1.0 Reference and Address			
Report Number	150601876SHA-001	Original Issued: 10-Dec-2015	Revised: 19-Sep-2022
Standard(s)	Flat-Plate Photovoltaic Modules and Panels [UL 1703:2002 Ed.3+R:25Nov2019] Flat Plate Photovoltaic Modules And Panels [ULC ORD C1703:2018 Ed.2]		

Applicant	Toenergy Technology Hangzhou Co.,Ltd	Manufacturer 1	**Toenergy Technology Hangzhou Co.,Ltd**
Address	No.3, Gaoxin 9 Road,Xiaoshan Economy and Technology Development Zone,Hangzhou,311215	Address	No.3, Gaoxin 9 Road,Xiaoshan Economy and Technology Development Zone,Hangzhou,311215
Country	CHINA	Country	CHINA
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Phone	+86-13777408006	Phone	+86-177-0652-2667
FAX	-	FAX	-
Email	luchengrong@toenergysolar.com	Email	luchengrong@toenergysolar.com

Manufacturer 2	**Toenergy Solar SDN BHD**
Address	No.6,JALAN MUTIARA6,TAMAN PERINDUSTRIAN PLENTONG,81750,JOHOR BAHRU,JOHOR.
Country	Malaysia
Contact	Annie Loh
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2.0 Product Description	
Product	Crystalline Silicon Photovoltaic Modules
Brand name	TOENERGY
Description	The product covered by this report are flat-plate photovoltaic modules which convert elements of the electromagnetic spectrum to DC electrical power. The basic construction consists of a laminated assembly of individual solar cells and interconnecting ribbons encapsulated within an insulating material. This encapsulated assembly is sandwiched between a rigid transparent top surface (superstrate) and an insulating backsurface (substrate) for normal modules. The laminated assembly is supported by an anodized Aluminum frame for normal modules. Field wiring connections to the module are made by factory installed connector systems eminating from a sealed wiring cover assembly, allowing electrical connections that are acceptable for the application in accordance with the National Electrical Code (NEC) and Canadian Electrical Code (CEC) respectively. A product label and an installation instruction manual are provided. The modules are fully assembled from the factory. The modules are non-integral. The modules consist of polycrystalline solar cell which are encapsulated within a glass superstrate and a polymeric substrate backskin. Superstrate consists of tempered solar glass. Substrate consists of multi-layer polymeric backsheet material. The wire leads are stranded copper UL Listed wire. Internal cell-to-cell wire ribbons are enclosed within the module glass and backsheet. Internal current-carrying conductors attach to the external leads via connection rails inside the j-box. Bypass diodes for the module are provided inside the junction box.
Models	P followed by 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 130, 135, 140 or 145; followed by W. M follow by 10, 20, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 125, 130, 135, 140, 145, 150, 155 or 160; followed by W. 30W followed by -L.

2.0 Product Description	
Model Similarity	Normal Modules: P145W,P140W,P135W and P130W with 44 cells (126 mm x 156 mm, Poly-Si) P120W with 36 cells (124.8 mm x 156 mm, Poly-Si) P110W with 36 cells (114 mm x 156 mm, Poly-Si) P100W and P95W with 36 cells (104 mm x 156 mm, Poly-Si) P90W and P85W with 36 cells (93.6 mm x 156 mm, Poly-Si) P80W with 36 cells (83.2 mm x 156 mm, Poly-Si) P75W and P70W with 36 cells (78 mm x 156 mm, Poly-Si) P65W with 36 cells (72.8 mm x 156 mm, Poly-Si) P60W with 36 cells (62.4 mm x 156 mm, Poly-Si) P55W with 36 cells (57.2 mm x 156 mm, Poly-Si) P50W with 36 cells (52 mm x 156 mm, Poly-Si) P45W with 36 cells (46.8 mm x 156 mm, Poly-Si) P40W with 36 cells (41.6 mm x 156 mm, Poly-Si) P35W with 36 cells (39 mm x 156 mm, Poly-Si) P30W with 36 cells (31.2 mm x 156 mm, Poly-Si) P25W with 36 cells (26 mm x 156 mm, Poly-Si) P20W with 36 cells (22.286 mm x 156 mm, Poly-Si) P15W with 36 cells (17.33 mm x 156 mm, Poly-Si) P10W with 36 cells (10.4 mm x 156 mm, Poly-Si) P5W with 36 cells (15.6 mm x 52 mm, Poly-Si) 30W-L with 38 cells (31.2mm x 156.75 mm, Poly-Si) M150W, M155W, M160W with 44 cells (125.4mm*156.75mm, Mono-Si) M145W, M140W, M135W, M130W and M120W with 36 cells (124.8mm*156.75mm, Mono-Si) M115W and M110W with 36 cells (104*156.75mm, Mono-Si) M105W and M95W with 36 cells (93.6*156.75mm, Mono-Si) M100W with 36 cells (86.2*156.75mm, Mono-Si) M90W,M85W and M80W with 36 cells (78mm*156.75mm, Mono-Si) M75W and M70W with 40 cells, M65W with 36 cells (62.4mm*156.75mm, Mono-Si) M60W with 48 cells (39.6mm*158.75mm Mono-Si) M55W and M50W with 36 cells (52mm*156.75mm, Mono-Si) M45W and M40W with 36 cells (39mm*156.75mm, Mono-Si) M35W and M30W with 36 cells (31.2mm*156.75mm, Mono-Si) M20W with 36 cells (78mm*39mm, Mono-Si) M10W with 36 cells (39mm*39mm, Mono-Si) All models of normal modules are similar in construction, but differ in cell dimension and cell number, outMut voltage, Mower, current ratings.

2.0 Product Description

	Model	Voc (V)	Vmp (V)	Imp (A)	Isc (A)	Pmax(W)	Maximum Series Fuse (A)
Ratings	P145W	27.61	21.47	6.76	7.26	145	15
	P140W	27.56	21.42	6.54	6.96	146	15
	P135W	27.51	21.37	6.32	6.72	147	15
	P130W	27.46	21.32	6.10	6.49	148	15
	P120W	22.50	18.86	6.36	6.88	120	15
	P115W	22.28	18.64	6.17	6.59	115	15
	P110W	22.50	18.86	5.83	6.23	110	10
	P105W	22.07	18.51	5.67	5.96	105	10
	P100W	22.50	18.86	5.30	5.67	100	10
	P95W	22.07	18.51	5.13	5.42	95	10
	P90W	22.50	18.86	4.77	5.10	90	10
	P85W	22.07	18.51	4.59	4.88	85	10
	P80W	22.50	18.86	4.24	4.53	80	10
	P75W	22.50	18.86	3.98	4.25	75	10
	P70W	22.03	18.47	3.79	4.05	70	10
	P65W	22.50	18.86	3.45	3.97	65	10
	P60W	29.80	25.60	2.52	2.35	60	10
	P55W	22.50	18.86	2.92	3.12	55	10
	P50W	22.50	18.86	2.65	2.83	50	10
	P45W	22.50	18.86	2.39	2.55	45	10
	P40W	22.50	18.86	2.12	2.27	40	10
	P35W	22.03	18.47	1.89	2.03	35	10
	P30W	23.80	20.14	1.49	1.79	30	10
	P25'W	22.50	18.79	1.33	1.42	25	10
	P20W	22.07	18.46	1.08	1.16	20	10
	P15W	22.28	18.64	0.80	0.92	15	10
	P10W	22.46	18.86	0.53	0.56	10	10
	P5W	21.50	18.52	0.27	0.31	5	10
	30W-L	23.60	20.10	1.65	1.50	30	10
	M10W	22.02	18.68	0.54	0.60	10	10
	M20W	22.32	18.72	1.07	1.18	20	10
	M30W	22.10	17.68	1.70	1.79	30	10
	M35W	22.86	19.26	1.82	1.98	35	10
	M40W	22.14	18.54	2.16	2.35	40	10
	M45W	22.30	18.91	2.38	2.61	45	10
	M50W	22.00	18.00	2.78	3.01	50	10
	M55W	22.32	18.72	2.94	3.19	55	10
	M60W	29.80	25.60	2.35	2.52	60	10
	M65W	22.32	18.72	3.47	3.71	65	10
	M70W	23.20	20.60	3.40	3.98	70	10
	M75W	23.40	20.80	3.61	4.15	75	10
	M80W	22.14	18.54	4.31	4.67	80	10
	M85W	22.32	18.72	4.54	4.93	85	10
	M90W	22.68	18.90	4.76	5.17	90	10
	M95W	22.14	18.54	5.12	5.55	95	10
	M100W	23.00	19.20	5.21	5.51	100	10
	M105W	22.86	19.26	5.45	5.87	105	10
	M110W	22.32	18.72	5.88	6.46	110	10
	M115W	22.68	19.08	6.03	6.59	115	15
	M120W	22.14	18.36	6.54	6.95	120	15
	M125W	22.32	18.54	6.74	7.15	125	15
	M130W	22.50	18.72	6.94	7.35	130	15
	M135W	22.68	18.90	7.14	7.54	135	15

2.0 Product Description							
	M140W	22.86	19.08	7.34	7.73	140	15
	M145W	23.04	19.26	7.53	7.92	145	15
	M150W	26.90	22.20	6.76	7.15	150	15
	M155W	27.10	22.50	6.89	7.29	155	15
	M160W	27.30	22.80	7.02	7.42	160	15
Other Ratings	Overall diameter:						
	1480 mm by 670mm by 40mm, 10.8kg, P145W~P130W						
	1200 mm by 670mm by 35mm, 8.5kg, P120W,P115W						
	1100 mm by 670mm by 35mm, 7.8kg, P110W,P105W						
	1010 mm by 670mm by 35mm, 7.2kg, P100W,P95W						
	920 mm by 670mm by 30mm, 7kg, P90W,P85W						
	820 mm by 670mm by 30mm, 6.6kg, P80W						
	780 mm by 670mm by 30mm, 6.3kg, P75W,P70W						
	730 mm by 670mm by 30mm, 6.1kg, P65W						
	630 mm by 670mm by 30mm, 5.5kg, P60W						
	590 mm by 670mm by 30mm, 5.1kg, P55W						
	540 mm by 670mm by 30mm, 4.6kg, P50W						
	490 mm by 670mm by 30mm, 4.2kg, P45W						
	450 mm by 670mm by 25mm, 3.9kg, P40W						
	420 mm by 670mm by 25mm, 3.5kg, P35W						
	345 mm by 710mm by 25mm, 3kg, P30W						
	300 mm by 670mm by 25mm, 3kg, P25W						
	490 mm by 350mm by 20mm, 2.5kg, P20W						
	400 mm by 350mm by 20mm, 2.1kg, P15W						
	280 mm by 350mm by 20mm, 1.5kg, P10W						
	220 mm by 250mm by 20mm, 1kg, P5W						
	2052mm by 202mm by 35mm, 30W-L						
	1450 mm by 670 mm by 30mm, M150W~M160W						
	1200 mm by 670 mm by 30mm, M145W~M120W						
	1006 mm by 670 mm by 30mm, M110W~M115W						
	915 mm by 670 mm by 30mm, M105W and M95W						
	840 mm by 670 mm by 30mm, M100W						
	770 mm by 670 mm by 30mm, M90W~M80W						
	1350 mm by 345 mm by 30mm, M70W~M75W						
	630 mm by 670 mm by 30mm, M65W						
	2052mm by 202mm by 35mm, M60W						
	535 mm by 670 mm by 30mm, M50W~M55W						
	420 mm by 670 mm by 30mm, M45W~M40W						
	650 mm by 350 mm by 30mm, M35W~M30W						
	415mm by 355 mm by 25mm, M20W						
	415mm by 195 mm by 25mm, M10W						
	Design load: 30 lb/ft2						

3.0 Product Photographs

Photo 1 - Overall Front Side View of Module Model P145W

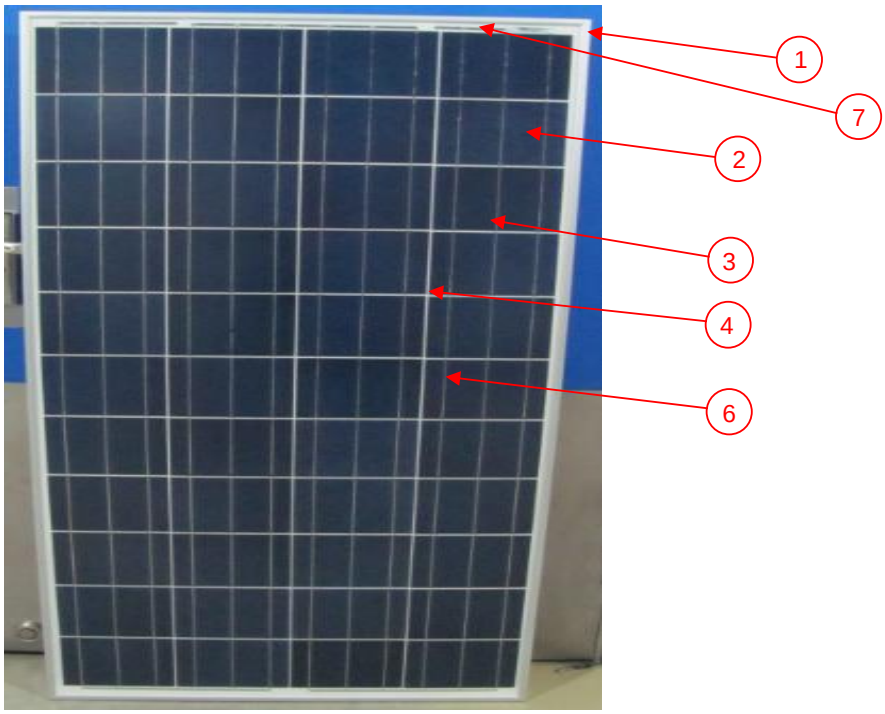
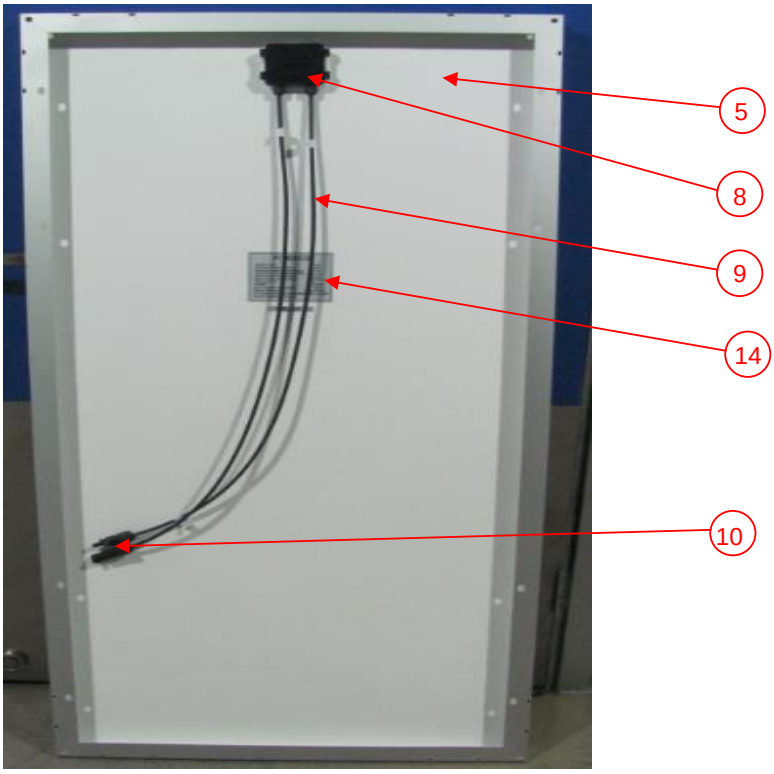


