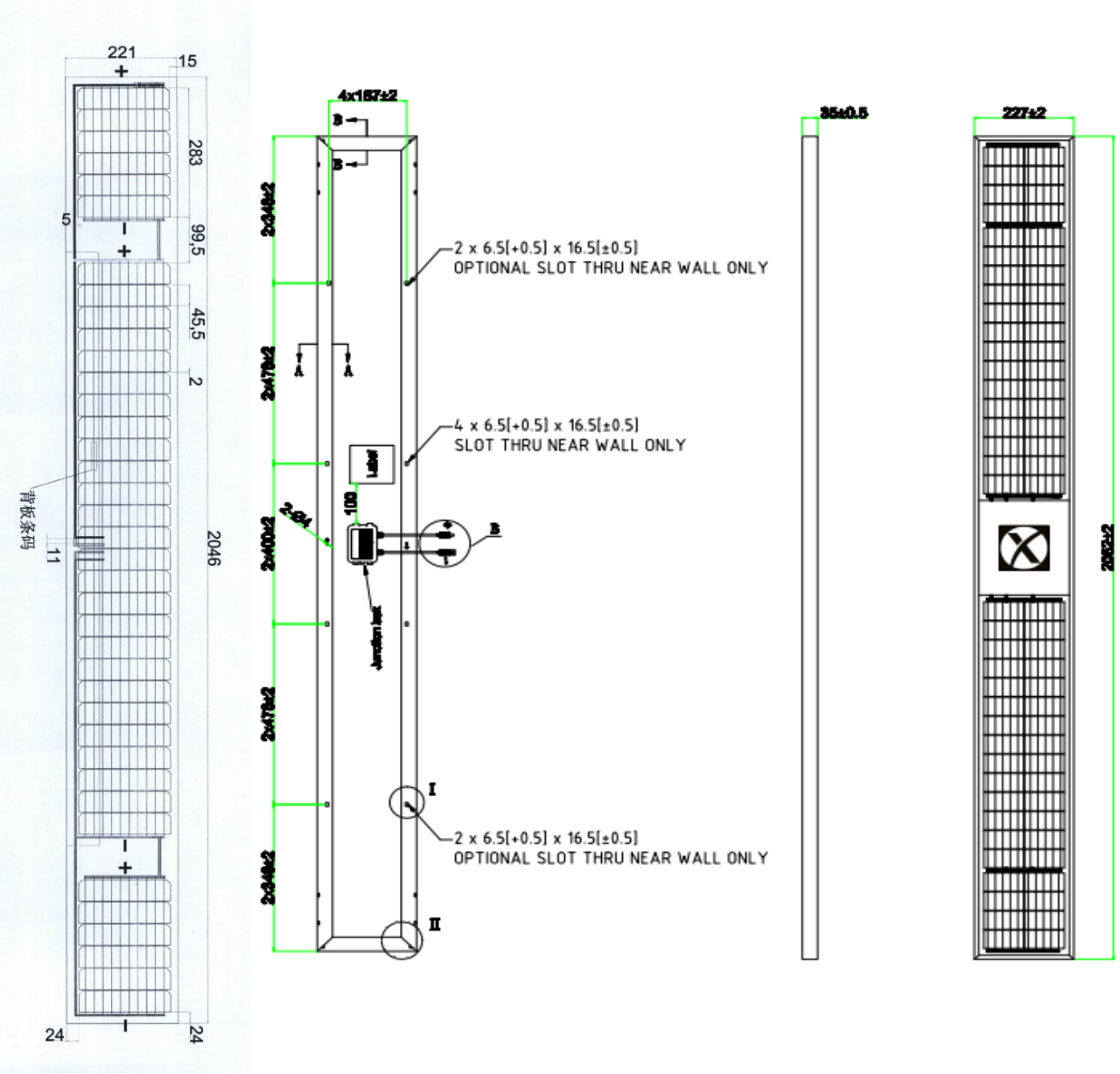
7.0 Illustrations

Illustration 1M - Schematic Diagram of module 412918/412920 (Unit: mm)



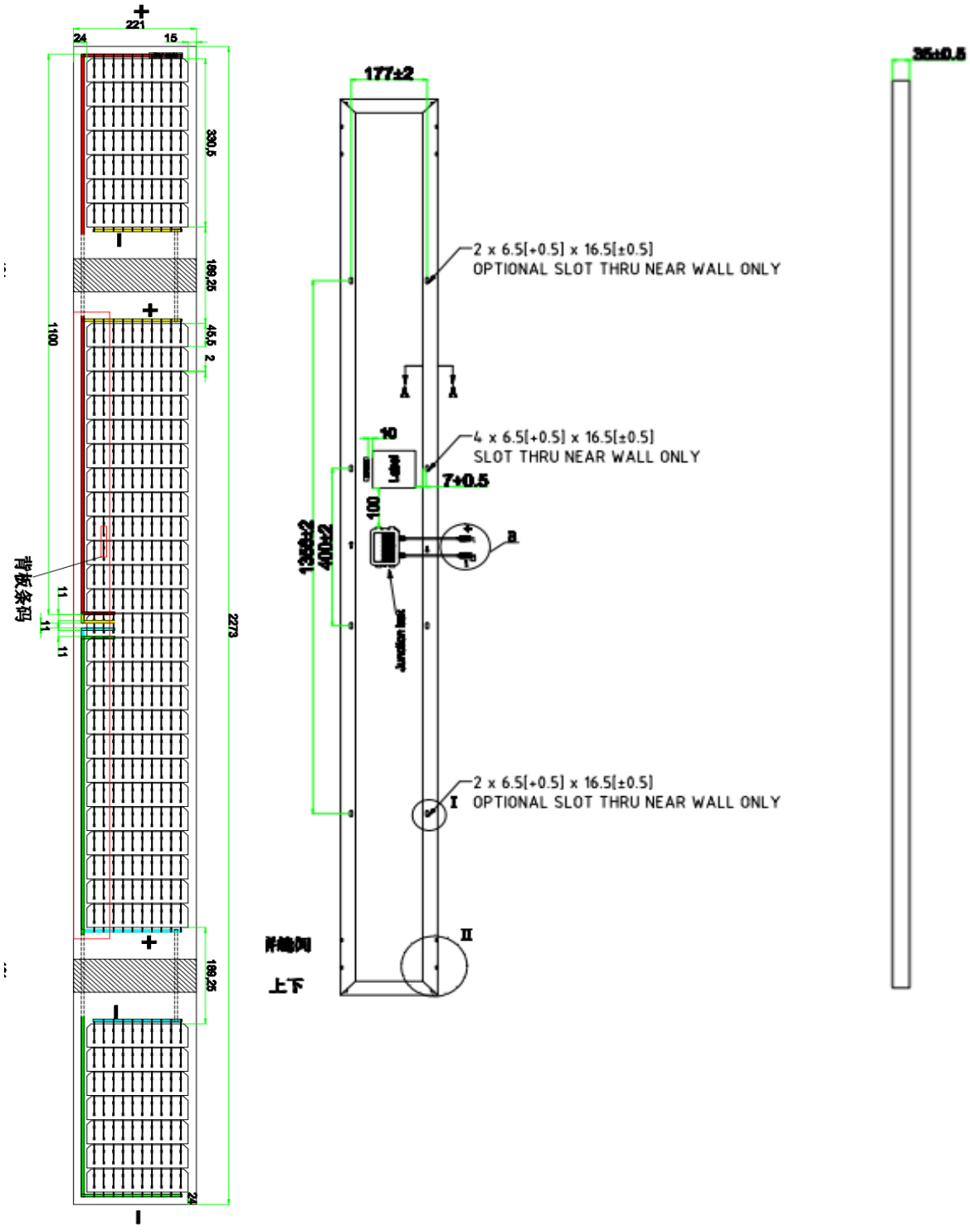
7.0 Illustrations

Illustration 1N - Schematic Diagram of module 413541 (Unit: mm)



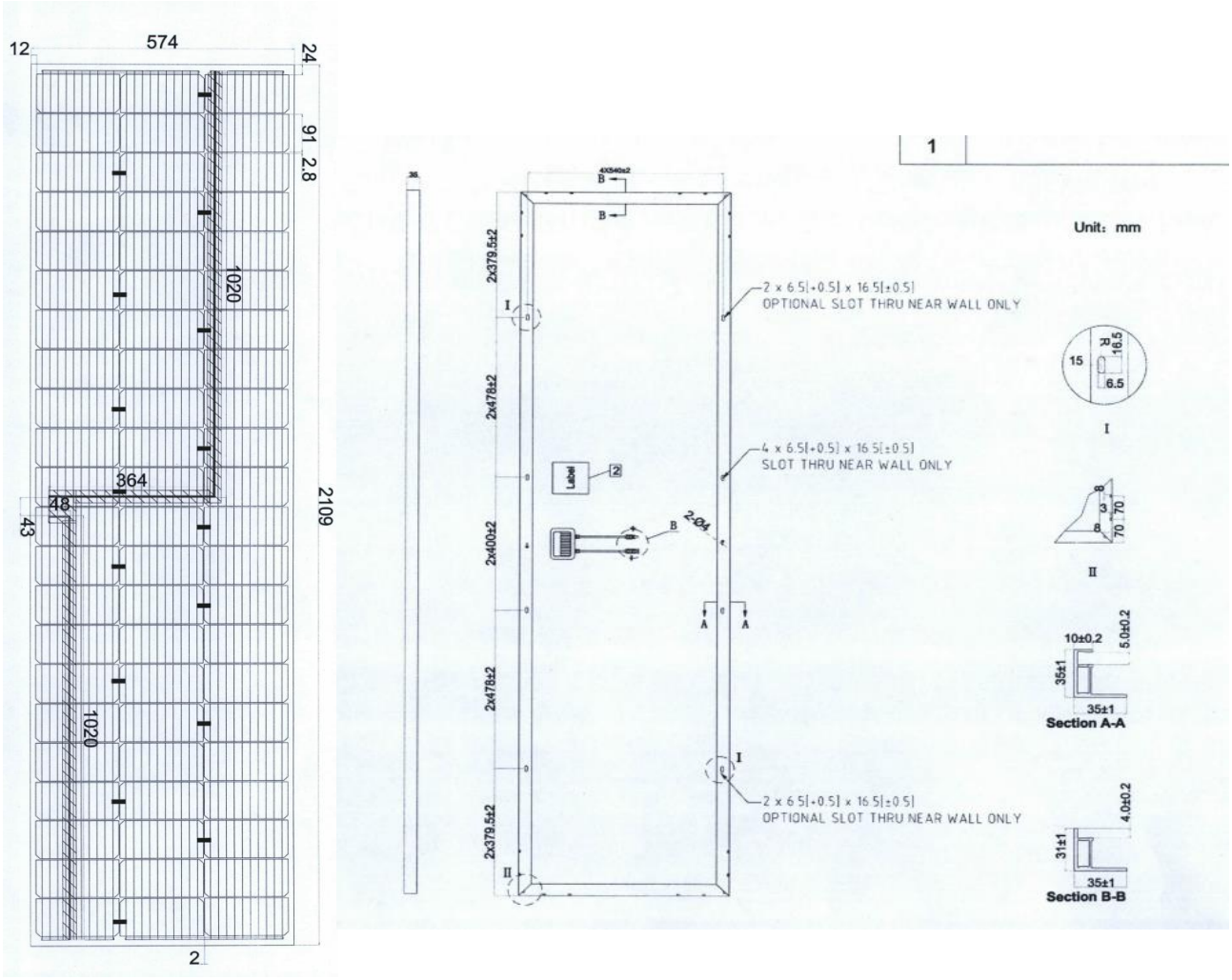
7.0 Illustrations

Illustration 1O - Schematic Diagram of module 412919/412921 (Unit: mm)