Photo 2 - Overall Backside View of Module Model P145W



3.0 Product Photographs

Photo 3 - Overall Close-up Internal View of J-Box

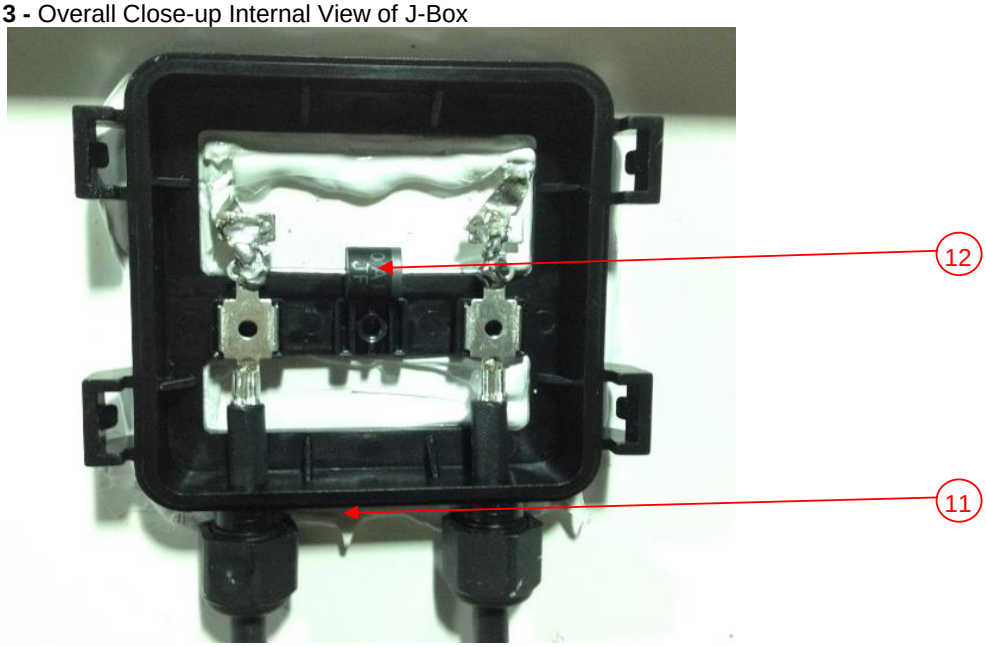


Photo 4 - Coner

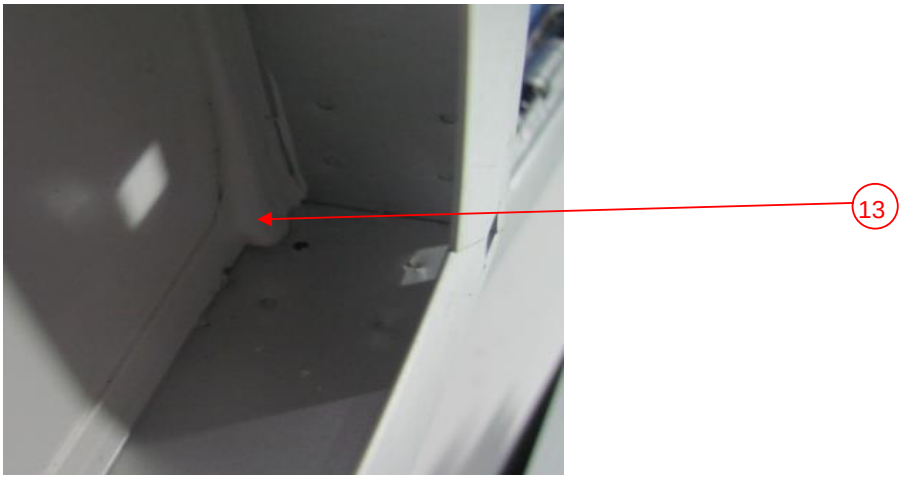


Photo 5 - Polarized Connectors

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	Frame	Zhangjiagang Xiechang photovoltaic Co., Ltd	6063	Four piece construction. Alumimium Extrusion, Anodized. Secured together by corner pieces.	NR
			Tanglong Technology Co.,Ltd	6063-T5	Four piece construction. Alumimium Extrusion, Anodized. Secured together by corner pieces.	NR
1	2	Cell (Poly)	Changzhou trina solar co., LTD	MM156P220	P145W,P140W,P135W,P130W, with 44 cells (126 mm x 156 mm cell dimensions) P120W, with 36 cells (124.8 mm x 156 mm cell dimensions) P110W, with 36 cells (114 mm x 156 mm cell dimensions) P100W,P95W with 36 cells (104 mm x 156 mmcell dimensions) P90W,P85W with 36 cells (93.6 mm x 156 mm cell dimensions) P80W, with 36 cells (83.2 mm x 156 mm cell dimensions) P75W,P70W with 36 cells (78 mm x 156 mm cell dimensions) P65W, with 36 cells (72.8 mm x 156 mm cell dimensions) P60W, with 36 cells (62.4 mm x 156 mm cell dimensions) P55W, with 36 cells (57.2 mm x 156 mm cell dimensions), 200 µm ± 20 µm cell thickness; For rest data please refer to maker's datasheet.	NR
					P50W with 36 cells (52 mm x 156 mm, Poly-Si) P45W with 36 cells (46.8 mm x 156 mm, Poly-Si) P40W with 36 cells (41.6 mm x 156 mm, Poly-Si) P35W with 36 cells (39 mm x 156 mm, Poly-Si) P30W with 36 cells (31.2 mm x 156 mm, Poly-Si) P25W with 36 cells (26 mm x 156 mm, Poly-Si) P20W with 36 cells (22.286 mm x 156 mm, Poly-Si) P15W with 36 cells (17.33 mm x 156 mm, Poly-Si) P10W with 36 cells (10.4 mm x 156 mm, Poly-Si) P5W with 36 cells (15.6 mm x 52 mm, Poly-Si) 200 µm ± 20 µm cell thickness; For rest data please refer to maker's datasheet.	

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]
			JA SOLAR	156.75	30W-L (31.2*156.75., Ploy-Si)	NR
1	2a	Cell (Mono)	Jinko Solar Co.,Ltd	156M-210	Five busbars and 8 segment thickness 200um±20um M145W, M140W, M135W,M130W and M120W with 36 cells (124.8mm*156.75mm, Mono-Si) M115W and M110W with 36 cells (104*156.75mm, Mono-Si) M105W, M100W and M95W with 36 cells (93.6*156.75mm, Mono-Si) M90W,M85W and M80W with 36 cells (78mm*156.75mm, Mono-Si) M75W and M70W with 40 cells, M65W and M60W with 36 cells (62.4mm*156.75mm, Mono-Si) M55W and M50W with 36 cells (52mm*156.75mm, Mono-Si) M45W and M40W with 36 cells (39mm*156.75mm, Mono-Si) M35W and M30W with 36 cells (31.2mm*156.75mm, Mono-Si) M20W with 36 cells (78mm*39mm, Mono-Si) M10W with 36 cells (39mm*39mm, Mono-Si)	NR
			JA SOLAR	158.75	M60W (39.6*158.75., Mono-Si)	NR
1	3	Glass Superstrate	Hangzhou Tuneng	Tempered Glass ironless	3.2 mm thickness	NR
1	4	Encapsulation Material	CHANGZHOU SVECK With UL file no.: E334244	15297	Ethylene vinyl acetate (EVA). 0.45 mm thick sheet of clear EVA is provided on top and bottom of cells.	UR
1	4a	Encapsulation Material	HANGZHOU SUOKANGBO ENERGY TECHNOLOGY CORP LTD With UL file no.: E341985	SKB825T	Ethylene vinyl acetate (EVA). 0.4 mm thick sheet of clear EVA is provided on top and bottom of cells.	UR
1	4b	Encapsulation Material	Hangzhou First PV Material Co., Ltd With UL file no: E326347	F806P	Ethylene vinyl acetate (EVA). 0.45 mm thick sheet of clear EVA is provided on top and bottom of cells.	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]
2	5	Substrate	Suzhou Haosheng New Material Co., Ltd	PV320R	Overall thickness 0.31 mm. Reference RTI of outer layer is 105°C.	UR
			Cybrid Technology INC With UL file no: E333414	Cynagard275A	PET/PET/Fluorine Overall thickness 0.314 mm. Reference RTI of outer layer is 105°C.	UL
1	6	Cell to Cell Connectors	Wuxi Ever-Bright	NR	Solder plated copper ribbons (Sn63%Pb37%), 1.8 mm wide by 0.18 mm thick for Pmax blow 100,1.8 mm wide by 0.2 mm thick for others.	NR
			Yaoheng Technology Co.,Ltd	NR	Solder plated copper ribbons (Sn60%Pb40%), 1.2 mm wide by 0.16 mm min. thick.	NR
1	7	String Connector	Wuxi Ever-Bright	NR	Solder plated copper ribbons (Sn60%Pb40%), 4.0 mm wide by 0.2 mm min. thick for Pmax below 50, 5.0 mm wide by 0.25 mm min. thick for others.	NR
			Yaoheng Technology Co.,Ltd	NR	Solder plated copper ribbons (Sn60%Pb40%), 5.0 mm wide by 0.3 mm min. thick.	NR
2	8	Junction Box	Hangzhou Shantian Photovoltaic Technology Co., LTD With ETL Control No.: 5002613	HZTN PV-TN606	Rated 1000 V, 6 A max. Secured at substrate by sealing compound.	ETL Recognized
2	8a	Junction Box	Renhe Photovoltaic technology Co., Ltd. With UL files No.E312261	BM-90xy	Rated 600 V, 6.5 A max. Secured at substrate by sealing compound.	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]
2	8b	Junction Box	ZHEJIANG FORSOL ENERGU CO LTD With UL file No. E479691	15T11A	Rated 1000 V, 20 A max. Secured at substrate by sealing compound.	UR
2	9	Connecting Cable	NINGBO KIBOR WIRE&CABLE CO.LTD With UL file no.: E470608	PV wire	Rated sunlight resistant, 90°C, 1000 V, 14 AWG conductor size, with nominal 5.5 mm outer diameter.	UL
2	9a	Connecting Cable	Wuxi Xinhongye Wire & Cable Co., LTD (E332548)	PV wire	Rated sunlight resistant, 90°C, 1000 V, 14 AWG conductor size, with nominal 5.5 mm outer diameter.	UL
2	9b	Connecting Cable	Wuxi Xinhongye Wire & Cable Co., LTD (E332548)	PV wire	Rated sunlight resistant, 90°C, 1000 V, 12 AWG conductor size, with nominal 6.3 mm outer diameter.	UL
2	9c	Connecting Cable	WUXI XINHONGYE WIRE & CABLE CO LTD (E332548)	PV wire	Rated sunlight resistant, 90°C, 1000 V or 2000 V, 14 AWG conductor size, with nominal 5.9 mm outer diameter.	UL
2	10	Connectors	AMPHENOL INDUSTRIAL OPERATIONS With UL file no.: E339277	H4	Rated 1500 Vdc, 35A maximum.	UR
2	10a	Connectors	NINGBO SHIHE NEW ENERGY TECHNOLOGY CO LTD With UL file no.: E344739	DJ2011-4ab	Rated 600 Vdc, 25A maximum.	UR
2	10b	Connectors	ZHEJIANG RENHE PHOTOVOLTAIC TECHNOLOGY CO LTD With UL file no.: E344325	RHc2xyzA	Rated 600 Vdc, 30A maximum.	UR
3	11	Sealing Compound	SHANGHAI HUITIAN NEW MATERIAL CO LTD With UL file no.: E248611	HT906Z	White, rated V-0, RTI=105°C, HAI=0, HWI=1, CTI=0 at 3 mm minimum thickness.	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	11a	Sealing Compound	HANGZHOU ZHIJIANG SILICONE CHEMICAL CO LTD With UL file no.: E335227	JS-1184A/JS-1184B	White, rated V-0, RTI=105°C, HAI=0, HWI=0, CTI=0	UR
3	12	Bypass Diode	Jinan Jingheng Electronics co., LTD	10A10	Rated 10 A, 1000 PIV. 1 provided.	NR
3	12a	Bypass Diode	YANGZHOU YANGJIE ELECTRONIC TECHNOLOGY CO.,LTD	GF3045MG	Rated 10 A, 1000 PIV. 3 provided.	NR
3	12b	Bypass Diode	ZHEJIANG FORSOL ENERGY CO., Ltd.	FSL3045	Peak reverse voltage 45V Rated current 30A. Max. junction temperature: 200℃(t ≤ 1 h)	NR
4	13	Edge Sealing Material	SHANGHAI HUITIAN NEW MATERIAL CO LTD With UL file no.: E248611	HT906Z	White, rated V-0, RTI=105°C, HAI=0, HWI=1, CTI=0 at 3 mm minimum thickness.	UR
4	13a	Edge Sealing Material	HANGZHOU ZHIJIANG SILICONE CHEMICAL CO LTD With UL file no.: E335227	JS-606	White, rated V-0, RTI=105°C	UR
2	14	Label	AVERY (CHINA) CO LTD With UL file no.: MH20558	50 micron Matte Silver PET TC/S333(c)(d)	Rated for outdoor use, and suitable for use at temperatures between -40 ~ 85 ºC.	UR
2	14a	Label	AVERY (CHINA) CO LTD	72826T	Rated for outdoor use, and suitable for use at temperatures between -40 ~ 85 ºC.	NR
4	15	Coner key (not show)	Various	6063	Internally secures the frame members together. See Illustration 23 for details.	NR

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.

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) 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.						

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 -

Between parts (other than filed wiring)	Required Spacings (mm)
Cell to edge of lamination(through air(50V))	1.6
Cell to edge of lamination(over surfaces(50V))	1.6

2. Mechanical Assembly - Components such as switches, fuseholders, connectors, wiring terminals and display lamps are mounted and prevented from shifting or rotating by the use of lockwashers, starwashers, or other mounting format that prevents turning of the component.
3. Corrosion Protection - All ferrous metal parts are protected against corrosion by painting, plating or the equivalent.
4. Accessibility of Live Parts - All uninsulated live parts in primary circuitry are housed within a non-metallic enclosure constructed with no openings other than those specifically described in Sections 4 and 5.
5. Grounding - All exposed dead-metal parts and all dead-metal parts within the enclosure that are exposed are connected 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.
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 No(s). 3-23 and 27-38A for schematics requiring verification during Field Representative Inspection Audits.
9. Markings - The product is marked on UL 969 approved label material identified as item 14&14a in section 4 of this report. Markings shall include: applicant's name, model number, date of manufacture, electrical rating.
10. Cautionary Markings - A module or panel marking shall include the following: 'Warning electric Hazard, this module produces electricity exposed to light. Follow all applicable electrical safety precaution', in both English and French.
11. Installation, Operating and Safety Instructions - Instructions for installation and use of this product are provided by the applicant as required by the standard. Refer to Illustration No(s). 24 for details.