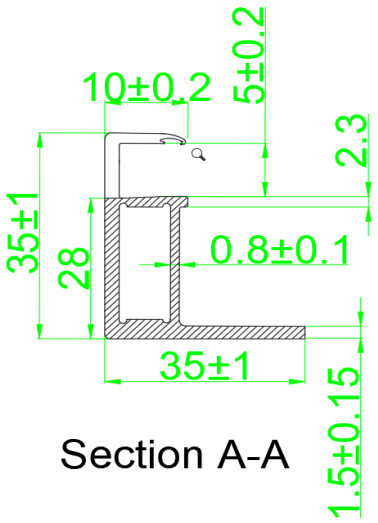
7.0 Illustrations

Illustration 1P - Schematic Diagram of module 61878 (Unit: mm)

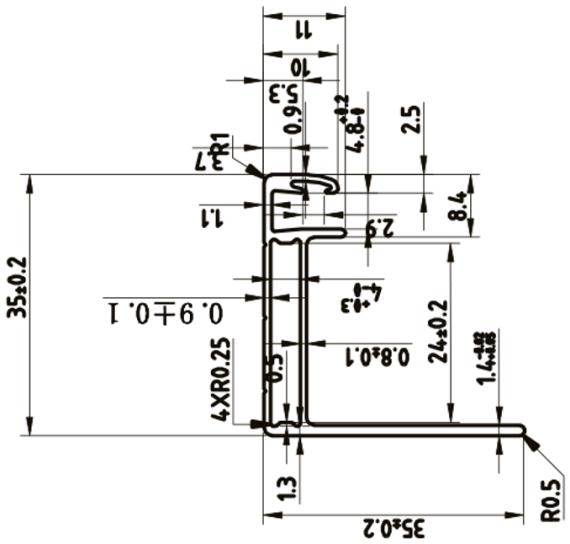


7.0 Illustrations

Illustration 2 - Schematic Diagram of frame crosssection for model 61798, 61791, 61849, 412922, 412923,

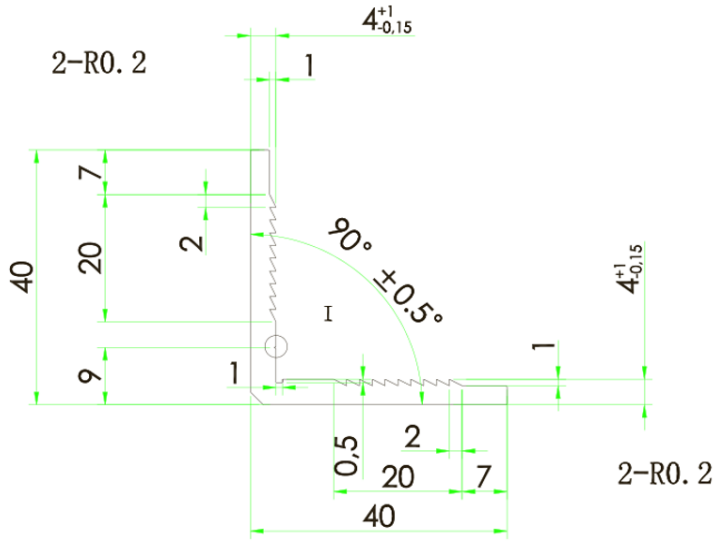


short edge



long edge

Illustration 2A - Schematic Diagram of corner key for model 61798, 61791, 61849, 412922, 412923, 412924.



7.0 Illustrations

Illustration 2B - Schematic Diagram of frame crosssection for model TN-XX-XXXMH, TN-XX-XXXM series.

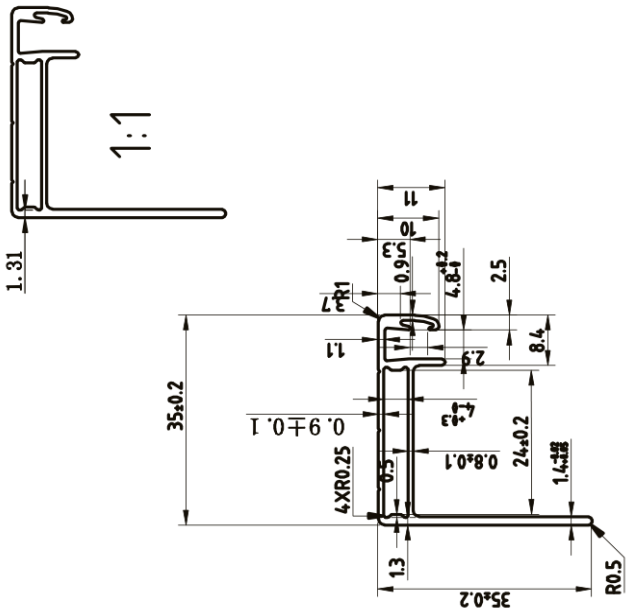
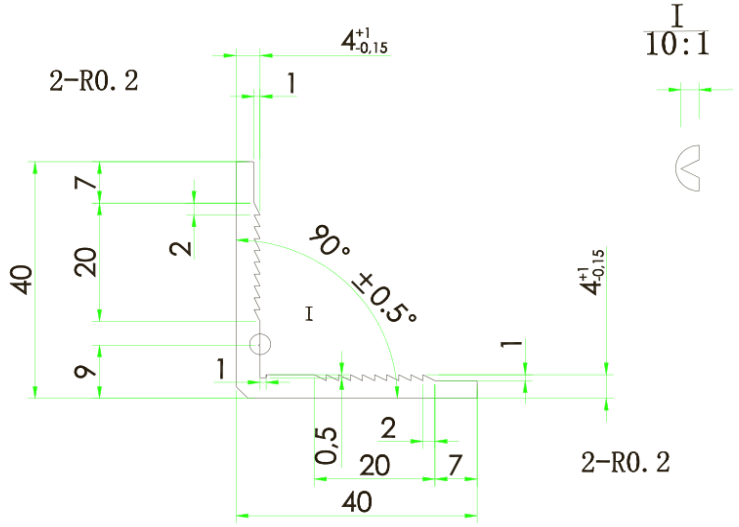


Illustration 2C - Schematic Diagram of corner key for model TN-XX-XXXMH, TN-XX-XXXM series.



7.0 Illustrations

Illustration 2D - Schematic Diagram of frame crosssection for model TN-MGXXX-XXX series.

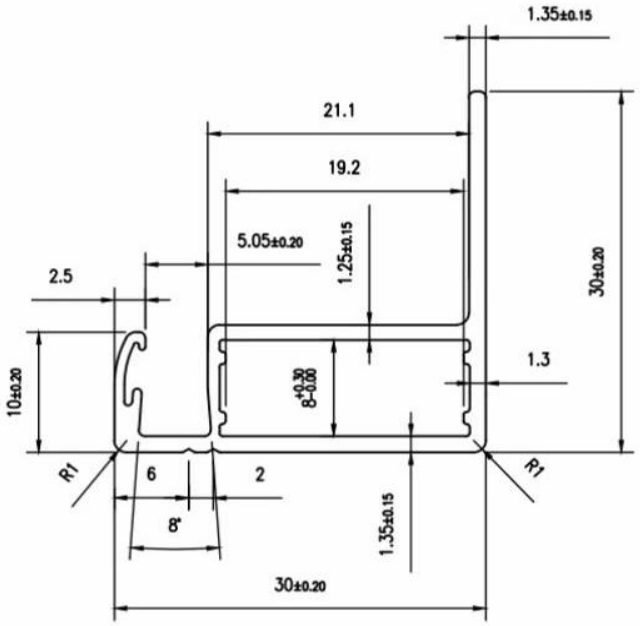
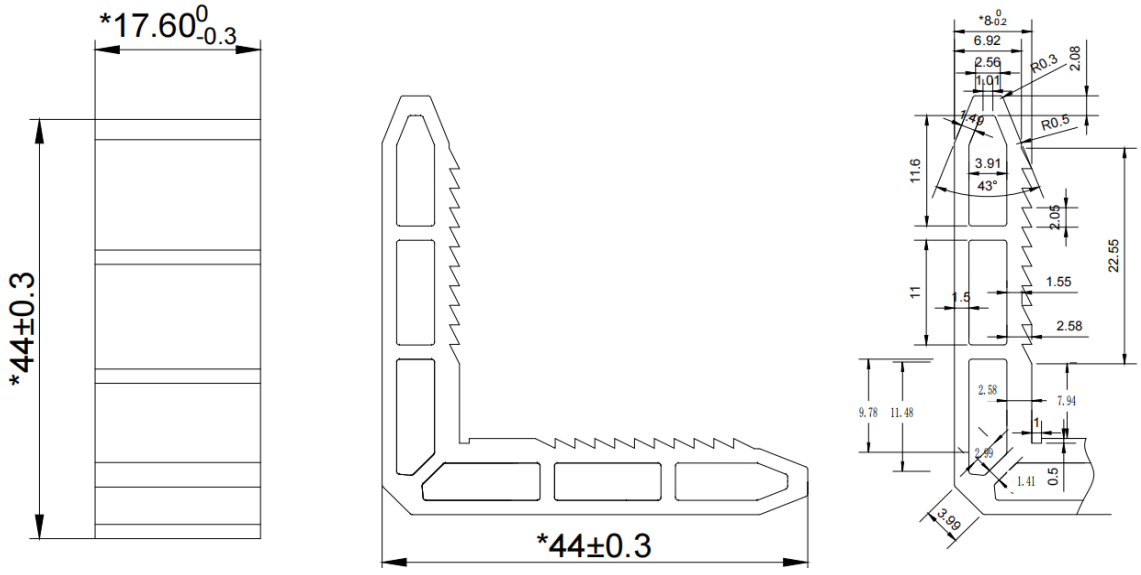
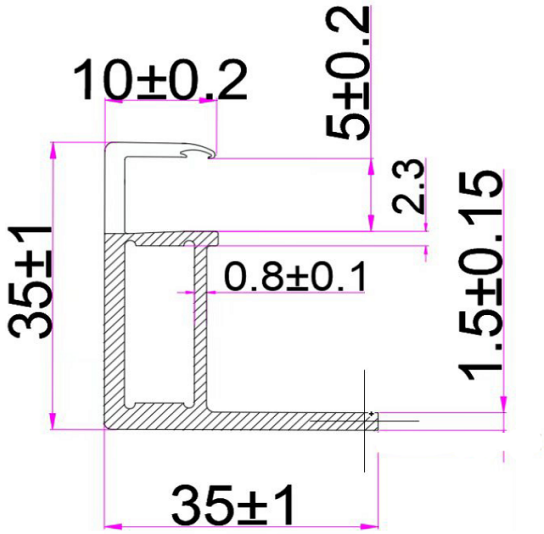


Illustration 2E - Schematic Diagram of corner key for model TN-MGXXX-XXX series.