7.0 Illustrations

Illustration 1 - Grounding method

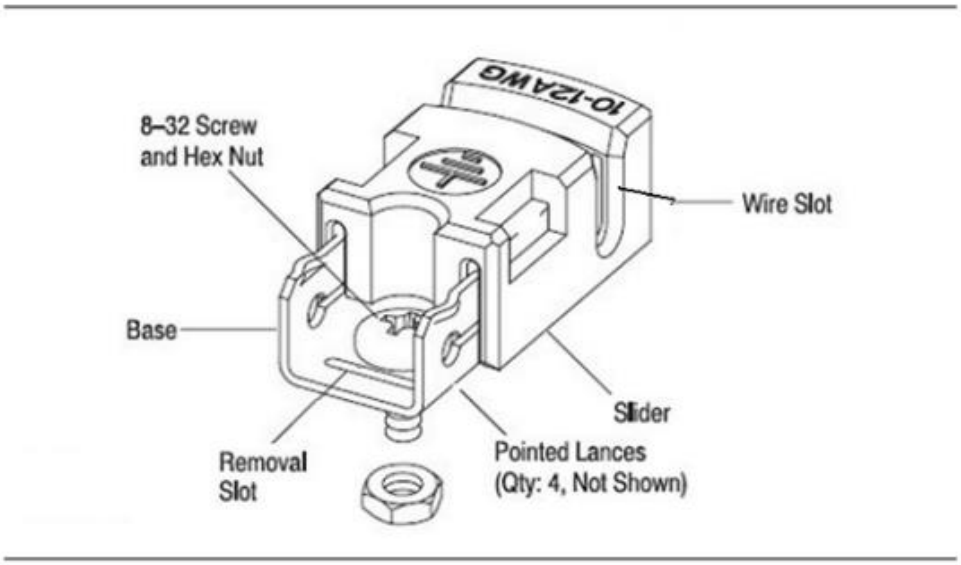


Figure 1

Notice: Use TYCO.1954381-2(UL Certificate No.E69905)

7.0 Illustrations

Illustration 3 - Laminator Schematic (P130W-P145W)

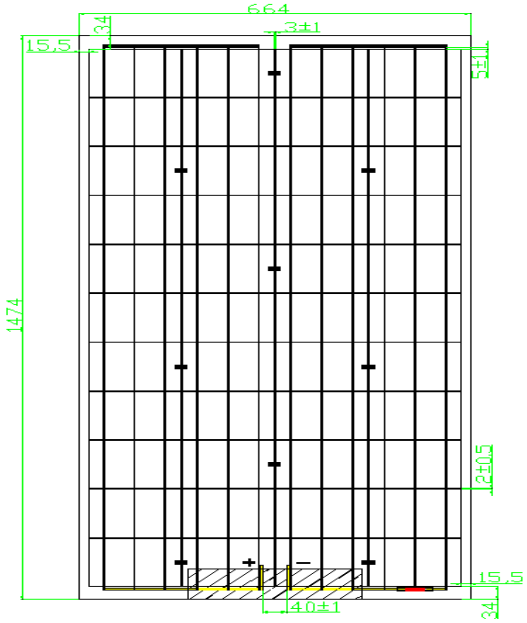
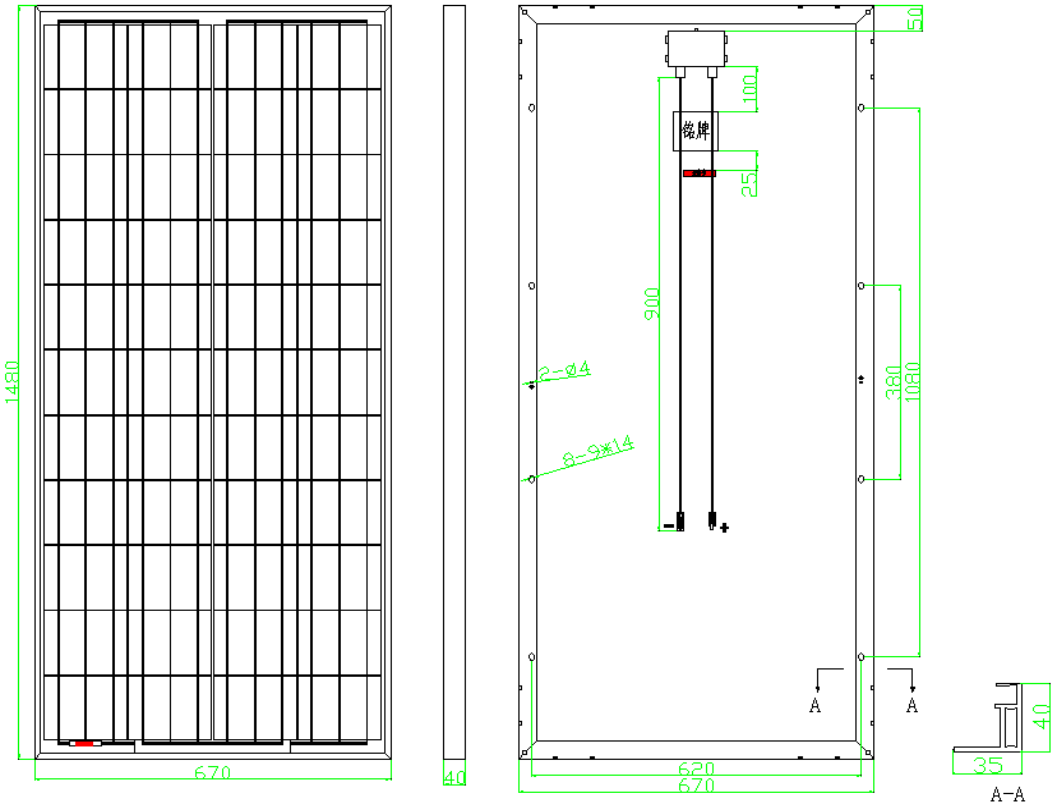
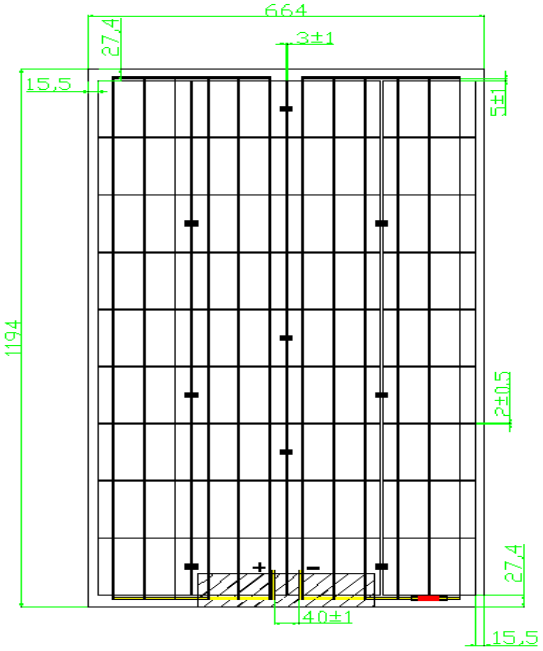


Illustration 3A - Module Schematic (P130W-P145W)



7.0 Illustrations

Illustration 4 - Laminator Schematic (P115W-P120W)



7.0 Illustrations

Illustration 4A - Module Schematic (P115W-P120W)

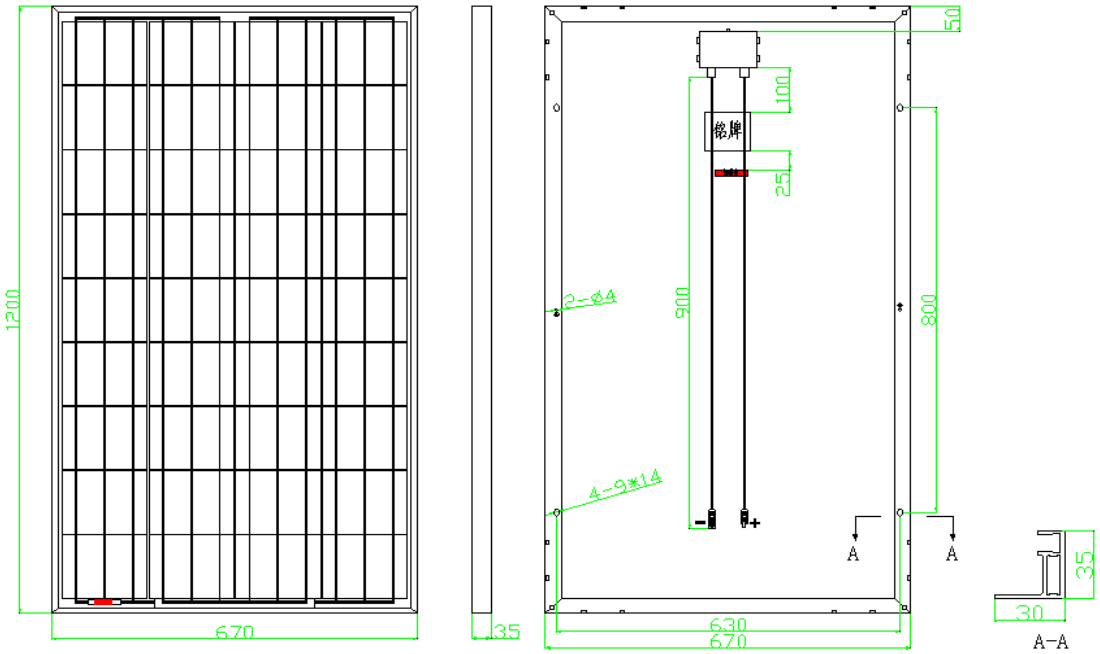
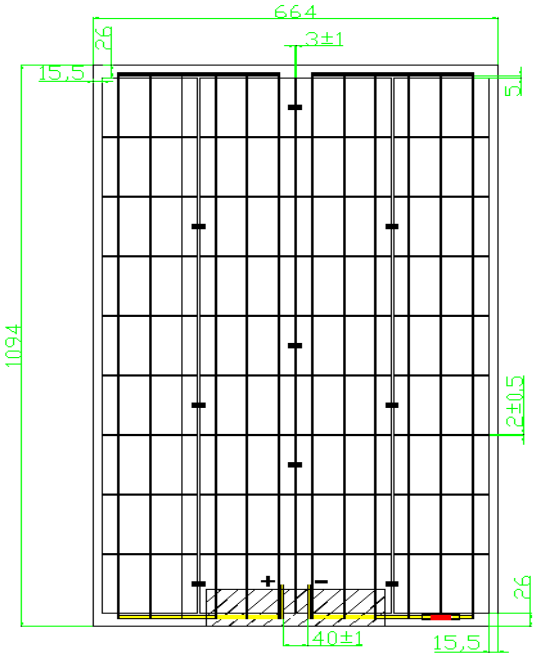


Illustration 5 - Laminator Schematic (P105W-P110W)



7.0 Illustrations

Illustration 5A - Module Schematic (P105W-P110W)

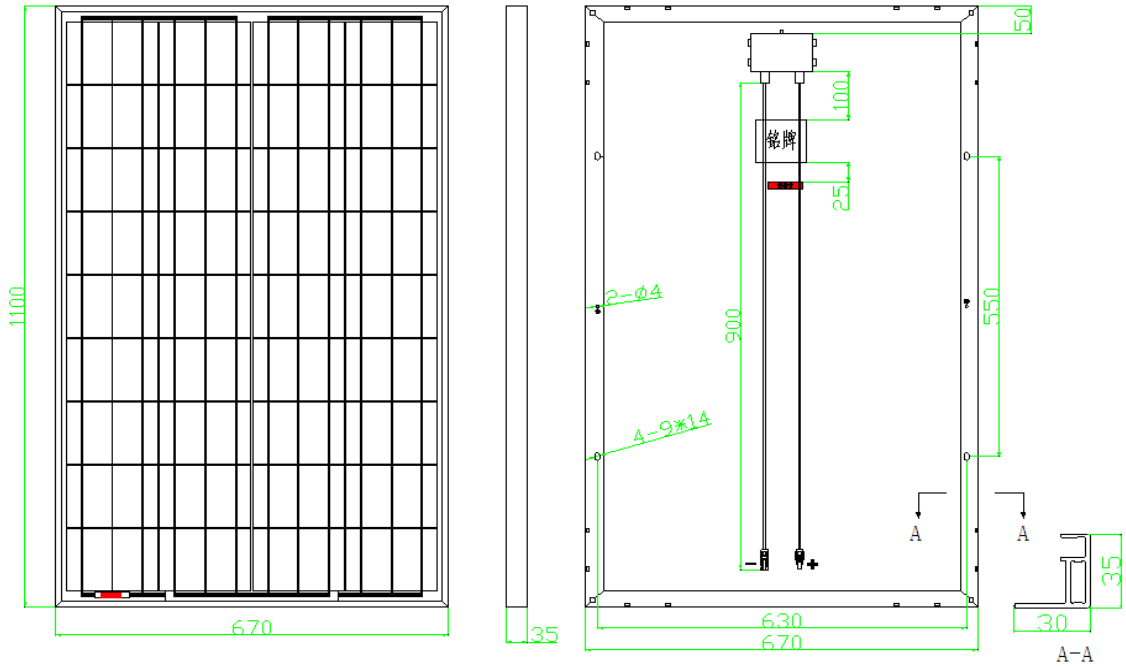
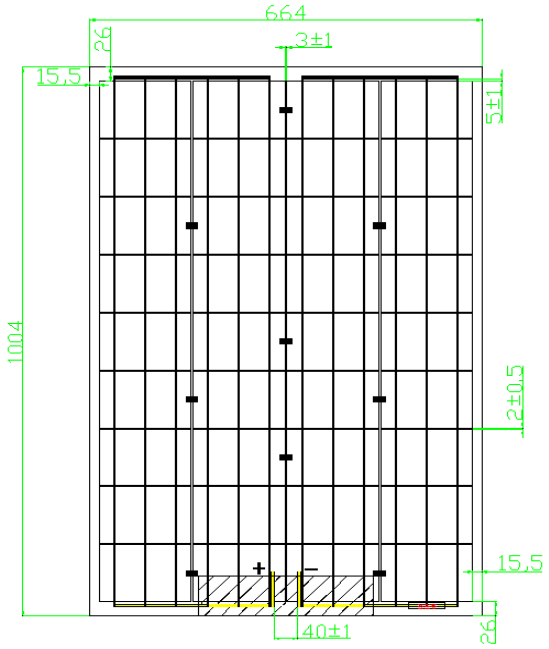


Illustration 6 - Laminator Schematic (P95W-P100W)



7.0 Illustrations

Illustration 6A - Module Schematic (P95W-P100W)

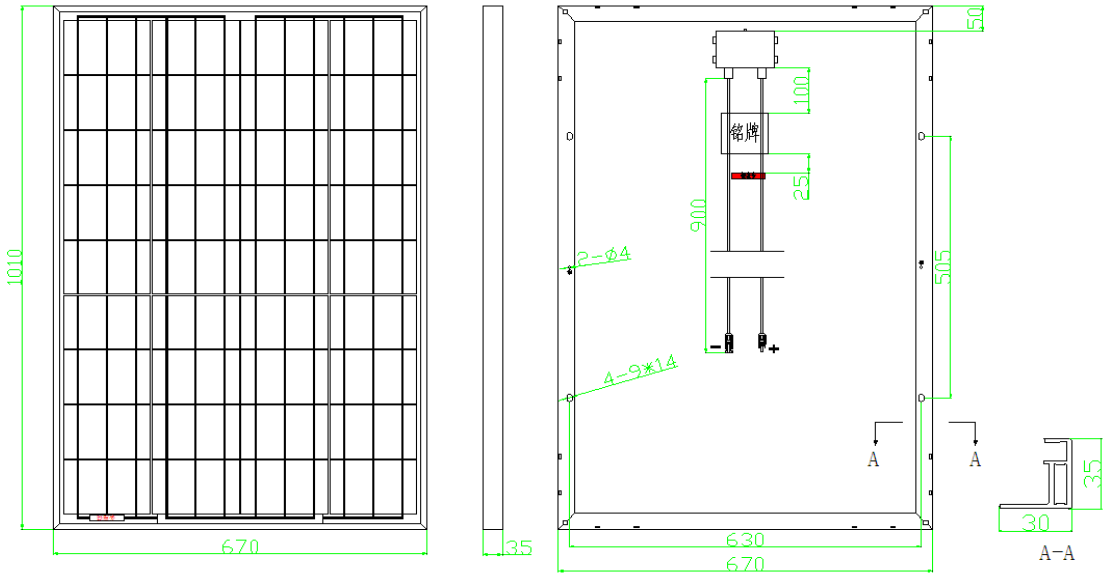
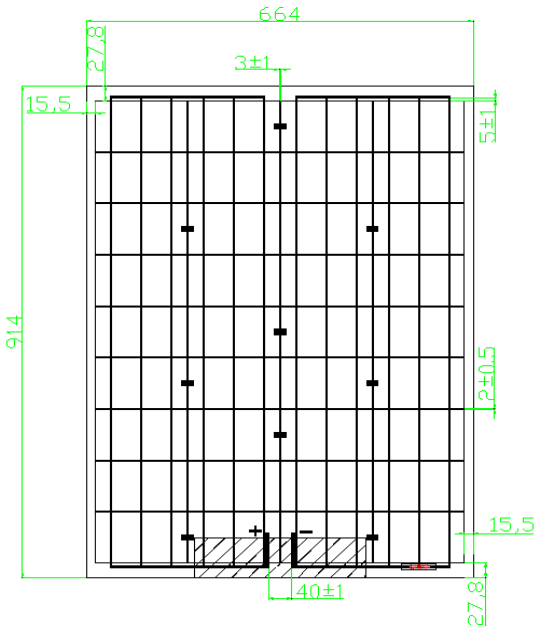


Illustration 7 - Laminator Schematic (P85W-P95W)



7.0 Illustrations

Illustration 7A - Module Schematic (P85W-P95W)

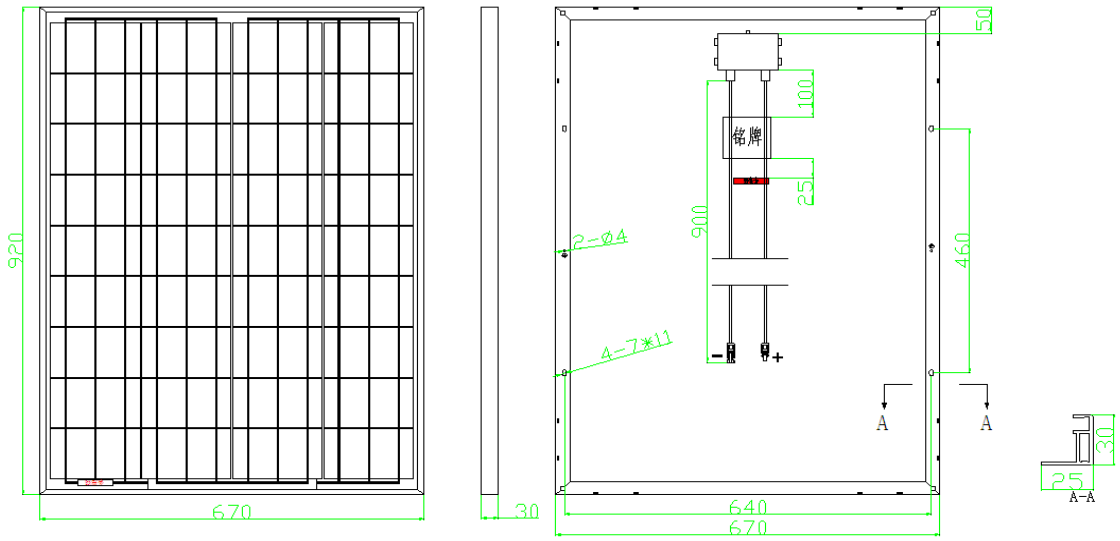
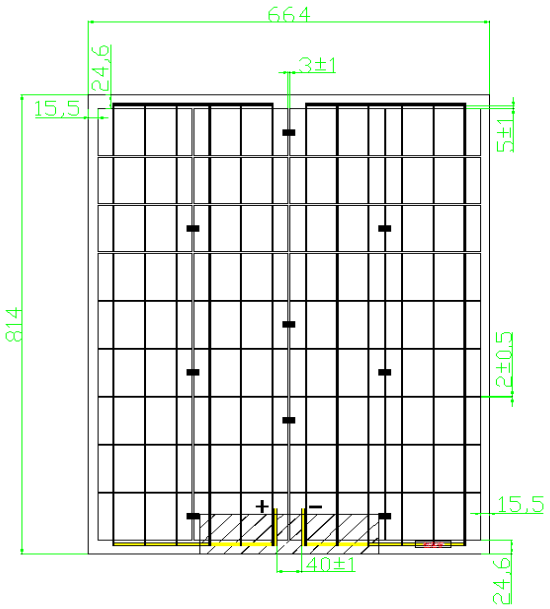


Illustration 8 - Laminator Schematic (P80W)



7.0 Illustrations

Illustration 8A - Module Schematic (P80W)

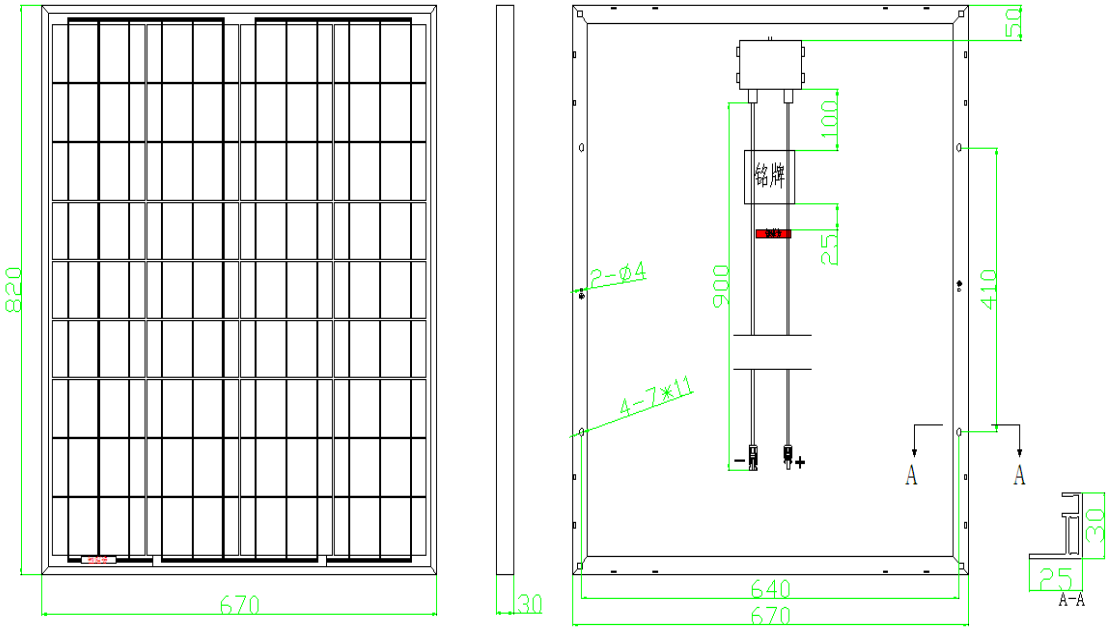
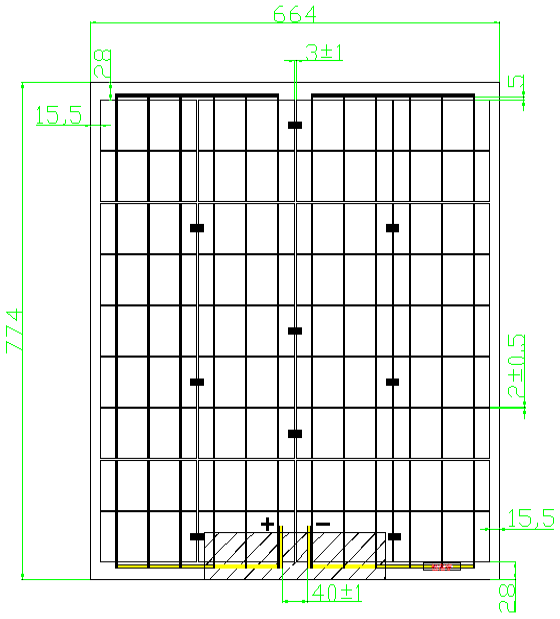


Illustration 9 - Laminator Schematic (P70W-P75W)



7.0 Illustrations

Illustration 9A - Module Schematic (P70W-P75W)

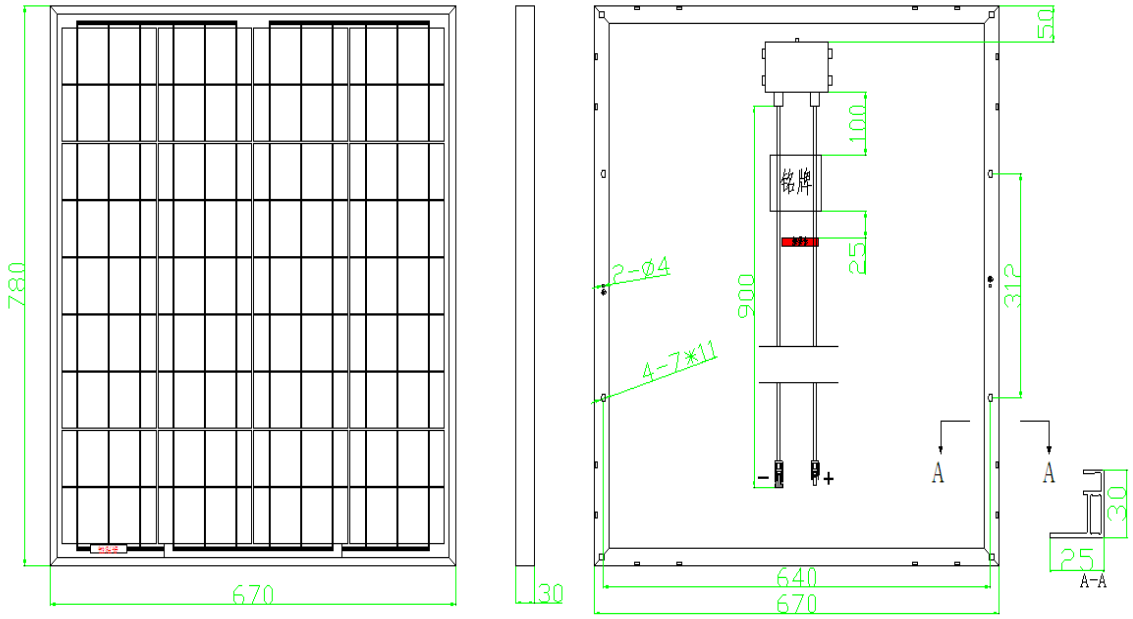
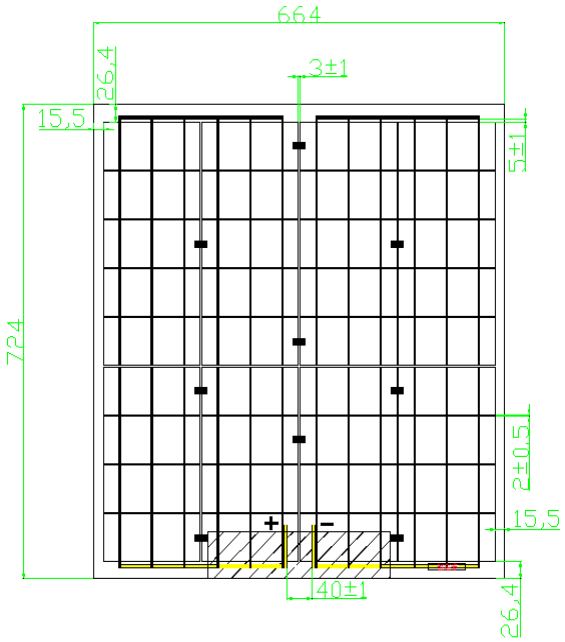


Illustration 10 - Laminator Schematic (P65W)



7.0 Illustrations

Illustration 10A - Module Schematic (P65W)

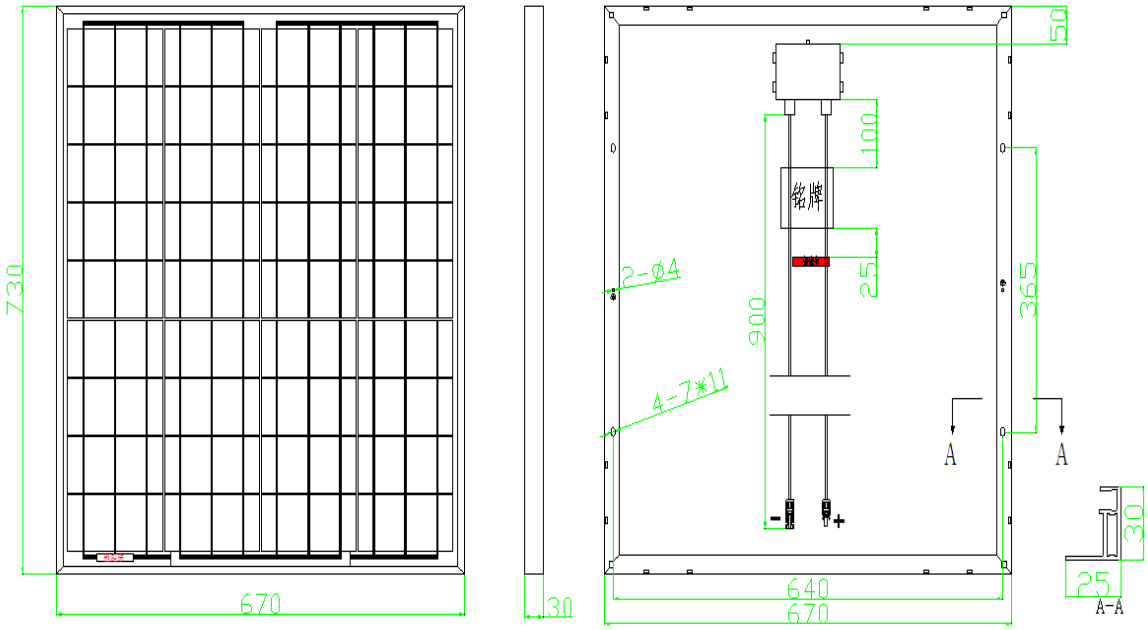
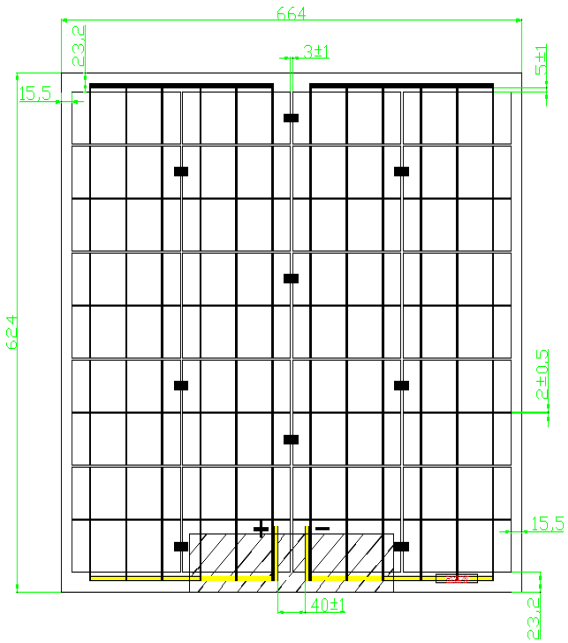


Illustration 11 - Laminator Schematic (P60W)



7.0 Illustrations

Illustration 11A - Module Schematic (P60W, M60W and M65W)