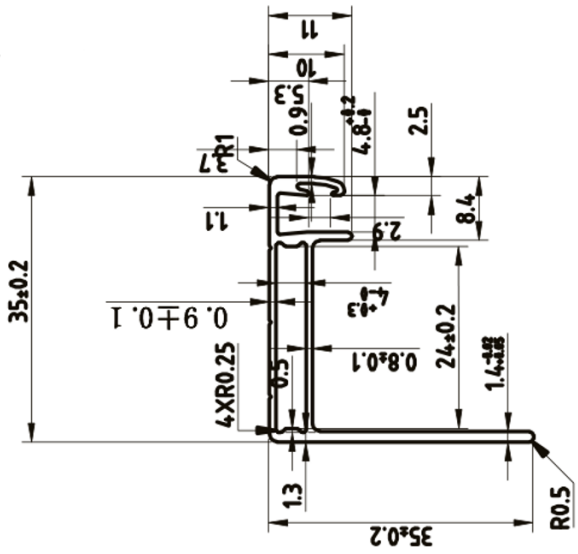
7.0 Illustrations

Illustration 2F - Schematic Diagram of frame crosssection for model 61798, 61791, 61849, 412922, 412923, 412924.



short edge

Illustration 2G - Schematic Diagram of frame crosssection for model 413540, 412918, 412920, 413541, 412919, 412921



7.0 Illustrations

Illustration 2H - Schematic Diagram of frame crosssection for model 61878.

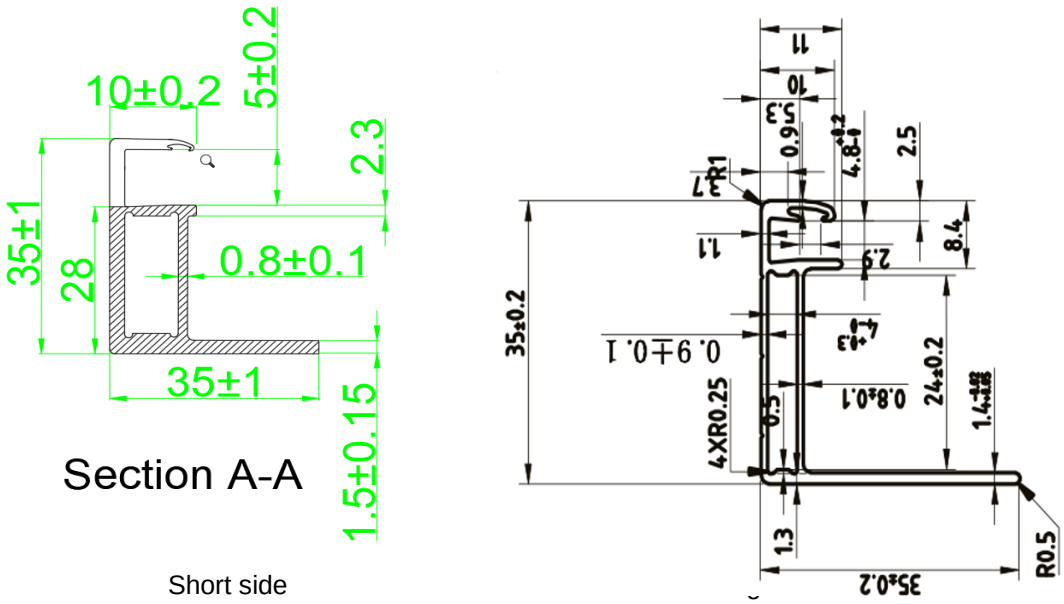
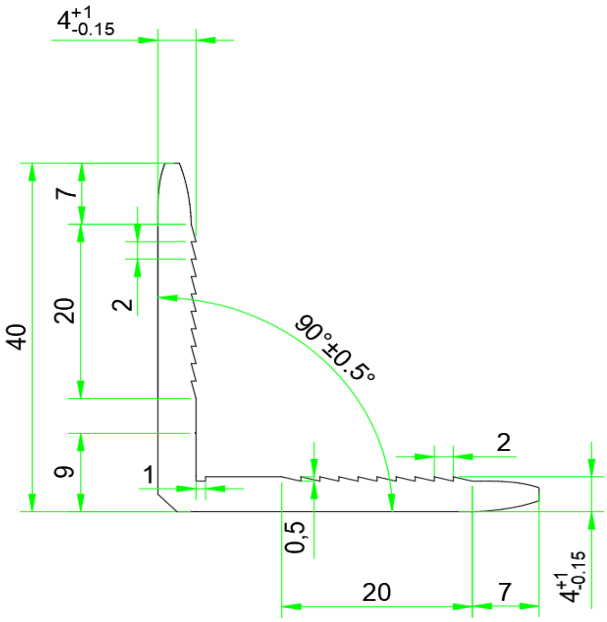


Illustration 2I - Conner key of frame crosssection for model 413540, 412918, 412920, 413541, 412919, 412921, 61878.



7.0 Illustrations

Illustration 3- Installation Method

K.4 Installing the Smart Panel on the SPC bracket

1. Place the smart panel on its bracket on the SPC bracket and secure it in place using four M6 serrated cap screws, as shown in Figure K-4a and b.

> NOTE: Install the smart panel 1.0-degree relative to the first production panel to avoid shadow on the production panel.

2. Secure with M6 serrated nuts and torque to 75 in-lb (8.5 Nm).

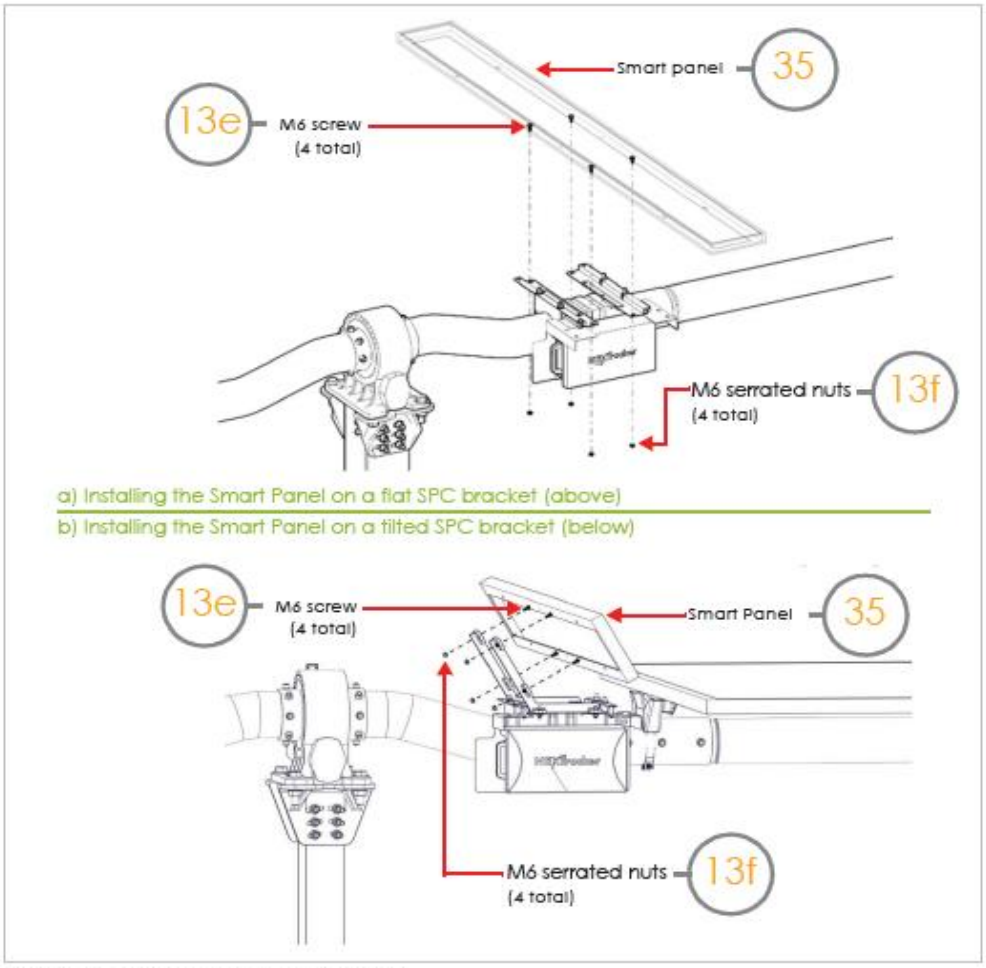


Figure K-4: Installing smart panel on flat SPC bracket.

7.0 Illustrations

Illustration 3A - Installation Method

Table M-2: (Continued)Smart module specifications

Specification	Smart Module Model		
	61798 (85W)	61849 (110W)	61791 (135W)
Maximum Altitude	2000m		
Bonding and Grounding	Frame Grounding (see "PV Module Grounding" on page 8)		
Design Load (Wind/Snow)	Positive and Negative load 2400Pa		
Design Load (Wind/Snow) Safety Factor[8]	Positive and Negative load 3600Pa		
Mounting	See "Installing the Smart Panel on the SPC bracket" on page 63		

7. PV wiring connectors that comply with the Standard for Connectors for Use in Photovoltaic Systems, UL 6703, shall mate with the specific allowable mating connector, including manufacturer(s) and model number(s) listed, as well as contact information and/or website of the PV connector manufacturer.
8. These PV modules have been evaluated to operate in an ambient air temperature range of -40°C to + 40°C and to a wind/ snow load of 3600 Pa for maximum positive design and 3600 Pa for maximum negative design with a safety factor of 1.5 in single axis mounting method.