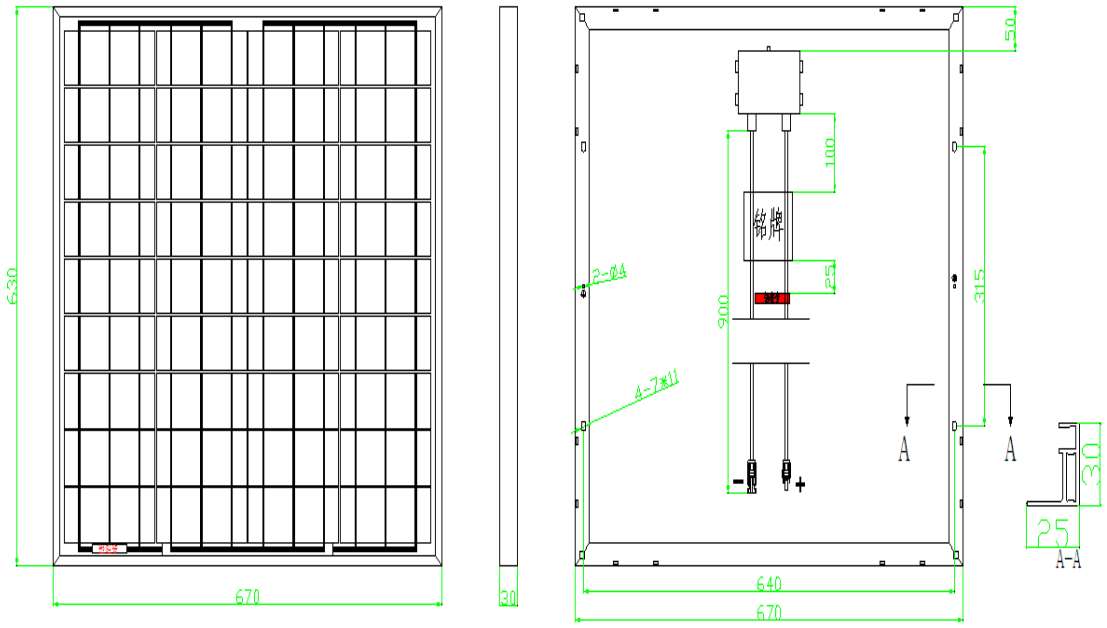
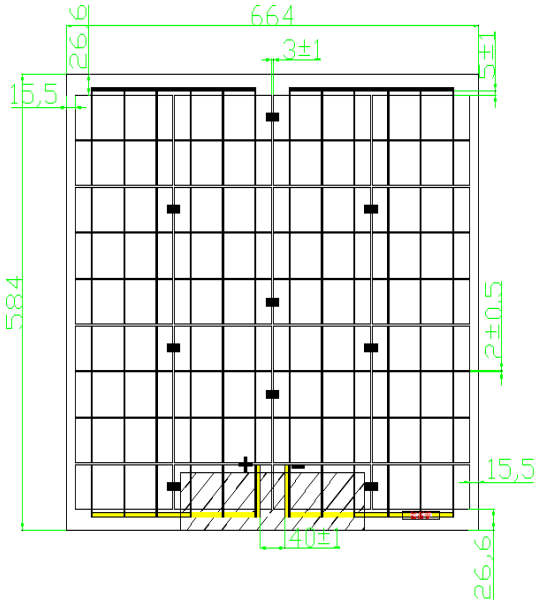


Illustration 12 - Laminator Schematic (P55W)



7.0 Illustrations

Illustration 12A - Module Schematic (P55W)

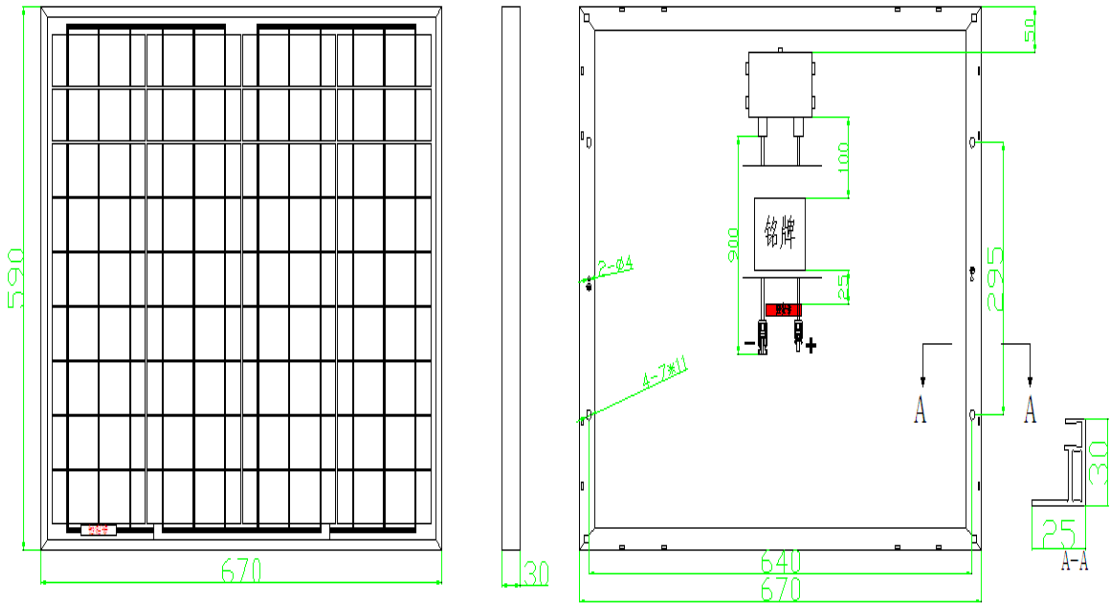
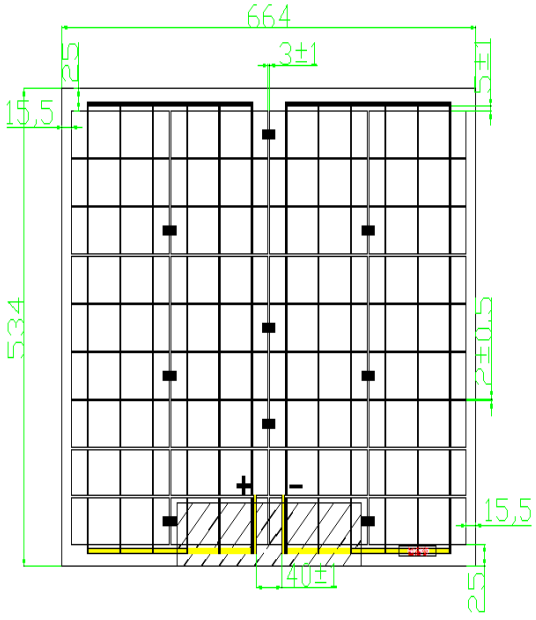


Illustration 13 - Laminator Schematic (P50W)



7.0 Illustrations

Illustration 13A - Module Schematic (P50W)

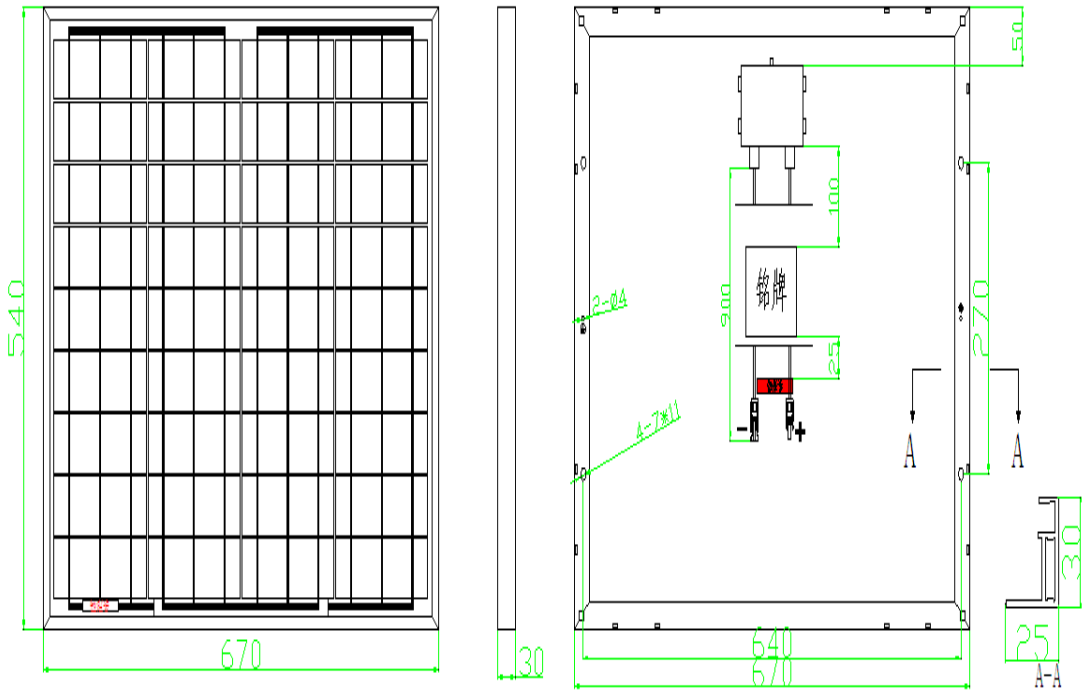
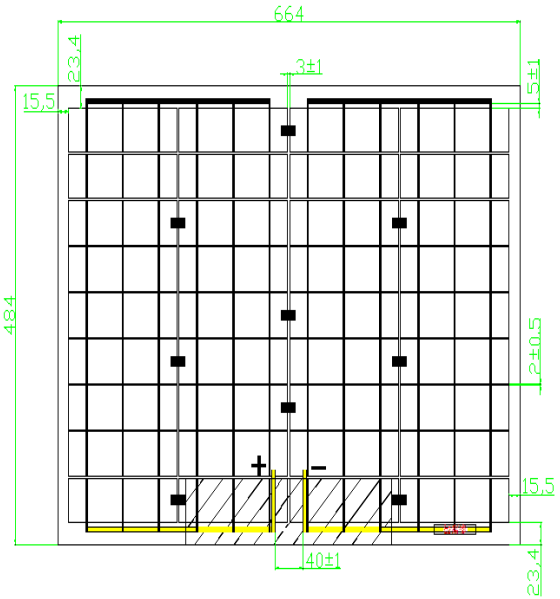


Illustration 14 - Laminator Schematic (P45W)



7.0 Illustrations

Illustration 14A - Module Schematic (P45W)

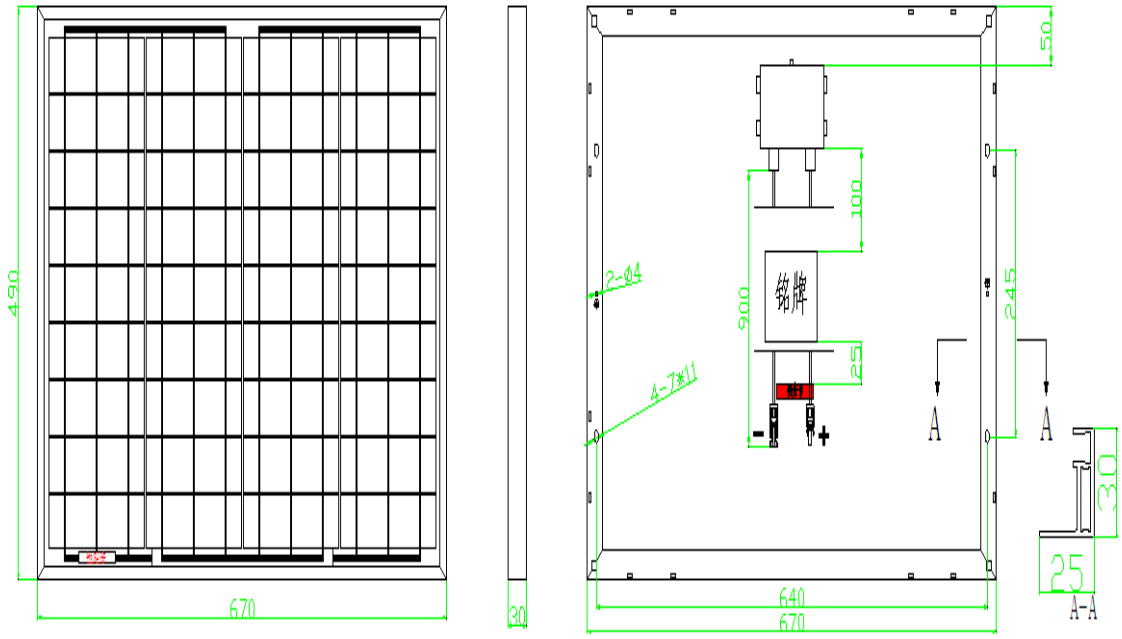
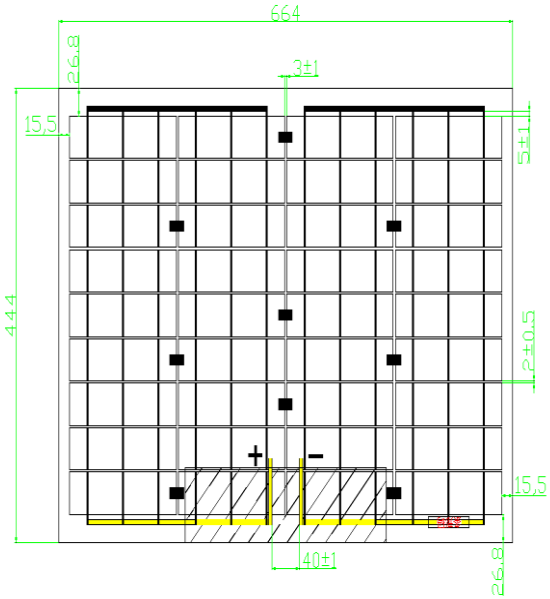


Illustration 15 - Laminator Schematic (P40W)



7.0 Illustrations

Illustration 15A - Module Schematic (P40W)

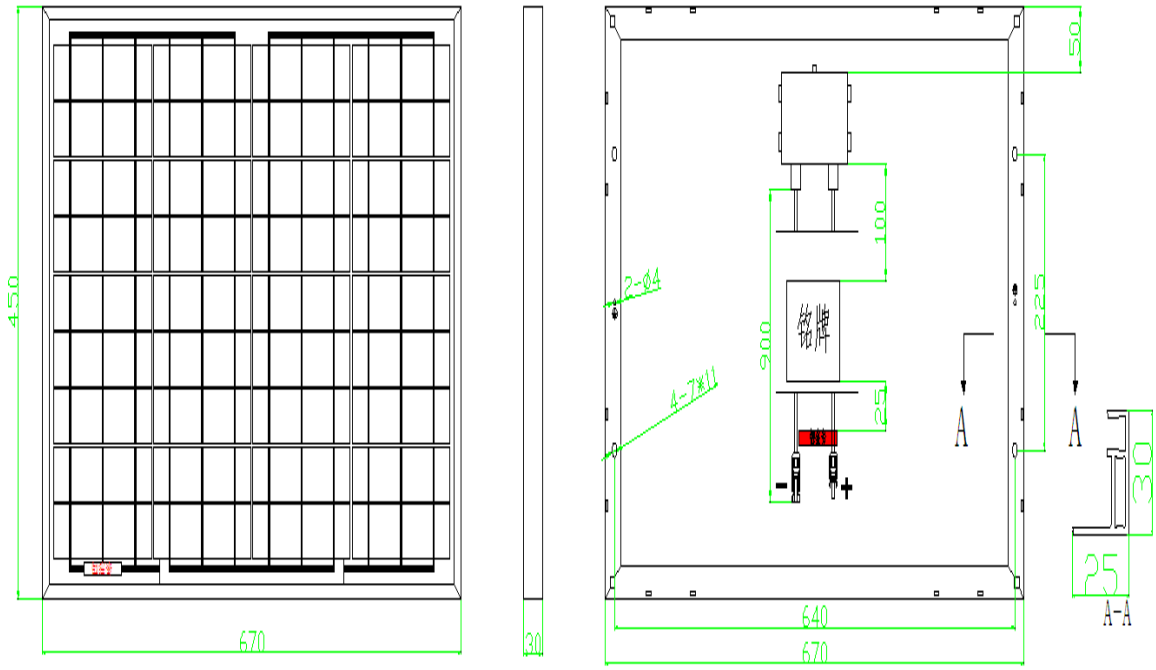
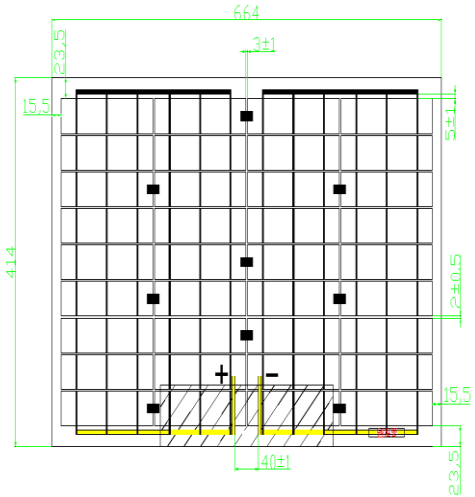


Illustration 16 - Laminator Schematic (P35W)



7.0 Illustrations

Illustration 16A - Module Schematic (P35W)

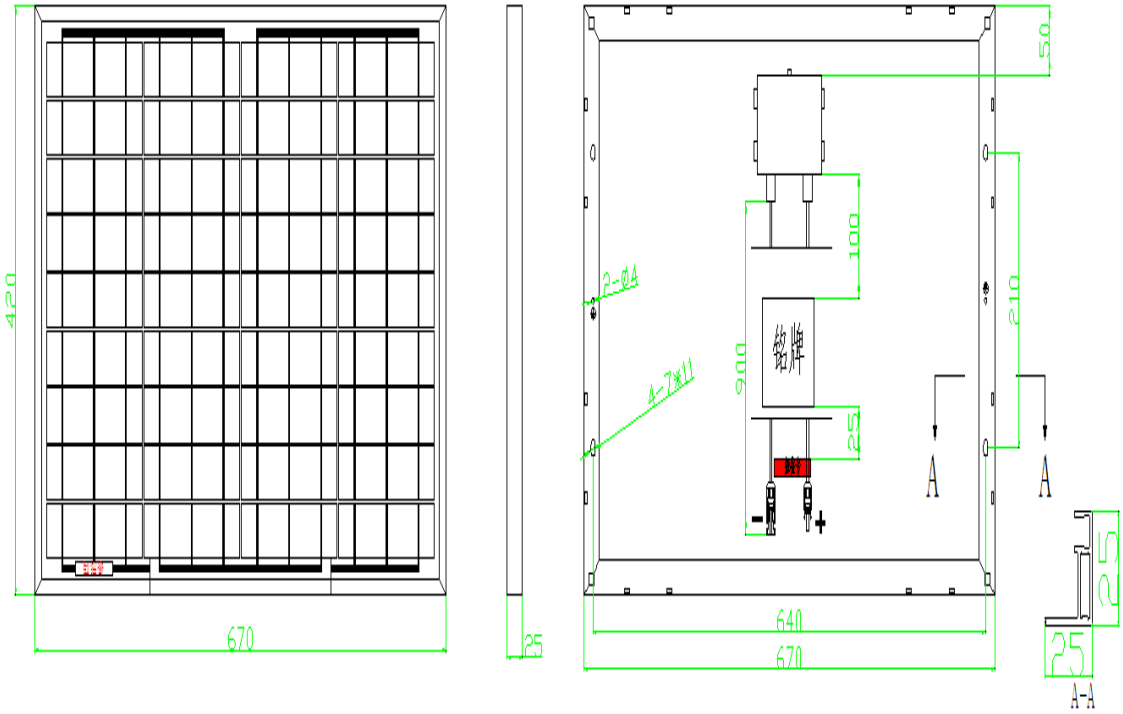
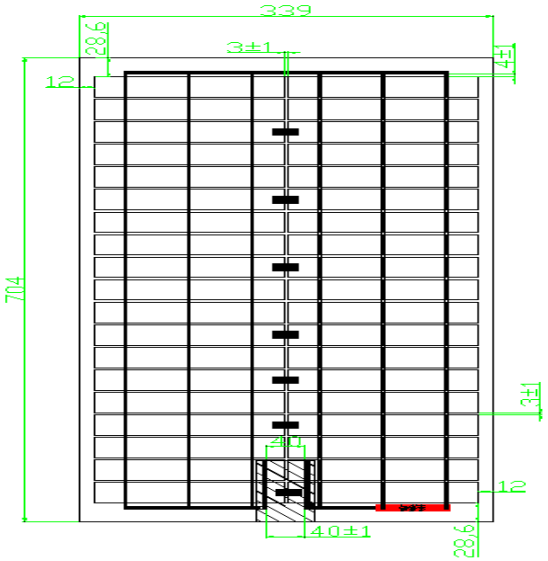


Illustration 17 - Laminator Schematic (P30W)



7.0 Illustrations

Illustration 17A - Module Schematic (P30W)

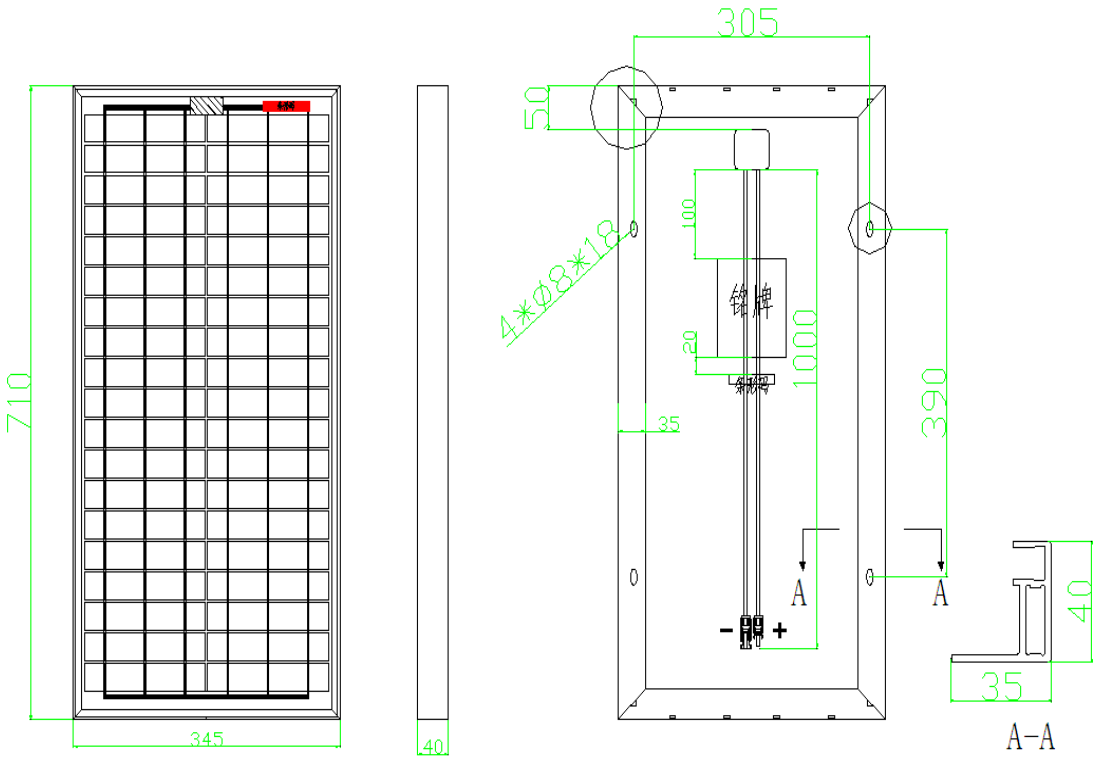
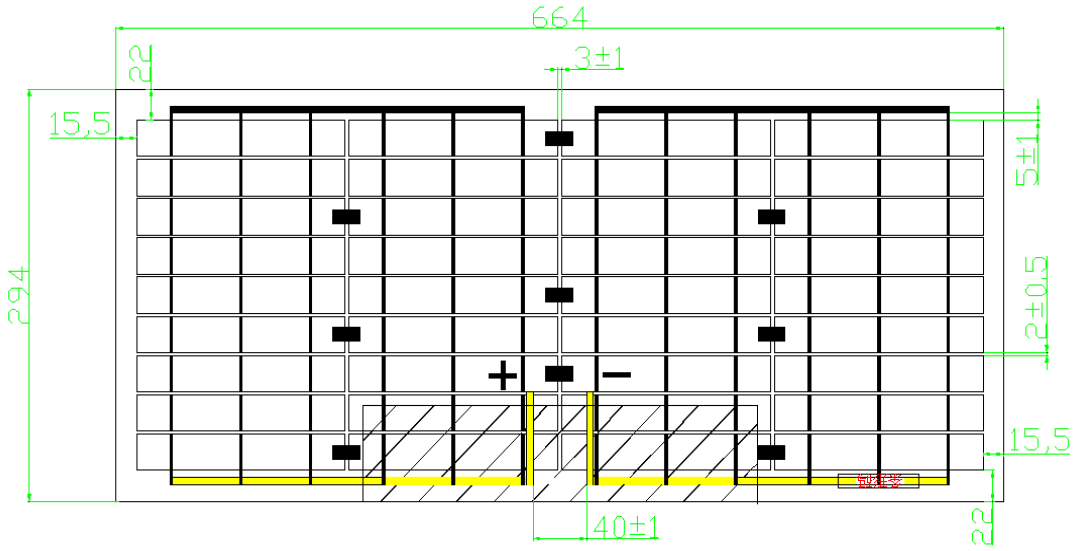


Illustration 18 - Laminator Schematic (P25W)



7.0 Illustrations

Illustration 18A - Module Schematic (P25W)

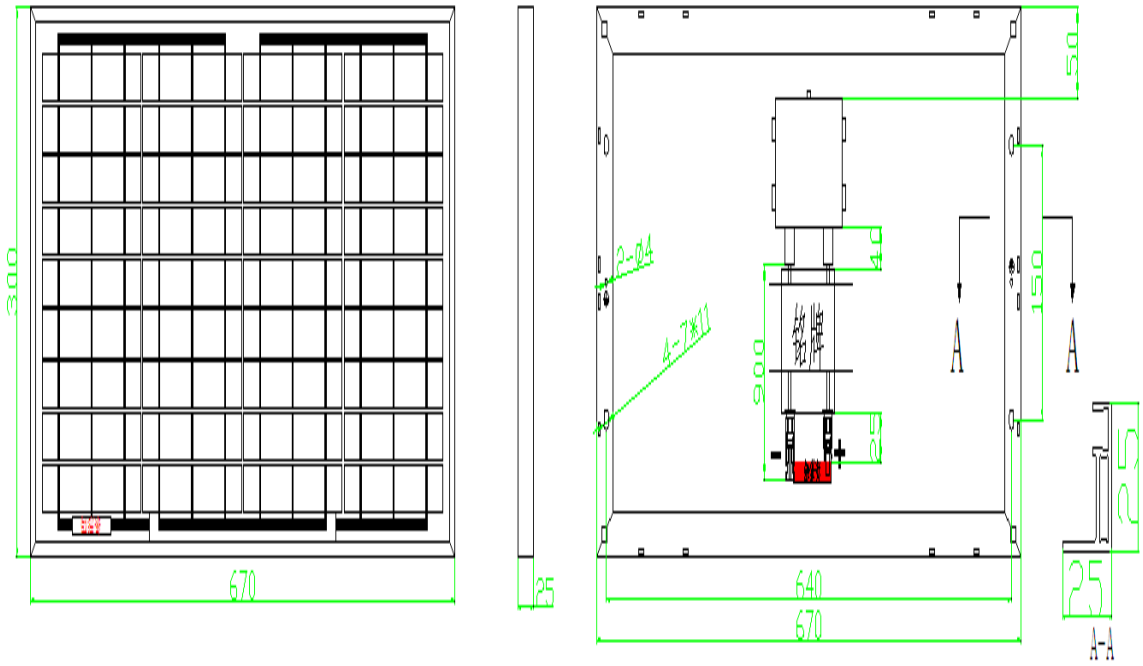
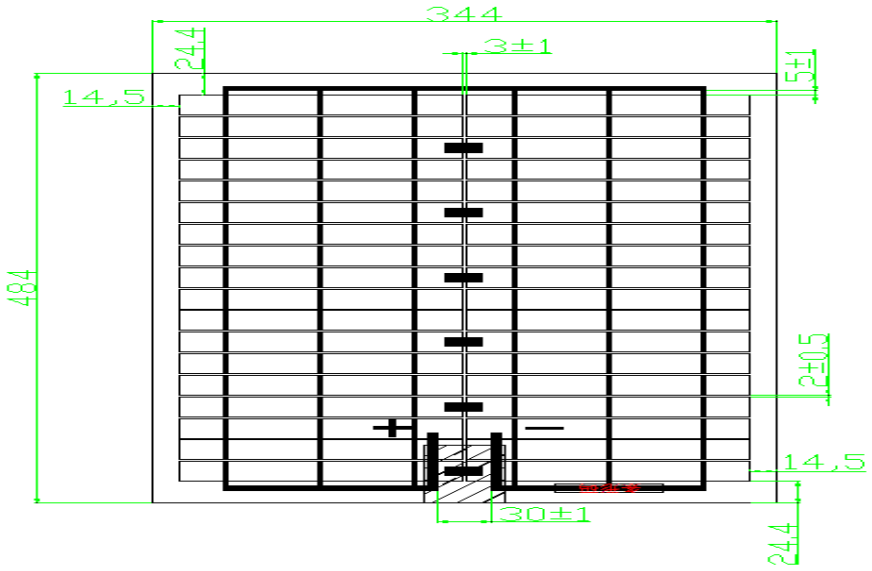


Illustration 19 - Laminator Schematic (P20W)



7.0 Illustrations

Illustration 19A - Module Schematic (P20W)

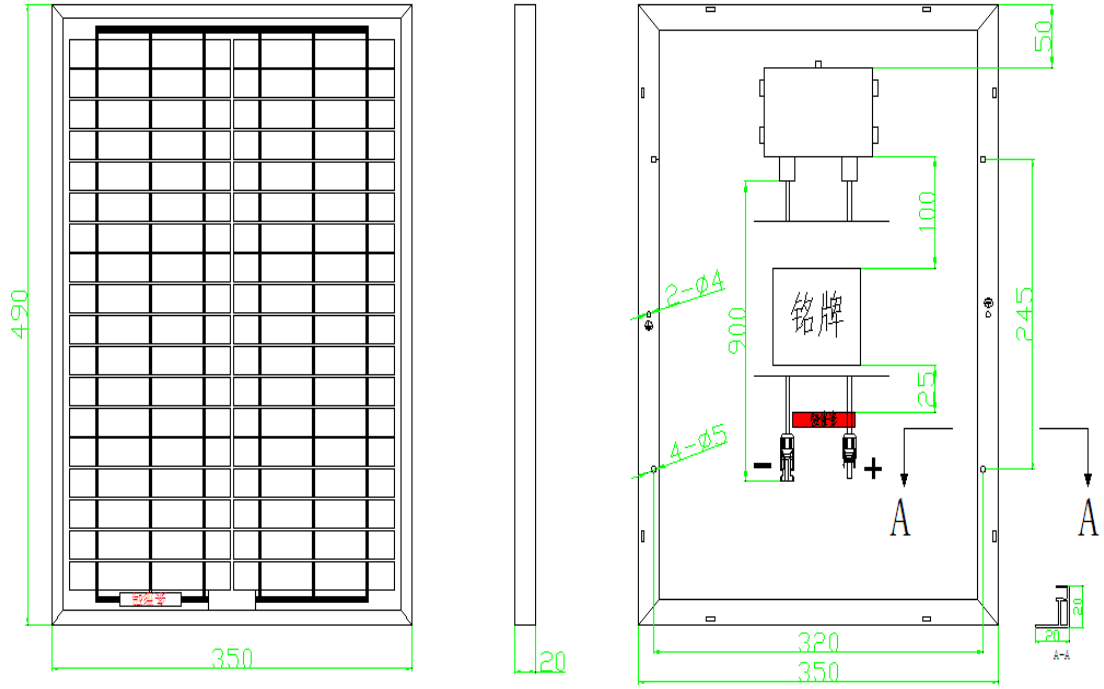
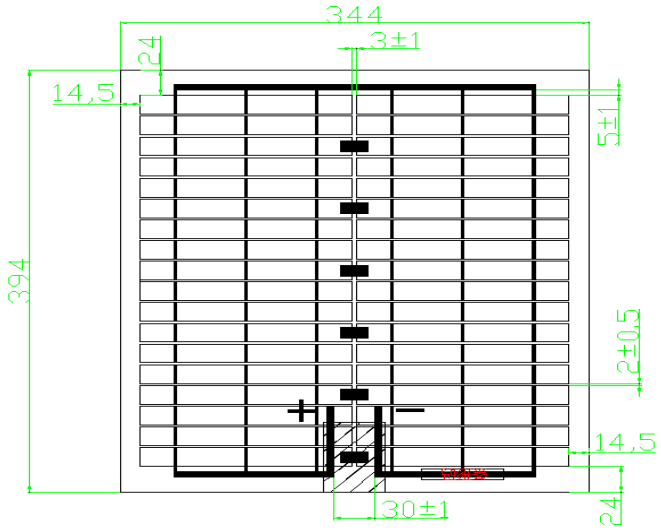