Table M-3: Grounding hardware configurations

Module	Grounding hardware configuration		
	Hardware	Material	Size
All	Screw[9]	Stainless Steel	M4*20
	Flat washer		M4*9*0.8
	Spring Washer		M4*1*1*2
	Nut		M4
	Wire Copper		BVR12AWG

9. The torque of the screw is 1.5 N.M.

7.0 Illustrations

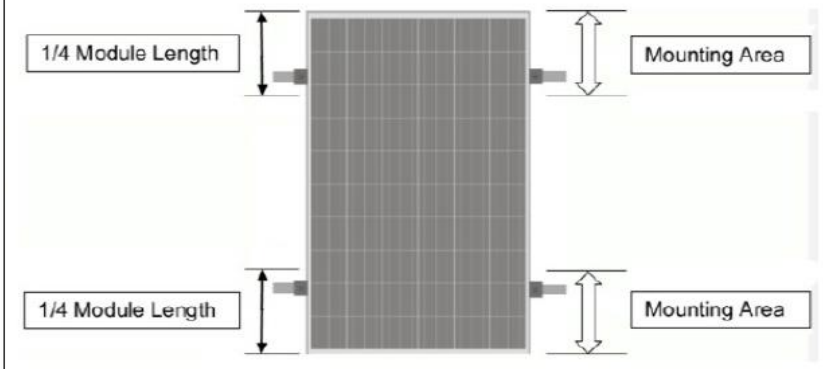
Illustration 3B - Installation Method

7.2 Installation Method

7.2.1 Mechanical installation matters and attentions

The connection of the module and support system can use the mounting holes on the frames, jig or embedded system to install.Installing modules must be conducted in accordance with the following example and advice, if the installation way is different from the public of our company, please consult our technical support or after sales team, and unless we agree the method, it will damage the modules and lead to warranty invalid。

- The minimum distance between two modules is 10 mm (0.4 inch)
- Baffle can't afford to exceed the maximum allowable load of the storm hit, also cannot bear the excessive force caused by thermal expansion of the support structure。
- During the installation or use, drain cannot be blocked in all cases。

The clamping system connecting to the long frame	

7.0 Illustrations

Illustration 4- Grounding Method

PV Module Grounding

When fasteners are installed correctly, modules are grounded through tracker components to the piers. The overall grounding of the entire racking system is to be investigated to meet the standards of the latest edition of the National Electrical Code, NEC, to Article 690: Solar Photovoltaic Systems and Article 250: Grounding and Bonding.

The array pier is in direct contact with the earth and is to be installed based on the requirements of a grounding electrode per Article 250. Any local electrical codes must be adhered to in addition to the national electrical codes. Figure 2-2 shows the grounding path for PV modules.

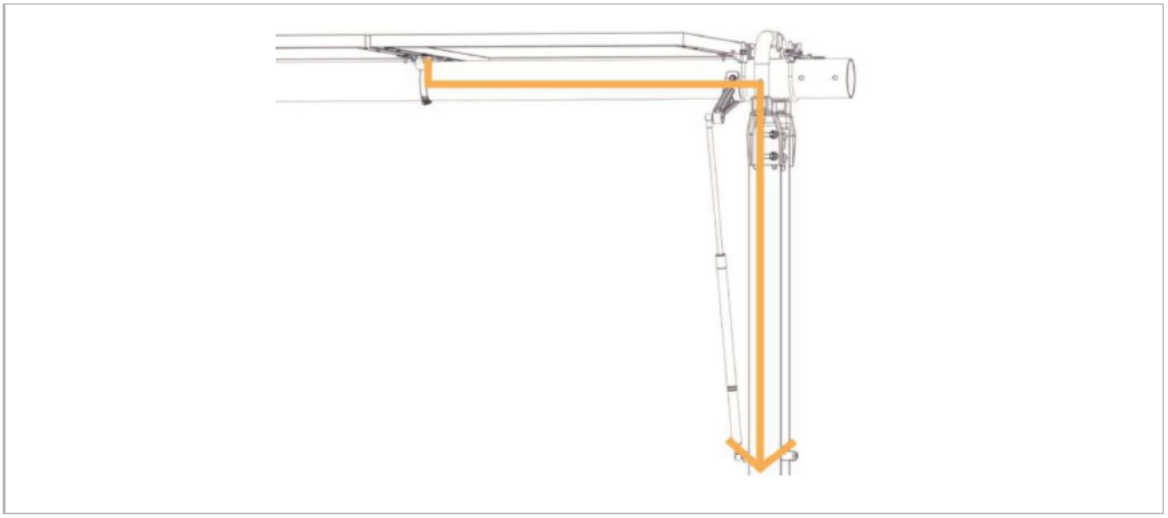


Figure 2-2: Grounding path for PV modules

7.0 Illustrations

Illustration 4A - Grounding Method

7. 2. 2 Grounding

All module frames and mounting bracket must be properly grounded in accordance with the corresponding national electrical discipline.By using proper grounding conductor, module frame and all metal construction continuously be connected together to achieve correct grounding.Grounding conductor or grounding wire can be copper, copper alloy, or any other materials used for electrical conductor conforming to the corresponding requirement of the national electrical discipline.Grounding conductor must be connected to the earth going through proper grounding electrode. Grounding device of earthing installation on third party's list can be used for grounding the meatal frame of the PV modules.The equipment must be carried out in accordance with the earthing equipment installation guide specified by the manufacturer.

- All the module frames and mounting brackets must be grounded.Using the recommended grounding terminals ,the cable be connected well, then fixed to the module frame。
- Use supportting frame after plating processing, in order to keep good conductive。
- Use proper grounding conductor, connect the module frame and supporting components, in order to achieve good grounding effect。
- The grounding conductor must be connected to the ground passing through a suitable ground electrode.It is recommended to use ground wire accessories (wiring nose) to connect the grounding cable.Welding the grounding cables within the socket connecting nose, then use the M4 screw to insert into the wiring nose rings and module frame grounding hole,then fasten them with a nut.Star spring washer should be used to prevent the screw loose ,which leads to bad earth.As shown in figure 4
- The earthing resistance of the module must be less than 10 ohms。
- If the module working conditions is of high temperature and high humidity, it is reccomanded clients choosing the inverter with isolation transformer which its negative can be grounded inside，

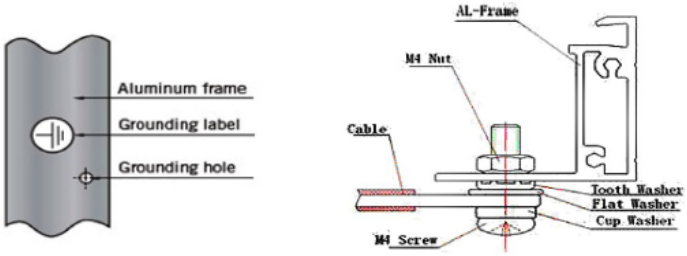


Figure 4. Grounding mark on module and the bolt connection

7.0 Illustrations

Illustration 5 - Controled combination of material solar cell and encapsulation

Combination No.	Component Name	Manufacturer	Type
1	Encapsulation (Upper side)	HANGZHOU FIRST APPLIED MATERIAL CO.,LTD.	F806P
	Solar Cell	Venus Energy (Cambodia) CO.,Ltd	VNS166M-9BB 9BB
		Tainergy Tech CO.,Ltd	T1S-00000HE1B
			T1S-xxxxxZ
		Tongwei solar Co.,Ltd.	M1585BPERC
			M182ABPERCBP SE
			M1669BPERC
	Encapsulation (lower side)	HANGZHOU FIRST APPLIED MATERIAL CO.,LTD.	F806P

7.0 Illustrations

Illustration 6 - Controled combination of material for junction box 15T11A (model 61798, 61791, 413540, 412918, 412920, 413541, 412919, 412921)

Component Name	Manufacturer	Type
Junction Box	Zhejiang Forsol Energy Co.,Ltd	15T11A
Backsheet	Cybrid Technologies Inc	Cynagard 465A(R)
Cable	Wuxi Xinhongye Wire&cable CO,.LTD	PV WIRE
	CHANGSHU JHOSIN COMMUNICATION TECHNOLOGY CO LTD	
Connector	AMPHENOL INDUSTRIAL OPERATIONS	H4CMC2DM/H4C FC2DM
Potting Material	LINKTECH SILICONE MATERIAL CO LTD	Encapsil 5202
Junction Box Adhesive	LINKTECH SILICONE MATERIAL CO LTD	AdheSil 3166
Bypass diode	Zhejiang Forsol Energy Co.,Ltd	FSL3045

Illustration 6A - Controled combination of material for junction box 15T11A (model 61849, 61878)

Component Name	Manufacturer	Type
Junction Box	Zhejiang Forsol Energy Co.,Ltd	15T11A
Backsheet	Cybrid Technologies Inc	Cynagard 465A(R)
Cable	Wuxi Xinhongye Wire&cable CO,.LTD	PV WIRE
Connector	Staubli Electrical Connectors AG	PV-KST4/6II-UR; PV-KBT4/6II-UR
Potting Material	LINKTECH SILICONE MATERIAL CO LTD	Encapsil 5202
Junction Box Adhesive	LINKTECH SILICONE MATERIAL CO LTD	AdheSil 3166
Bypass diode	Zhejiang Forsol Energy Co.,Ltd	FSL3045

7.0 Illustrations

Illustration 6B - Controled combination of material for junction box F303D(model TN-XX-XXXM series and TN-XX-XXXMH series)

Component Name	Manufacturer	Type
Junction Box	Zhejiang Forsol Energy Co.,Ltd	F303D
Backsheet	Cybrid Technologies Inc	Cynagard2X5A(R)
Cable	Wuxi Xinhongye Wire&cable CO,.LTD	PV WIRE
	Ningbo Kibor Wire&Cable Co.,LTD	PV WIRE
Connector	ZHEJIANG FORSOL ENERGY CO LTD	SIKE6
Potting Material	HANGZHOU ZHIJIANG SILICONE CHEMICAL CO LTD	JS1184A/JS1184B
Junction Box Adhesive	HANGZHOU ZHIJIANG SILICONE CHEMICAL CO LTD	JS-606
Bypass diode	SUZHOU GOOD-ARK ELECTRONIC CO., LTD	GFT3050SM

Illustration 6C - Controled combination of material for junction box F303G (model TN-MGXXX-XXX series)

Component Name	Manufacturer	Type
Junction Box	Zhejiang Forsol Energy Co.,Ltd	F303G
Backsheet	Cybrid Technologies Inc	Cynagard2X5A(R)
Cable	Wuxi Xinhongye Wire&cable CO,.LTD	PV WIRE
	Ningbo Kibor Wire&Cable Co.,LTD	PV WIRE
Connector	ZHEJIANG FORSOL ENERGY CO LTD	SIKE6
Potting Material	HANGZHOU ZHIJIANG SILICONE CHEMICAL CO LTD	JS1184A/JS1184B
Junction Box Adhesive	HANGZHOU ZHIJIANG SILICONE CHEMICAL CO LTD	JS-606
Bypass diode	SUZHOU GOOD-ARK ELECTRONIC CO., LTD	GFT3050SM
		GFT5050CT
	SUZHOU GOOD-ARK ELECTRONIC CO., LTD / ZHEJIANG FORSOL ENERGY Co., Ltd.	MK3050
		MK5050

7.0 Illustrations

Illustration 7 - Controled combination of material Backsheet and Encapsulation

Combination No.	Component Name	Manufacturer	Type
1	Backsheet	Cybrid Technologies Inc.	Cynagard 465A(R)
	Encapsulation	HANGZHOU FIRST APPLIED MATERIAL CO.,LTD.	F806P

Combination No.	Component Name	Manufacturer	Type
2	Backsheet	Cybrid Technologies Inc.	Cynagard2X5A (R)
	Encapsulation	HANGZHOU FIRST APPLIED MATERIAL CO.,LTD.	F806P

7.0 Illustrations

Illustration 8 - Cautionary Markings 'Do not disconnect under load'

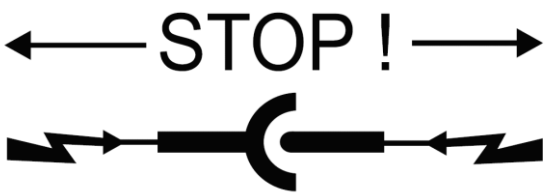


Illustration 8A - Cautionary Markings 'Do not disconnect under load'

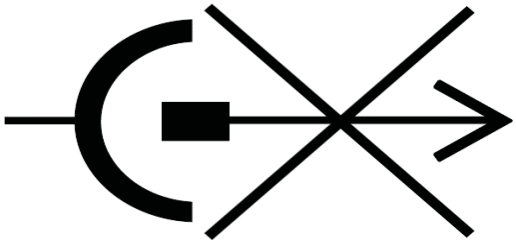


Illustration 8B - Cautionary Markings 'risk of electric shock'

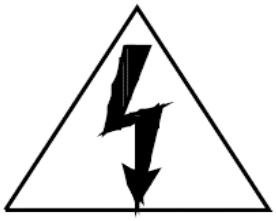


Illustration 8C - Cautionary Markings 'Classfication'

Class II	

8.0 Test Summary					
Evaluation Period	Jan 27, 2022 to Apr 26, 2022			Project No.	220401269HAN
Sample Rec. Date	1/26/2022	Condition	Prototype	Sample ID.	0220126-55
Test Location	Building No.2, No. 500 East Shuiyueting Road, Haining City, Zhejiang Province, China				
Test Procedure	Testing Lab				

Determination of the result includes consideration of measurement uncertainty from the test equipment and methods. The product was tested as indicated below with results in conformance to the relevant test criteria.

The following tests were performed on Mode 61791 with 44cells (166mm*83mm, Mono-Si) to evaluate the product.

1. Solar Cell Venus Energy (Cambodia) CO.,Ltd--VNS166M-9BB
2. Frontsheet Anhui Shunshun New Material Technology Co.,Ltd--Coating tempered glass
3. Encapsulation HANGZHOU FIRST APPLIED MATERIAL CO.,LTD--F806P
4. Frame Hangzhou Tanglong Energy Techonoly Co.,Ltd--6063-T5
5. Backsheet Cybrid Technologies Inc..--Cynagard 465A®
6. Adhesive (between Junction Box and backsheet and frame) LINKTECH SILICONE MATERIAL CO LTD--AdheSil 3166
7. Junction Box Zhejiang Forsol Energy Co.,Ltd--15T11A
8. Cable Wuxi Xinhongye Wire&cable CO,.LTD--PV WIRE
9. Connector AMPHENOL INDUSTRIAL OPERATIONS--H4CMC2DM/H4CFC4DM
10. Potting Material LINKTECH SILICONE MATERIAL CO LTD--Encapsil 5202
11. Bypass Diode Zhejiang Forsol Energy Co.,Ltd--FSL3045
12. Cell Connector Yaoheng Technology Co.,Ltd--0.6x0.16mm
13. String Connector Yaoheng Technology Co.,Ltd.--0.3x5.0mm
14. Fixing Tape 3M COMPANY--UV-1
15. Flux Singapore Asahi Chemical and Solder Industries Pte Ltd--SF105

Test Description	[UL 61215-1:2017 Ed.1	[UL 61730-2:2017 Ed.1+R:30Apr2020]	[CSA C22.2#61730-2:2019 Ed.2]
Visual inspection	MQT 01	MST 01	MST 01
Performance at STC and NMOT	MQT 06	–	–
Maximum power determination	MQT 02	MST 03	MST 03
Insulation thickness test	–	–	MST 04
Durability of markings	–	MST 05	MST 05
Sharp edge test	–	MST 06	MST 06
Bypass diode functionality test	MQT 18.2	MST 07	MST 07
Bypass diode thermal test	MQT 18.1	MST 25	MST 25
Accessibility test	–	MST 11	MST 11
Cut susceptibility test	–	MST 12	MST 12
Continuity test of equipotential bonding	–	MST 13	MST 13
Impulse voltage test	–	MST 14	MST 14
Insulation test	MQT 03	MST 16	MST 16

8.0 Test Summary			
Wet leakage current test	MQT 15	MST 17	MST 17
Temperature test	–	MST 21	MST 21
Hot-spot endurance test	MQT 09	MST 22	MST 22
Reverse current overload test	–	MST 26	MST 26
Module breakage test	–	MST 32	MST 32
Static mechanical load test	MQT 16	MST 34	MST 34
Materials creep test	–	MST 37	MST 37
Robustness of terminations test	MQT 14	MST 42	MST 42
Thermal cycling test (50 & 200 cycles)	MQT 11	MST 51	MST 51
Humidity freeze test	MQT 12	MST 52	MST 52
Damp heat test	MQT 13	MST 53	MST 53
UV test	MQT 10	MST 54	MST 54
Cold conditioning	–	MST 55	MST 55
Dry heat conditioning	–	MST 56	MST 56
Measurement of temperature coefficients	MQT 04	–	–
Performance at low irradiance	MQT 07	–	–
Outdoor exposure test	MQT 08	–	–
Hail test	MQT 17	–	–
Stabilization	MQT 19.1	–	–

8.0 Test Summary					
Evaluation Period	Jan 27, 2022 to Apr 26, 2022			Project No.	220401269HAN
Sample Rec. Date	1/26/2022	Condition	Prototype	Sample ID.	0220126-55
Test Location	Building No.2, No. 500 East Shuiyueting Road, Haining City, Zhejiang Province, China				
Test Procedure	Testing Lab				

Determination of the result includes consideration of measurement uncertainty from the test equipment and methods. The product was tested as indicated below with results in conformance to the relevant test criteria.

The following tests were performed on Mode 61798 with 44cells (166mm*55.3mm, Mono-Si), 61791 with 44 cells (166 mm x 83.0 mm, Mono-Si) and 61849 with 72 cells (166 mm x 41.5 mm, Mono-Si) to evaluate the product.

1. Solar Cell Venus Energy (Cambodia) CO.,Ltd--VNS166M-9BB
2. String Connector Yaoheng Technology Co.,Ltd.--0.2x5.0mm

Test Description	[UL 61215-1:2017 Ed.1	[UL 61730-2:2017 Ed.1+R:30Apr2020]	[CSA C22.2#61730-2:2019 Ed.2]
Visual inspection	MQT 01	MST 01	MST 01
Maximum power determination	MQT 02	MST 03	MST 03
Insulation test	MQT 03	MST 16	MST 16
Wet leakage current test	MQT 15	MST 17	MST 17
Temperature test	–	MST 21	MST 21
Hot-spot endurance test	MQT 09	MST 22	MST 22
Reverse current overload test	–	MST 26	MST 26
Thermal cycling test (200 cycles)	MQT 11	MST 51	MST 51

8.0 Test Summary					
Evaluation Period	Jun 15, 2022 to Aug 4, 2022			Project No.	220501437HAN
Sample Rec. Date	6/16/2022	Condition	Prototype	Sample ID.	02200616-49
Test Location	Building No.2, No. 500 East Shuiyueting Road, Haining City, Zhejiang Province, China No. 7 Building, No. 6958 Daye Road, Fengxian District, Shanghai, China (Fire test and ignitability test only)				
Test Procedure	Testing Lab				

Determination of the result includes consideration of measurement uncertainty from the test equipment and methods. The product was tested as indicated below with results in conformance to the relevant test criteria.

The following tests were performed on Mode 61798 with 44cells (166mm*55.3mm, Mono-Si), 61791 with 44 cells (166 mm x 83.0 mm, Mono-Si) and 61849 with 72 cells (166 mm x 41.5 mm, Mono-Si), 61849 with 72cells (166mm*41.5mm, Mono-Si) to evaluate the product.

1. Solar Cell Tainergy Tech CO.,Ltd --T1S-00000HE1B
2.Flux Asahi solder technology (Wuxi) Co. , Ltd.--SF105

Test Description	[UL 61215-1:2017 Ed.1	[UL 61730-2:2017 Ed.1+R:30Apr2020]	[CSA C22.2#61730-2:2019 Ed.2]
Visual inspection	MQT 01	MST 01	MST 01
Maximum power determination	MQT 02	MST 03	MST 03
Insulation test	MQT 03	MST 16	MST 16
Wet leakage current test	MQT 15	MST 17	MST 17
Temperature test	–	MST 21	MST 21
Hot-spot endurance test	MQT 09	MST 22	MST 22
Reverse current overload test	–	MST 26	MST 26
Thermal cycling test (200 cycles)	MQT 11	MST 51	MST 51
Damp heat test	MQT 13	MST 53	MST 53
Static mechanical load test	MQT 16	MST 34	MST 34
Insulation thickness test	–	–	MST 04
Fire test	–	MST 23	MST 23
Ignitability test	–	–	MST 24

8.0 Test Summary

Evaluation Period	October 24, 2022 to November 11, 2022	Project No.	221001163SHA

Due to the previous testing performed under UL Report E521529 Vol. 1 Sec. 1 no addition test was necessary.

The following tests were performed on Mode TN-72-440MH and TN-72-400M to evaluate the product.

a. Cell: Mono c-Si: BOM1: 166 mm * 83 mm, type" M1669BPERC", BOM2: 158.75 mm * 79.375 mm, type" M1585BPERC";
b. Encapsulant: "F806P";
c. Substrate: "Cynagard2X5A(R)", white;
d. Superstrate: low iron tempered glass, manufactured by HANGZHOU TONENG PHOTOVOLTAIC TECHNOLOGY CO. , LTD., nominal 3.2 mm thick;
e. Frame: extruded aluminum, anodized, cross section: 35 mm x 35 mm, corner pieces: aluminum, L shape, 40 mm by 40 mm by 25 mm;
f. Fixing tape: "UV-1";
g. Soldering Material: "W037933";
h. Frame/Junction box adhesive: "JS-606";
i. Junction box: F303x Series;
j. Potting: "JS1184A/JS1184B".