Illustration 20 - Laminator Schematic (P15W)



7.0 Illustrations

Illustration 20A - Module Schematic (P15W)

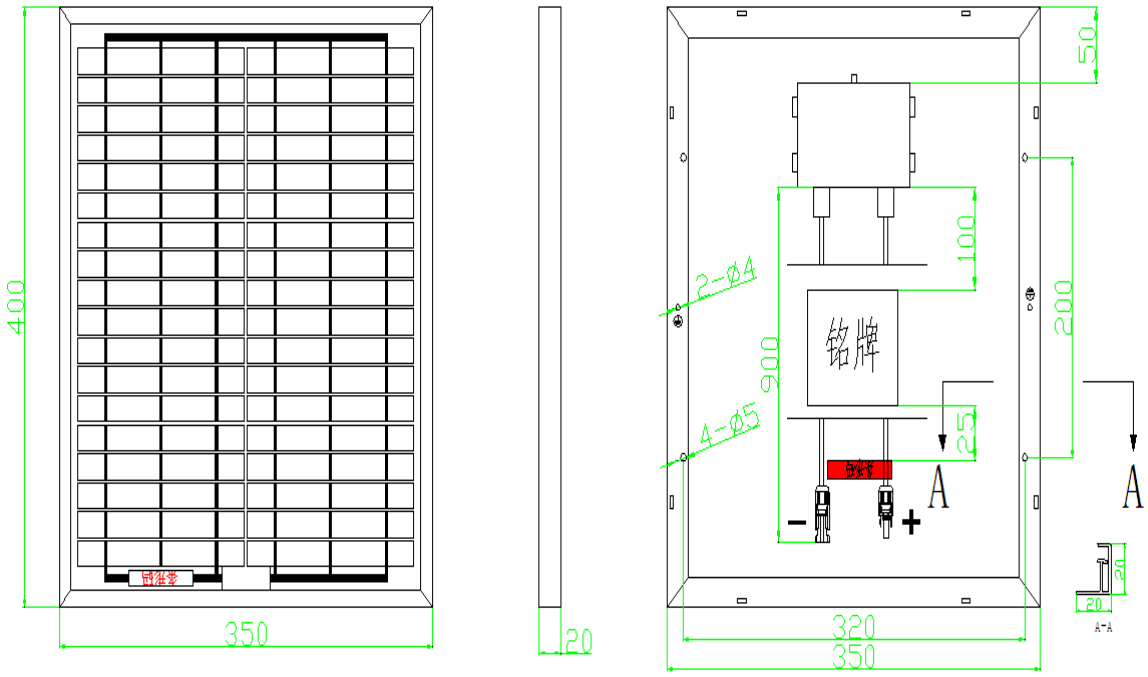
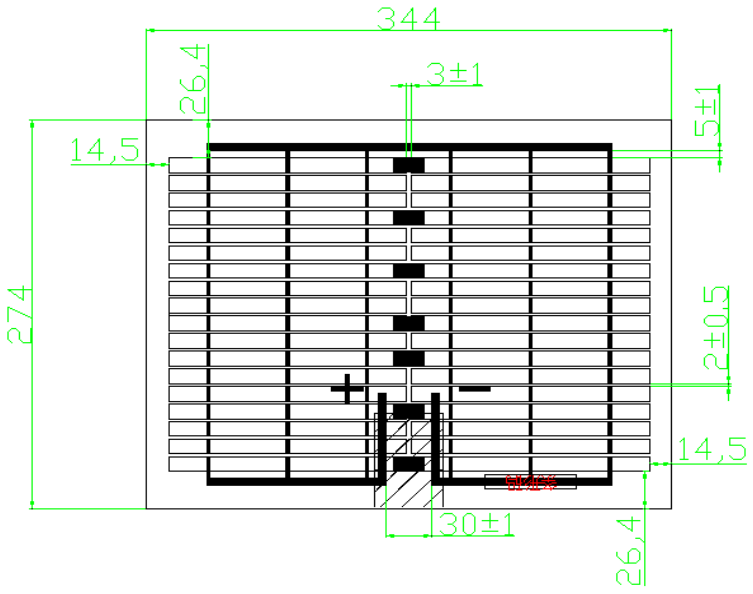


Illustration 21 - Laminator Schematic (P10W)



7.0 Illustrations

Illustration 21A - Module Schematic (P10W)

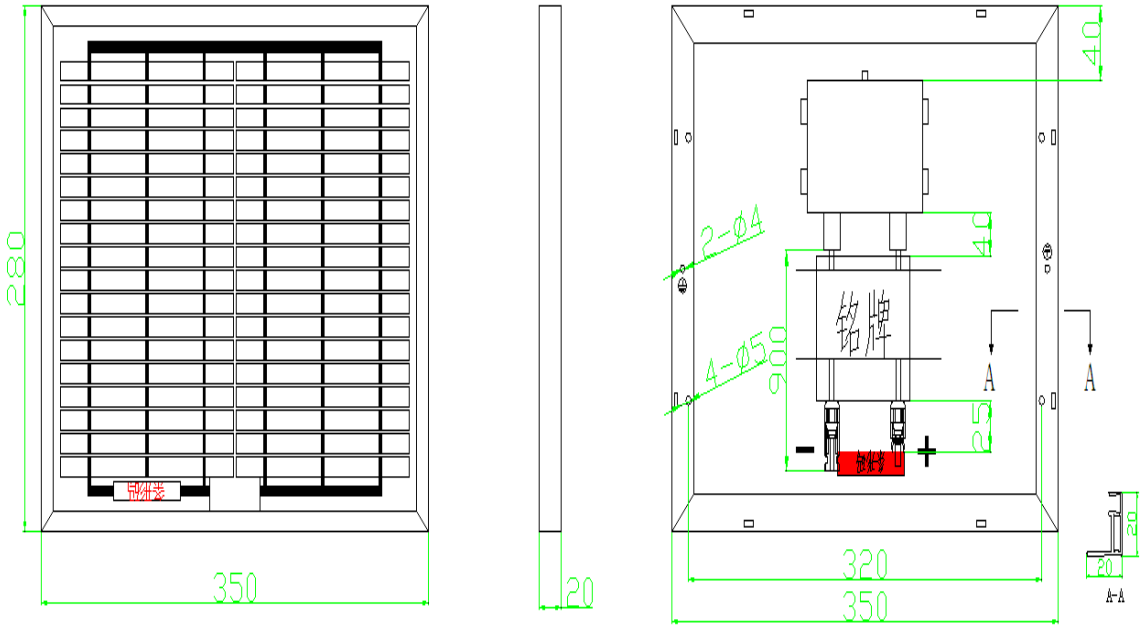
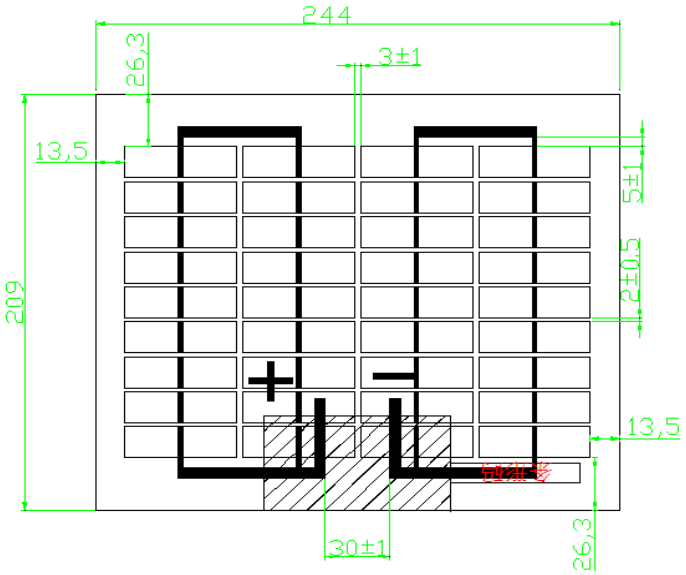
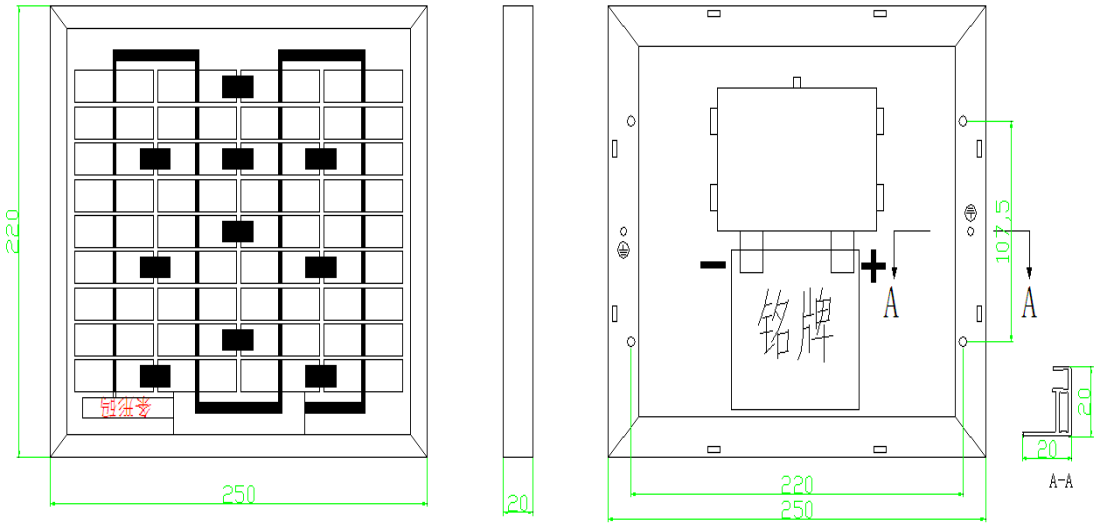


Illustration 22 - Laminator Schematic (P5W)



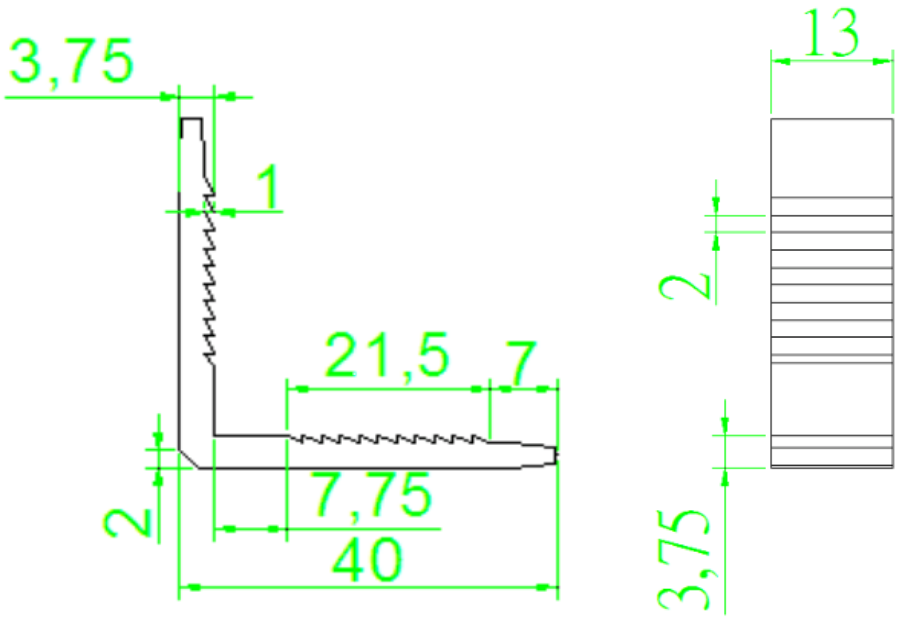
7.0 Illustrations

Illustration 22A - Module Schematic (P5W)



7.0 Illustrations

Illustration 23 - corner key



7.0 Illustrations

Illustration 24a - Installation manual

TOENERGY TECHNOLOGY HANGZHOU CO.,LTD.
NO 358,HONGXING ROAD, XIAOSHAN ECONOMY AND TECHNOLOGY DEVELOPMENT ZONE,
HANGZHOU CITY,ZHEJIANG PROVINCE ,CHINA
Tel/Fax:86-571-22831033
sales@toenergysolar.com

Installation Manual

For Solar Series PV Moules

7.0 Illustrations

Illustration 24b - Installation manual

TOENERGY TECHNOLOGY HANGZHOU CO.,LTD.
NO 358,HONGXING ROAD, XIAOSHAN ECONOMY AND TECHNOLOGY DEVELOPMENT ZONE,
HANGZHOU CITY,ZHEJIANG PROVINCE ,CHINA
Tel/Fax:86-571-22831033
sales@toenergysolar.com

1.Warning Notices

DANGER OF DEATH FROM ELECTRICAL SHOCK!

- The installation of PV should only be performed by qualified personnel.
- Do not wear metallic jewelry when installing. Do not touch live terminals with bare hands. Use insulated tools for electrical connections.
- Do not install PV modules when wet. Tools must be dry.
- Do not use damaged or defective modules. Place all damaged or defective modules in a carton to avoid exposure to light. Even damage or defective modules can produce electricity.
- Contact with electrically active parts of a PV module such as terminals, can result in burns sparks and lethal shock whenever the PV modules are connected or not.
- PV systems can produce high voltage and current which could present an increased hazard and may cause serious injury or death.
- Artificial sunlight should no be concentrated upon the PV module. Do not expose PV modules to sunlight concentrated with mirrors, lens or other means.
- Use appropriate safety equipment when working on any wiring.

DANGER OF DEATH FROM ARCOMG!