Test Description	[UL 61215-1:2017 Ed.1	[UL 61730-2:2017 Ed.1+R:30Apr2020]	[CSA C22.2#61730-2:2019 Ed.2]
Visual inspection	MQT 01	MST 01	MST 01
Performance at STC and NMOT	MQT 06	–	–
Maximum power determination	MQT 02	MST 03	MST 03
Insulation thickness test	–	–	MST 04
Durability of markings	–	MST 05	MST 05
Sharp edge test	–	MST 06	MST 06
Bypass diode functionality test	MQT 18.2	MST 07	MST 07
Bypass diode thermal test	MQT 18.1	MST 25	MST 25
Accessibility test	–	MST 11	MST 11
Cut susceptibility test	–	MST 12	MST 12
Continuity test of equipotential bonding	–	MST 13	MST 13
Impulse voltage test	–	MST 14	MST 14
Insulation test	MQT 03	MST 16	MST 16
Wet leakage current test	MQT 15	MST 17	MST 17
Temperature test	–	MST 21	MST 21
Hot-spot endurance test	MQT 09	MST 22	MST 22
Reverse current overload test	–	MST 26	MST 26
Module breakage test	–	MST 32	MST 32
Static mechanical load test	MQT 16	MST 34	MST 34
Materials creep test	–	MST 37	MST 37
Robustness of terminations test	MQT 14	MST 42	MST 42
Thermal cycling test (50 & 200 cycles)	MQT 11	MST 51	MST 51
Humidity freeze test	MQT 12	MST 52	MST 52
Damp heat test	MQT 13	MST 53	MST 53
UV test	MQT 10	MST 54	MST 54
Cold conditioning	–	MST 55	MST 55
Dry heat conditioning	–	MST 56	MST 56

8.0 Test Summary			
Measurement of temperature coefficients	MQT 04	–	–
Performance at low irradiance	MQT 07	–	–
Outdoor exposure test	MQT 08	–	–
Hail test	MQT 17	–	–
Stabilization	MQT 19.1	–	–
Ignitability test	–	–	MST 24

8.0 Test Summary

Evaluation Period	Nov 2, 2022 to Jan 3, 2023			Project No.	221001163SHA
Sample Rec. Date	11/2/2022	Condition	Prototype	Sample ID.	0221102-12
Test Location	Building No.2, No. 500 East Shuiyueting Road, Haining City, Zhejiang Province, China				
Test Procedure	Testing Lab				

Determination of the result includes consideration of measurement uncertainty from the test equipment and methods. The product was tested as indicated below with results in conformance to the relevant test criteria.

The following tests were performed on Mode TN-MG144-550.

1. Solar Cell Tainergy Tech CO.,Ltd --
2. Cable Ningbo Kibor Wire&Cable Co.,LTD-- PV WIRE
3. Bypass SUZHOU GOOD-ARK ELECTRONIC CO., LTD -- GFT3050SM
4. Cell Connector Yaoheng Technology Co.,Ltd--Φ0.3mm
5. String Connector Yaoheng Technology Co.,Ltd.--0.3×6.0mm/0.3×4.0mm

Test Description	[UL 61215-1:2017 Ed.1	[UL 61730-2:2017 Ed.1+R:30Apr2020]	[CSA C22.2#61730-2:2019 Ed.2]
Visual inspection	MQT 01	MST 01	MST 01
Maximum power determination	MQT 02	MST 03	MST 03
Insulation test	MQT 03	MST 16	MST 16
Wet leakage current test	MQT 15	MST 17	MST 17
Temperature test	–	MST 21	MST 21
Hot-spot endurance test	MQT 09	MST 22	MST 22
Reverse current overload test	–	MST 26	MST 26
Thermal cycling test (200 cycles)	MQT 11	MST 51	MST 51
Damp heat test	MQT 13	MST 53	MST 53
Static mechanical load test	MQT 16	MST 34	MST 34

8.0 Test Summary					
Evaluation Period	December 5, 2022 to February 14, 2023			Project No.	230200960SHA
Sample Rec. Date	12/30/2022	Condition	Prototype	Sample ID.	0221230-41
Test Location	Building No.2, No. 500 East Shuiyueting Road, Haining City, Zhejiang Province, ChinaNo. 7 Building ChinaNo. 7 Building, No. 6958 Daye Road, Fengxian District, Shanghai, China (Fire test and ignitability test only)				
Test Procedure	Testing Lab				

Determination of the result includes consideration of measurement uncertainty from the test equipment and methods. The product was tested as indicated below with results in conformance to the relevant test criteria.

The following tests were performed on Mode 61791.

1. Frame Hangzhou Tanglong Energy Techonoly Co.,Ltd - 6063-T5

Test Description	[UL 61215-1:2017 Ed.1	[UL 61730-2:2017 Ed.1+R:30Apr2020]	[CSA C22.2#61730-2:2019 Ed.2]
Visual inspection	MQT 01	MST 01	MST 01
Maximum power determination	MQT 02	MST 03	MST 03
Insulation test	MQT 03	MST 16	MST 16
Wet leakage current test	MQT 15	MST 17	MST 17
Thermal cycling test (50 cycles)	MQT 11	MST 51	MST 51
Humidity freeze test	MQT 12	MST 52	MST 52
UV test	MQT 10	MST 54	MST 54
Hail test	MQT 17	–	–

8.0 Test Summary					
Evaluation Period	Mar 22, 2023 to May 15, 2023			Project No.	230200962HAN
Sample Rec. Date	3/22/2022	Condition	Prototype	Sample ID.	0230320-66
Test Location	Building No.2, No. 500 East Shuiyueting Road, Haining City, Zhejiang Province, China				
Test Procedure	Testing Lab				

Determination of the result includes consideration of measurement uncertainty from the test equipment and methods. The product was tested as indicated below with results in conformance to the relevant test criteria.

The following tests were performed on Mode 412978 with 44 cells (91 mm x 45.5 mm, Mono-Si) and 61787 with 66 cells (182 mm x 91 mm, Mono-Si) to evaluate the product.

1. Solar Cell ET SOLAR TECHNOLOGY (VIET NAM) COMPANY LIMITED--ECM1010BSE2
2. Frame Zhangjiagang City XiechangPV CO.,Ltd --6063-T5
3. Cell Connector Hangzhou Fuyangchanghe Newenergy Technologies Company Limited--0.6x0.16mm
4. String Connector Hangzhou Fuyangchanghe Newenergy Technologies Company Limited--0.3×5.0mm/0.2×5.0mm
5. Insulation Sheet Cynagard 115F--Cynagard 115F

Test Description	[UL 61215-1:2017 Ed.1	[UL 61730-2:2017 Ed.1+R:30Apr2020]	[CSA C22.2#61730-2:2019 Ed.2]
Visual inspection	MQT 01	MST 01	MST 01
Performance at STC and NMOT	MQT 06	–	–
Maximum power determination	MQT 02	MST 03	MST 03
Bypass diode functionality test	MQT 18.2	MST 07	MST 07
Continuity test of equipotential bonding	–	MST 13	MST 13
Insulation test	MQT 03	MST 16	MST 16
Wet leakage current test	MQT 15	MST 17	MST 17
Temperature test	–	MST 21	MST 21
Hot-spot endurance test	MQT 09	MST 22	MST 22
Reverse current overload test	–	MST 26	MST 26
Static mechanical load test	MQT 16	MST 34	MST 34
Thermal cycling test	MQT 11	MST 51	MST 51
Damp heat test	MQT 13	MST 53	MST 53
Stabilization	MQT 19.1	–	–

8.0 Test Summary					
Evaluation Period	Mar 22, 2023 to May 15, 2023			Project No.	230200962HAN
Sample Rec. Date	3/22/2022	Condition	Prototype	Sample ID.	0230322-66
Test Location	Building No.2, No. 500 East Shuiyueting Road, Haining City, Zhejiang Province, China				
Test Procedure	Testing Lab				

Determination of the result includes consideration of measurement uncertainty from the test equipment and methods. The product was tested as indicated below with results in conformance to the relevant test criteria.

The following tests were performed on Mode 412978 with 44 cells (91 mm x 45.5 mm, Mono-Si) and 61787 with 66 cells (182 mm x 91 mm, Mono-Si) to evaluate the product.

1. Solar Cell Tongwei solar Co.,Ltd.--M182ABPERCBP SE
2. Frame Zhangjiagang City XiechangPV CO.,Ltd --6063-T5
3. Cell Connector Hangzhou Fuyangchanghe Newenergy Technologies Company Limited--0.6x0.16mm
4. String Connector Hangzhou Fuyangchanghe Newenergy Technologies Company Limited--0.3×5.0mm/0.2×5.0mm
5. Insulation Sheet Cynagard 115F--Cynagard 115F

Test Description	[UL 61215-1:2017 Ed.1	[UL 61730-2:2017 Ed.1+R:30Apr2020]	[CSA C22.2#61730-2:2019 Ed.2]
Visual inspection	MQT 01	MST 01	MST 01
Performance at STC and NMOT	MQT 06	–	–
Maximum power determination	MQT 02	MST 03	MST 03
Bypass diode functionality test	MQT 18.2	MST 07	MST 07
Continuity test of equipotential bonding	–	MST 13	MST 13
Insulation test	MQT 03	MST 16	MST 16
Wet leakage current test	MQT 15	MST 17	MST 17
Temperature test	–	MST 21	MST 21
Hot-spot endurance test	MQT 09	MST 22	MST 22
Reverse current overload test	–	MST 26	MST 26
Static mechanical load test	MQT 16	MST 34	MST 34
Thermal cycling test	MQT 11	MST 51	MST 51
Damp heat test	MQT 13	MST 53	MST 53
Stabilization	MQT 19.1	–	–

8.0 Test Summary

Evaluation Period	October 24, 2022 to November 11, 2022	Project No.	230200962HAN

Due to the previous testing performed under UL Report E521529 Vol. 1 Sec. 1 no addition test was necessary.

The following tests were performed on Mode TN-72-445MH and TN-72-400M to evaluate the product.

1. Alternate one type new cell as below to model TN-60-xxxMH and TN-72-xxxMH series.
Alternate cell – type T1S-00000HE1B, manufactured by TAINERGY TECH CO., LTD., dimension 166 mm * 83 mm, thickness 190 um, 9BB.
2. Alternate one type new soldering material as below:
Alternate – type S05081915, manufactured by SINASAHI SOLDER(M) SDN.BHD
3. Alternate one type new Flux as below:
Alternate – type SF105, manufactured by Singapore Asahi Chemical and Solder Industries Pte Ltd.
4. Update dimension for model TN-60-xxxMH series from 1756 mm * 1039 mm to 1755 mm * 1038 mm and TN-72-xxxMH from 2096 mm * 1039 mm to 2094 mm * 1038 mm.

Test Description	[UL 61215-1:2017 Ed.1	[UL 61730-2:2017 Ed.1+R:30Apr2020]	[CSA C22.2#61730-2:2019 Ed.2]
Visual inspection	MQT 01	MST 01	MST 01
Performance at STC and NMOT	MQT 06	–	–
Maximum power determination	MQT 02	MST 03	MST 03
Bypass diode functionality test	MQT 18.2	MST 07	MST 07
Bypass diode thermal test	MQT 18.1	MST 25	MST 25
Continuity test of equipotential bonding	–	MST 13	MST 13
Insulation test	MQT 03	MST 16	MST 16
Wet leakage current test	MQT 15	MST 17	MST 17
Temperature test	–	MST 21	MST 21
Hot-spot endurance test	MQT 09	MST 22	MST 22
Reverse current overload test	–	MST 26	MST 26
Thermal cycling test	MQT 11	MST 51	MST 51
Damp heat test	MQT 13	MST 53	MST 53
Stabilization	MQT 19.1	–	–

8.1 Signatures

A representative sample of the product covered by this report has been evaluated and found to comply with the applicable requirements of the standards indicated in Section 1.0.

Completed by:	Zach Zhou	Reviewed by:	Ken Gu
Title:	Engineer	Title:	Reviewer
Signature:	Zach Zhou	Signature:	

9.0 Correlation Page For Multiple Listings	
The following products, which are identical to those identified in this report except for model number and Listee name, are authorized to bear the ETL label under provisions of the Intertek Multiple Listing Program.	
BASIC LISTEE	Toenergy Technology Hangzhou Co Ltd
Address	No.3, Gaoxin 9 Road, Xiaoshan Economy and Technology Development Zone, Hangzhou, 311215
Country	CHINA
Product	Crystalline Silicon Photovoltaic (PV) Modules

MULTIPLE LISTEE 1	NEXTracker Inc.
Address	6200 Paseo Padre Parkway Fremont CA 94555
Country	USA
Brand Name	NEXTRACKER
ASSOCIATED MANUFACTURER	All manufacturers shown in Section 1.0
Address	
Country	

MULTIPLE LISTEE 1 MODELS	BASIC LISTEE MODELS
61791, 61798, 61849	61791, 61798, 61849

MULTIPLE LISTEE 2	None
Address	
Country	
Brand Name	
ASSOCIATED MANUFACTURER	
Address	
Country	

MULTIPLE LISTEE 2 MODELS	BASIC LISTEE MODELS

MULTIPLE LISTEE 3	None
Address	
Country	
Brand Name	
ASSOCIATED MANUFACTURER	
Address	
Country	

MULTIPLE LISTEE 3 MODELS	BASIC LISTEE MODELS

10.0 General Information

The Applicant and Manufacturer have agreed to produce, test and label ETL Listed products in accordance with the requirements of this Report. The Manufacturer has also agreed to notify Intertek and to request authorization prior to using alternate parts, components or materials.

COMPONENTS

Components used shall be those itemized in this Intertek report covering the product, including any amendments

LISTING MARK

The ETL Listing mark applied to the products shall either be separable in form, such as labels purchased from Intertek, or on a product nameplate or other media only as specifically authorized by Intertek. Use of the mark is subject to the control of Intertek.

The mark must include the following four items:

1) applicable country identifiers "US" and/or "C" or "US", "C" and "EU"
2) the word "Listed" or "Classified" or "Recognized Component" (whichever is appropriate)
3) a control number issued by Intertek
4) a product descriptor that identifies the standards used for certification. Example:

For US standards, the words, “Conforms to” shall appear with the standard number along with the word, “Standard” or “Std.” Example: “Conforms to ANSI/UL Std. XX.”

For Canadian standards, the words “Certified to CAN/CSA Standard CXX No. XX.” shall be used, or abbreviated, “Cert. to CAN/CSA Std. CXX No. XX.”

Can be used together when both standards are used.

If all standards on the ATM have the same standard title, the shared title or its abbreviation may be used in place of the examples above. Example: "Medical Electrical Equipment" or "MEE"; "Information Technology Equipment" or "ITE"; "Audio/Video Information And Communication Technology Equipment" or "A/V ICTE".

Note: A facsimile must be submitted to Intertek, Attn: Follow-up Services for approval prior to use. The facsimile need not have a control number. A control number will be issued **after signed Certification Agreements** have been received by the Follow-up Services office, approval of the facsimile of your proposed Listing Mark, satisfactory completion of the Listing Report, and scheduling of a factory

MANUFACTURING AND PRODUCTION TESTS

Manufacturing and Production Tests shall be performed as required in this Report.

FOLLOW-UP SERVICE

Periodic unannounced audits of the manufacturing facility (and any locations authorized to apply the mark) shall be scheduled by Intertek. An audit report shall be issued after each visit. Special attention will be given to the following:

1. Conformance of the manufactured product to the descriptions in this Report.
2. Conformance of the use of the ETL mark with the requirements of this Report and the Certification Agreement.
3. Manufacturing changes.
4. Performance of specified Manufacturing and Production Tests.

In the event that the Intertek representative identifies non-conformance(s) to any provision of this Report, the Applicant shall take one or more of the following actions:

1. Correct the non-conformance.
2. Remove the ETL Mark from non-conforming product.
3. Contact the issuing product safety evaluation center for instructions.

10.1 Evaluation of Unlisted Components

Because Unlisted Components are uncontrolled, and they do not fall under a third party follow up program, Intertek may require these components to be tested and/or evaluated at least once annually, more often for certain components, as part of the independent certification process. The Unlisted Components in Section 5.0 require testing and/or evaluation as indicated.

The Applicant will be notified, in writing, via the applicable contact methods, as defined in Section 1.0, when these components must be selected and sent to Component Evaluation Center (CEC) for re-evaluation.

Due to particular testing requirements, some components may be requested to be shipped to specific labs. Thus, specific shipment destination(s) for each sample will be provided in the written notification.

Managing CEC Location:
Intertek Testing Services Shanghai Limited
ETL Component Evaluation Center
Building No. 86, 1198 Qinzhou Road (North)
Shanghai 200233, China
Attn: Ms. Emiliana Zhou
Sample Disposition: Due to the destructive nature of the testing, all samples will be discarded at the conclusion of testing unless, the manufacturer specifically requests the return of the samples. The request for return must accompany the initial component shipment.

11.0 Manufacturing and Production Tests

The manufacturer agrees to conduct the following Manufacturing and Production Tests as specified:

Required Tests

Visual inspection, Module output power, Bypass diode functionality test, Continuity test of equipotential bonding, Insulation Test

11.1 Insulation Test:

Method

Each module (100%) shall withstand for 1 second without electrical breakdown as a routine production line test, the application of a dc test potential of $1.2 \times (2 \times V_{SYS} + 1000V)$ where V_{SYS} is the maximum rated system voltage. The voltage shall be applied between the active circuit of the module and accessible metal parts. The test is to be conducted when the module is complete and ready for packing, or when it is complete except for covers or other parts that may interfere with the performance of the test.

Test Equipment

The test equipment is to include a means of indicating the test voltage that is being applied to the product under test and a means of effectively indicating unacceptable performance. A leakage current of greater than 50 µA represents a failure.

Products Insulation Test:

Product	Test Voltage	Test Time
All products covered by this Report with 600V system voltage	2200V	60 s
	or	
	2640V	1 s
All products covered by this Report with 1500V system voltage	4000V	60 s
	or	
	4800V	1 s

11.2 Module Output Power Test:

Method

The electrical output power shall be verified on the final wiring configuration on a 100% basis. Results from I-V curve measurements shall also be used to verify that the current and voltage rating falls within the specification. All production values of Isc and Voc shall be covered by the tolerances of the product qualified under UL 61730. Possible stabilization effects shall be considered if changes of Isc and Voc are expected during operation in sunlight. This test will also verify that bypass diodes are not shorted.

11.3 Bypass Diode Functionality Test:

Method

Verification that bypass diodes are working properly shall be performed on 100 % sampling rate.

Three alternative test methods can be applied:

a) Perform successive additional I-V measurements in conjunction with maximum power determination with one cell of each string in the interconnection circuit completely shaded. The bypass diode belonging to this string is working properly, if the characteristic bend in the I-V curve is observed.

b) A conductivity test can be performed with the PV module terminals connected in reverse polarity to a current source. The current flow and voltage drop across the PV module terminals can be used as indicator that the diodes are working properly.

c) The I-V characteristics of all diodes can be verified just before their assembly. If the bypass diodes are in the junction box this could be done through measurement at the corresponding terminals of the junction box. A precondition for the latter method is an appropriate plan to mitigate possible influence of electrostatic discharges on the diodes in production.

11.4 Continuity test of equipotential bonding Test:
Method PV modules provided with a connection for equipotential bonding are subjected to a continuity test for equipotential bonding (MST 13). At a sampling rate of 1 PV module per framing station per working shift demonstrate the electrical continuity between the grounding connection and all accessible conductive parts. Any appropriate indication device may be employed (current supply in conjunction with current and voltage measurement). PV modules that have no frames or equipotential bonding locations identified shall be exempt from this requirement.
11.5 Visual inspection:
All modules covered by this Report.

12.0 Revision Summary				
The following changes are in compliance with the declaration of Section 8.1:				
Date/ Proj # Site ID	Project Handler/ Reviewer	Section	Item	Description of Change
16-Jun-2022	Zach Zhou/Ken Gu	9	1	Added MULTIPLE LISTEE 1:NEXTracker Inc. Brand name:NEXTRACKER 61791, 61798
220501436SHA				
4-Aug-2022	Zach Zhou/Ken Gu	1	-	Added standard 'Photovoltaic (PV) Module Safety Qualification - Part 1: Requirements for Construction [CSA C22.2#61730-1:2019 Ed.2]' and 'Photovoltaic (PV) Module Safety Qualification - Part 2: Requirements for Testing [CSA C22.2#61730-2:2019 Ed.2]'.
220501437SHA		2	-	Added model '61849'
				Added 'Fire performance: Type 4'
		4	1	Added cell 'T1S-00000HE1B' manufactured by Tainergy Tech CO.,Ltd
			8	Added cable PV WIRE 12 AWG manufactured by Wuxi Xinhongye Wire&cable CO,.LTD
			9	Added new connector PV-KST4/6II-UR;PV-KBT4/6II-UR manufactured by Staubli Electrical Connectors AG
			18	Added flux SF105 manufactured by Asahi solder technology (Wuxi) Co. , Ltd.
		7	1B	Added Illustration 1B - Schematic Diagram of module 61849
			5	Added Combination 2
			6	Added combination of material for junction box 15T11A
		8	-	Added testing block of project 220501437HAN.

12.0 Revision Summary				
The following changes are in compliance with the declaration of Section 8.1:				
Date/ Proj # Site ID	Project Handler/ Reviewer	Section	Item	Description of Change
6-Sep-2022	Zach Zhou/Ken Gu	4	8	added cable PV WIRE 14 AWG manufactured by CHANGSHU JHOSIN COMMUNICATION TECHNOLOGY CO LTD
220900270SHA		7	6	added cable PV WIRE manufactured by CHANGSHU JHOSIN COMMUNICATION TECHNOLOGY CO LTD
9-Jan-2023	Zach Zhou/Ken Gu	2	Models	Added TN- followed by 60-; followed by 320, 325, 330, 335 or 340; followed by M. TN- followed by 72-; followed by 380, 385, 390, 395, 400, 405 or 410; followed by M. TN- followed by 60-; followed by 360, 365, 370 or 375; followed by MH. TN- followed by 72-; followed by 430, 435, 440, 445, 450 or 455; followed by MH. TN- followed by MG144-; followed by 525, 530, 535, 540, 545 or 550. TN- followed by MG132-; followed by 480, 485, 490, 495, 500 or 505. TN- followed by MG120-; followed by 435, 440, 445, 450, 455 or 460. TN- followed by MG108-; followed by 390, 395, 400, 405, 410 or 415.
221001163SHA			Model Similarity	Added new Model Similarity descraption
			Ratings	Updated Ratings due to add new models.
			Other Ratings	Updated Other Ratings due to add new models.
			1	Added cell 'M1585BPERC' manufactured by Tongwei solar Co.,Ltd.
				Added cell 'M1669BPERC' manufactured by Tongwei solar Co.,Ltd.
				Added cell 'T1S-xxxxxZ' manufactured by Tainergy Tech CO.,Ltd
			2	Added Frontsheet 'Low iron Tempered glass' manufactured by Hangzhou Tuneng Photovoltaic Technology Co. , Ltd.
			5	Added Backsheet 'Cynagard2X5A(R)‘ manufactured by Cybrid Technologies Inc.

12.0 Revision Summary

The following changes are in compliance with the declaration of Section 8.1:

Date/ Proj # Site ID	Project Handler/ Reviewer	Section	Item	Description of Change
		4	6	Added Adhesive (between Junction Box and backsheet) 'JS-606‘ manufactured by HANGZHOU ZHIJIANG SILICONE CHEMICAL CO LTD
			7	Added junction box 'F303D' manufactured by Zhejiang Forsol Energy Co.,Ltd.
				Added junction box 'F303G' manufactured by Zhejiang Forsol Energy Co.,Ltd.
			8	Added cable PV WIRE 12 AWG manufactured by Wuxi Xinhongye Wire&cable CO,.LTD.
				Added cable PV WIRE 12 AWG manufactured by Ningbo Kibor Wire&Cable Co.,LTD.
			9	Added connector 'SIKE6' manufactured by ZHEJIANG FORSOL ENERGY CO LTD.
			11	Added potting 'JS1184A/JS1184B' manufactured by HANGZHOU ZHIJIANG SILICONE CHEMICAL CO LTD.
			12	Added bypass diode 'GFT3050SM' manufactured by SUZHOU GOOD-ARK ELECTRONIC CO., LTD.
				Added bypass diode ‘GFT3050SM’ manufactured by SUZHOU GOOD-ARK ELECTRONIC CO., LTD
				Added bypass diode ‘GFT5050CT’ manufactured by SUZHOU GOOD-ARK ELECTRONIC CO., LTD
				Added bypass diode ‘MK3050’ manufactured by SUZHOU GOOD-ARK ELECTRONIC CO., LTD / ZHEJIANG FORSOL ENERGY Co., Ltd.
				Added bypass diode ‘MK5050’ manufactured by SUZHOU GOOD-ARK ELECTRONIC CO., LTD / ZHEJIANG FORSOL ENERGY Co., Ltd.
			13	Added Cell Connector '0.16x1.2mm and ф0.35' manufactured by Yaoheng Technology Co.,Ltd.

12.0 Revision Summary				
The following changes are in compliance with the declaration of Section 8.1:				
Date/ Proj # Site ID	Project Handler/ Reviewer	Section	Item	Description of Change
			13	Added Cell Connector 'ф0.3mm' manufactured by Yaoheng Technology Co.,Ltd.
			15	Adhesive for Frame 'JS-606' manufactured by HANGZHOU ZHIJIANG SILICONE CHEMICAL CO LTD.
		7	1C	Added ‘Illustration 1C - Schematic Diagram of module TN-72-XXXMH series (Unit: mm)’.
			1D	Added ‘Illustration 1D - Schematic Diagram of module TN-60-XXXMH series (Unit: mm)’.
			1E	Added 'Illustration 1E - Schematic Diagram of moduleTN-72-XXXM series (Unit: mm)'.
			1F	Added 'Illustration 1E - Schematic Diagram of moduleTN-60-XXXM series (Unit: mm)'.
			1G	Added Illustration 1G - Schematic Diagram of module TN-MG144-XXX series
			1H	Added Illustration 1H - Schematic Diagram of module TN-MG132-XXX series
			1I	Added Illustration 1I - Schematic Diagram of module TN-MG120-XXX series
			1J	Added Illustration 1J - Schematic Diagram of module TN-MG108-XXX series
			2B	Added 'Illustration 2B - Schematic Diagram of frame crosssection'.
			3B	Added 'Illustration 3B - Installation Method'.
			4A	Added 'Illustration 4A - Grounding Method'.
			5	Added new Controled combination of material solar cell and encapsulation
			6B	Added ‘Illustration 6B - Controled combination of material for junction box F303D.
			6C	Added ‘Illustration 6C - Controled combination of material for junction box F303G.
			7	Added Controled combination 2 of material Backsheet and Encapsulation
		8	-	Added two testing block of project 221001163SHA.

12.0 Revision Summary				
The following changes are in compliance with the declaration of Section 8.1:				
Date/ Proj # Site ID	Project Handler/ Reviewer	Section	Item	Description of Change
16-Jan-2023	Zach Zhou/Ken Gu	2	Models	Added TN- followed by MG144-; followed by 555
230100688SHA		9	1	Added Models 61849 to MULTIPLE LISTEE 1:NEXTracker Inc.
22-Feb-2023	Zach Zhou/Ken Gu	2	-	Added new models 412922, 412923, 412924
230200960SHA			Ratings	Changed model 61849 rating from 110W to 105W
		4	1	Added 412922 use WOR mono, 412923 use WRO Mmono, 412924 use WRO mono in 'VNS166M-9BB' Technical data manufactured by Venus Energy (Cambodia) CO.,Ltd
				Added 412922 use WOR mono, 412923 use WRO Mmono, 412924 use WRO mono in 'T1S-00000HE1B' Technical data manufactured by Tainergy Tech CO.,Ltd
			15	Added new adhesive for frame 'RP45' manufactured by 3M COMPANY INDUSTRIAL ADHESIVES & TAPES DIV
		7	1K	Added Illustration 1K - Schematic Diagram of module 61798, 61791, 61849, 412922, 412923, 412924.
			2F	Added Illustration 2F - Schematic iagram of frame crosssection for model 61798, 61791, 61849, 412922, 412923, 412924.
		8	-	Added one testing block of project 230200960SHA.

12.0 Revision Summary				
The following changes are in compliance with the declaration of Section 8.1:				
Date/ Proj # Site ID	Project Handler/ Reviewer	Section	Item	Description of Change
29-May-2023	Zach Zhou/Ken Gu	1	-	Changed contact form Luker Lu to Mr. Chengrong Lu
230200962HAN	Zach Zhou	2	models	Added new models 413540, 412918, 412920, 413541, 412919, 412921, 61878
			other ratings	Changed TN-60-xxxMH series demensions from 1756x1039x35 [mm] (framed) to 1755x1038x35 [mm] (framed)
				Changed TN-72-xxxMH series demensions from 2096x1039x35 [mm] (framed) to 2094x1038x35 [mm] (framed)
				Added 413540, 413541: 2052x227x35 [mm] (framed) 412918, 412920, 412919, 412921: 2280x227x35 [mm] (framed) 61878: 2115x580x35 [mm] (framed)
		4	1	Added technicle data TN-60-xxxMH series with 120, cells TN-72-xxxMH series with 144, cells (166 mm x 83 mm cell dimensions) in cell on cell T1S-00000HE1B.
				Added cell M182ABPERCBP SE manufactured by Tongwei solar Co.,Ltd.
				Added cell ECM1010BSE2 manufactured by ET SOLAR TECHNOLOGY (VIET NAM) COMPANY LIMITED
			4	Added frame 6063-T5 manufactured by Zhangjiagang City XiechangPV CO.,Ltd
			14	Added string connector 0.3×5.0mm/0.2×5.0mm manufactured by Hangzhou Fuyangchanghe Newenergy Technologies Company Limited.

12.0 Revision Summary				
The following changes are in compliance with the declaration of Section 8.1:				
Date/ Proj # Site ID	Project Handler/ Reviewer	Section	Item	Description of Change
			17	Added insulation sheet Cynagard 115F manufactured by Cybrid Technologies Inc.
		7	1C	Updated Illustration 1C - Schematic Diagram of module TN-72-XXXMH series (Unit: mm)
			1D	Updated Illustration 1D - Schematic Diagram of module TN-60-XXXMH series (Unit: mm)
			1L	Illustration 1L - Schematic Diagram of module 413542
			1M	Illustration 1M - Schematic Diagram of module 412918/412920
			1N	Illustration 1N - Schematic Diagram of module 413541
			1O	Illustration 1O - Schematic Diagram of module 412919/412921
			1P	Illustration 1P - Schematic Diagram of module 61878
			2	Upaded Illustration 2 - Schematic Diagram of frame crosssection for model 61798, 61791, 61849, 412922, 412923, 412924.
			2G	Added Illustration 2G - Schematic Diagram of frame crosssection for model 413540, 412918, 412920, 413541, 412919, 412921
			2H	Added Illustration 2H - Schematic Diagram of frame crosssection for model 61878
			2I	Added Illustration 2I - Conner key of frame crosssection for model 413540, 412918, 412920, 413541, 412919, 412921, 61878.
			5	Updated Illustration 5 - Controled combination of material solar cell and encapsulation
		8	-	Added three test block of project 230200962HAN