- PV modules generate current under direct sunlight. An arc produced when connections are separated. Thus, we recommend covering modules with a light proof cloth during installation. When breaking a connected string of modules (e.g.disconnecting the DC line from the inverter under load), a lethally strong arc can occur:
- Never disconnect the solar generator from the inverter when the inverter is still connected to the main grid remove the fuse from the AC side on the inverter first.
- Ensure cable connections are in perfect condition (no splitting, soiling, or contamination)

7.0 Illustrations

Illustration 24c - Installation manual

TOENERGY TECHNOLOGY HANGZHOU CO.,LTD.
NO 358,HONGXING ROAD, XIAOSHAN ECONOMY AND TECHNOLOGY DEVELOPMENT ZONE,
HANGZHOU CITY,ZHEJIANG PROVINCE ,CHINA
Tel/Fax:86-571-22831033
sales@toenergysolar.com

1.1 General Safety

1. All PV modules should be installed in accordance with applicable codes and regulations including, but not limited to the National Electrical Code(NEC).
2. Follow all safety precautions of other components used in the system.
3. Avoid uneven shade on the PV modules surface. Shaded cells may become hot(hotspot phenomenon) which may result in permanent damage to the module.
4. Do not use high pressure water spray or chemicals to clean the PV modules.

1.2 Handling Safety

1. Do not expose the PV module to excessive loads on the surface of the PV module or twist the frame. The glass may break.
2. Do not stand or step on the PV module. The glass may be slippery, and there is a risk of injury or electric shock if glass is broken.
3. PV modules are heavy. Please handle with care.
4. Do not hit or put excessive load on the glass or back sheet. PV cells may break.
5. Do not twist the interconnect cable excessively.
6. Do not drill holes in the frame. It may compromise the frame strength and cause corrosion of the frame and will void the warranty.
7. Do not touch the PV module with bare hands. The frame of the PV module has sharp edges and may cause injury. Wear suitable gloves, such as leather gloves with padding in the palm and finger areas.
8. Do not drop the PV module or allow objects to fall on the PV module.
9. PV module frame is made of anodized aluminum, and therefore corrosion can occur if PV module is subject to a salt-water environment and is in contact with another type of metal(electrolytic corrosion), if required, PVC or stainless steel washers can be placed between PV module frame and support structure to prevent this type of corrosion.

7.0 Illustrations

Illustration 24d - Installation manual

TOENERGY TECHNOLOGY HANGZHOU CO.,LTD.
NO 358,HONGXING ROAD, XIAOSHAN ECONOMY AND TECHNOLOGY DEVELOPMENT ZONE,
HANGZHOU CITY,ZHEJIANG PROVINCE ,CHINA
Tel/Fax:86-571-22831033
sales@toenergysolar.com

1.3 Installation Safety

1. Always wear protective head gear, insulating gloves and safety shoes(with rubber soles).
2. Due to risk of electrical shock, do not perform any work of terminals of the PV module are wet.
3. Do not install PV modules on the rain, snow or windy conditions.
4. Inset interconnect connectors fully and correctly. Check all connections. Cables should be secured to the PV module frames, support structure or raceway to prevent movement. Keep connectors out of direct sunlight.
5. Do not touch the terminal box and the end of the interconnect cables with bare hands during installation under sunlight, regardless of whether the PV module is connected to or disconnected from the system.
6. Do not unplug a connector if the system circuit is connected to an operating load.
7. Do not damage the back sheet of PV modules when mounting the PV module.
8. Do not damage the surrounding PV modules or mounting structure when replacing a PV module.
9. Keep children away from the system while installing.
10. When installing PV modules on roofs or other structures, the appropriate safety practices and safety equipment should be used at all times to avoid injury.

1.4 Fire Safety

1. Consult your local authority for guidelines and requirements for building or structural fire safety.
2. Roof constructions and installations may affect the fire safety of a building.
3. Improper installation may create hazards in the event of a fire.
4. Use components such as ground fault circuit breakers and fuses as required by local authority.
5. Do not use panels near equipment or in places where flammable gases may be generated.

7.0 Illustrations

Illustration 24e - Installation manual

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6. The module is considered to be in compliance with UL 1703 only when the module is mounted in the manner specified by the mounting instructions below.
7. A module with exposed conductive parts is considered to be in compliance with UL 1703 only when it is electrically grounded in accordance with the instructions presented below and the requirements of the National Electrical Code.
8. Any module without a frame (laminate) shall not be considered to comply with the requirements of UL 1703 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 1703.

2.Mechanical Installation

2.1 Installation and operation:

1.System should be installed by qualified personal only and at least two persons.The system involves electricity,and can be dangerous if the personnel are not familiar with the appropriate safety procedures.
2.Do not step on the module.
3.Although modules are quite rugged,the glass can be broken(and the module will no longer work properly)if it is dropped or hit by tools or other objects.
4.Put the solar cell modules on the frame and put on the screws and then combine them firmly after put on all the washers. All the screw caps should be finished on the frames together firmly. The modules frame is made of anodized aluminum, and therefore corrosion can occur if the module is subject to a salt-water environment with contact to a rack of another type of metal. (Electrolysis Corrosion) if required. PVC or stainless steel washers can be placed between the solar module frame and support structure to prevent this corrosion.

Installation Methods

7.0 Illustrations

Illustration 24f - Installation manual

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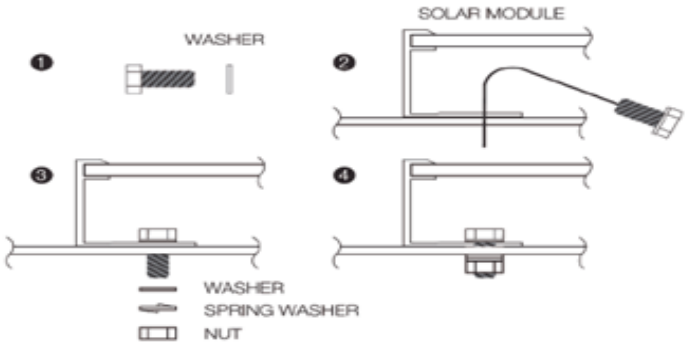
(1)Modules installed with mounting holes

Modules should be bolted to support structures through mounting holes located in the frame's back flanges.Refer to what is shown in Figure 2(Mounting Details).

Figure 2 Mounting Details



For your reference, please use the components specified in below:

1. Bolt
   Material: Stainless Steel
   Size and Length: M8*16mm
2. Washer
   Material: Stainless Steel
   Size: M8
3. Spring Washer
   Material: Stainless Steel
   Size: M8
4. Nut
   Material: Stainless Steel
   Size: M8

Recommended torque is between 14N.m to 20N.m.

(2)Modules installed with clamp

Modules should be mounted using specialized as shown in Figure 3.
A)Module should be attached on a supporting structure rail by metal clamps.It is recommended to use the clamps under the following condition or approved by system installation:
Width: No less than 38mm;

7.0 Illustrations

Illustration 24g - Installation manual

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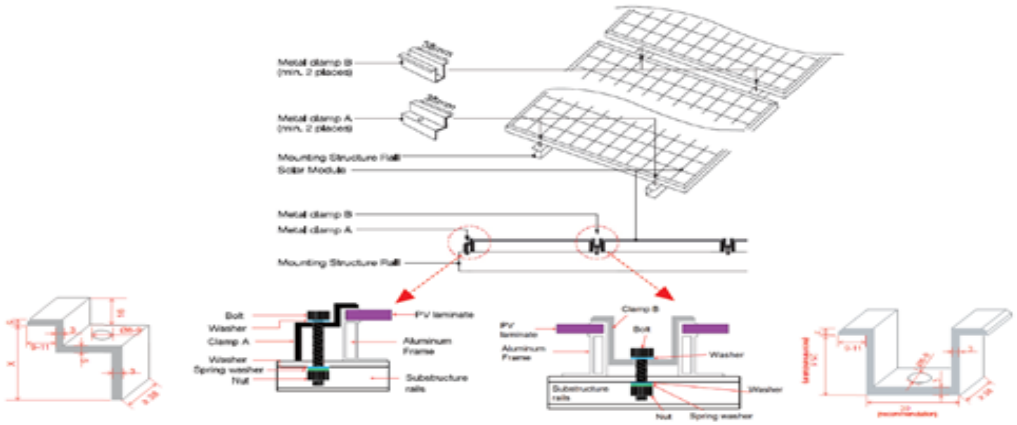
Thickness: No less than 3mm;
Material: Aluminum Alloy;
Bolt:M8.
B)Recommended bolt torque range:18N.m to 24N.m.
C)The Modules clamps must not contact the front glass or deform the frame in any way.Avoid shading effects from module clamps .Drainage holes on the Modules frame must not be closed or obscured by the clamps.

Figure 3: Clamp Details (Units: mm)



2.2 Wiring and Connection:

1.Before this procedure,please read the operation instructions of the PV control system carefully.
2.Refer to Section 690-8 of the National Electrical Code for an additional multiplying factor of 125 percent (80 percent de-rating) that may be applicable.
3.Make wiring by Multi-connecting cables between the PV modules in series or

7.0 Illustrations

Illustration 24h - Installation manual

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parallel connection, which is determined by user's configuration requirement for system power,current and voltage.

4.Open the connection box of the control system and connect the cabled from the PV arrays to the connection box in accordance with the installation indication of the PV control systems.

5.All module frames and mounting racks must be properly grounded in accordance with local and national electrical codes.

6.Follow the requirements of applicable local and national electrical codes.

7.Installation is in accordance with CSA C22.1, Safety Standard for Electrical Installations, Canadian Electrical Code, Part 1.

8.Suggest using PV wire cable, the length of the cable is 900mm, it contain 76 root cored wire and outside diameter is 6.2mm.

Make wiring by Multi-connecting cables between the PV modules in series or parallel connection, which is determined by user's configuration requirement for system power, current and voltage. When the modules are connected in series, each module's connector should be "+ 、 -"linked. When the modules are assembled in parallel connection, each module's connector should be "+ 、 +"linked together and "- 、 -"together linking.

3.Maintenance and cleaning

3.1 General

- Do not change the PV components optionally(diode, junction box, plug connectors)
- Given a sufficient tilt(at least 15°), it is not generally necessary to clean the modules (rainfall will have a self-cleaning effect). In case of heavy soiling (which will result in output reductions), we recommend cleaning the modules using plenty of water (from a hose) without cleaning agents and using a gentle cleaning implement(a sponge). Dirt must never be scraped or rubbed away when dry, as this will cause micro-scratched. We recommend that the system be inspected at regular intervals.

7.0 Illustrations

Illustration 24i - Installation manual

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- All fastenings are tight and secure and free of corrosion.
- All cable connections are secure, tight, clean and free of corrosion.
- Cables are not damaged in any way.
- Checking the earthling resistively of metals.

3.2 Breaks in the glass

Breaks in the glass are usually caused by outside cations, improper installation, hits,impacts with stones,etc. Some cases of damage during transportation have also been detected. Breaks in the glass, as it is tempered, always result in a complete splintering of the surface, with the location of the impact perfectly visible.The splintering reduces the performance by approximately some 30%, but the module can continue to be used, although it would be advisable to change it as soon as possible to ensure the operation of the installation.

3.3 Humidity on in the interior of the module

Although this failure not common, it can be caused by external impacts, scratches on the back sheet by external aggressions. When humidity penetrates deep enough the circuit of the cells and its connections, corrosions appear which reduce and even break the electrical contact between the electrodes and the cell material, impeding the collection of elections and making the module useless in this sense. The voltage and intensity fall to zero and the modules should be replaced immediately. It should be indicated that, as this failure results in the complete lack of function of the module, when serious problems are detected in a revision or check, it is advisable to replace the module at that time, to avoid the costs of another visit.

3.4 Failures in the connections of modules

Due to the thermal differences between, for example, day and night, the module's wiring connectors can come loose. Therefore, it is necessary to check the connections.

7.0 Illustrations

Illustration 24j - Installation manual

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Tightening them periodically (once every six months), if necessary.
During the installation, the water-tightness of the junction boxes through the grommets should be verified. Should water entering the junction box be detected, the presence of water in the contacts causes voltage drops in the circuit, and consequently, a reduction in power output. The repair consists of cleaning the terminals or connection terminals and changing the clamp of the junction box or grommet, if one of them is found to be defective.
Sprays for terminals used electronically or silicon seals are also useful.

3.5 Shading effect

The shading or hot spot effect is caused by precise shading on one or various cells of the modules while the test receive high radiation.This situation should be fixed by eliminating the cause of the shading. To avoid deterioration of the cells,it is advisable to use the protection diodes. We suggest using one diode within 24 cells in one series string.

4.Electrical Parameters for modules

4.1 Parameters for different modules

Nameplate rating are average values.The electriacal characteristics are within ±10 percent of the indicated values of ISC、VOC、and Pmax under standard test conditions(irradiance of 100 mW/cm2.AM 1.5 spectrum,and a cell temperation of 25℃(77° F)).

Refer to module datasheets for specific power output tolerances.

PXXXW (XXX=5-145)

Type	Pmax	Vmp	Imp	Voc	Isc	Maximum system voltage
P145W	145	21.47	6.76	27.61	7.26	30
P140W	140	21.42	6.54	27.56	6.96	30
P135W	135	21.37	6.32	27.51	6.72	30
P130W	130	21.32	6.10	27.46	6.49	30
P120W	120	18.86	6.36	22.50	6.88	30

7.0 Illustrations

Illustration 24k - Installation manual

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P115W	115	18.64	6.17	22.28	6.59	30
P110W	110	18.86	5.83	22.50	6.23	30
P105W	105	18.51	5.67	22.07	5.96	30
P100W	100	18.86	5.30	22.50	5.67	30
P95W	95	18.51	5.13	22.07	5.42	30
P90W	90	18.86	4.77	22.50	5.10	30
P85W	85	18.51	4.59	22.07	4.88	30
P80W	80	18.86	4.24	22.50	4.53	30
P75W	75	18.86	3.98	22.50	4.25	30
P70W	70	18.47	3.79	22.03	4.05	30
P65W	65	18.86	3.45	22.50	3.97	30
P60W	60	18.86	3.18	22.50	3.40	30
P55W	55	18.86	2.92	22.50	3.12	30
P50W	50	18.86	2.65	22.50	2.83	30
P45W	45	18.86	2.39	22.50	2.55	30
P40W	40	18.86	2.12	22.50	2.27	30
P35W	35	18.47	1.89	22.03	2.03	30
P30W	30	20.14	1.49	23.80	1.79	30
P25W	25	18.79	1.33	22.50	1.42	30
P20W	20	18.46	1.08	22.07	1.16	30
P15W	15	18.64	0.80	22.28	0.92	30
P10W	10	18.86	0.53	22.46	0.56	30
P5W	5	18.52	0.27	21.50	0.31	30

MXXXW (XXX= 10 - 145)

Type	Pmax	Vmp	Imp	Voc	Isc	maximum system voltage
M10W	10	18.68	0.54	22.02	0.60	30
M20W	20	18.72	1.07	22.32	1.18	30
M30W	30	17.68	1.70	22.10	1.79	30
M35W	35	19.26	1.82	22.86	1.98	30
M40W	40	18.54	2.16	22.14	2.35	30
M45W	45	18.91	2.38	22.30	2.61	30
M50W	50	18.00	2.78	22.00	3.01	30
M55W	55	18.72	2.94	22.32	3.19	30
M60W	60	25.60	2.35	29.80	2.52	30
M65W	65	18.72	3.47	22.32	3.71	30
M70W	70	20.60	3.40	23.20	3.98	30
M75W	75	20.80	3.61	23.40	4.15	30
M80W	80	18.54	4.31	22.14	4.67	30
M85W	85	18.72	4.54	22.32	4.93	30
M90W	90	18.90	4.76	22.68	5.17	30
M95W	95	18.54	5.12	22.14	5.55	30
M100W	100	19.20	5.21	23.00	5.51	30
M105W	105	19.26	5.45	22.86	5.87	30
M110W	110	18.72	5.88	22.32	6.46	30
M115W	115	19.08	6.03	22.68	6.59	30
M120W	120	18.36	6.54	22.14	6.95	30
M125W	125	18.54	6.74	22.32	7.15	30
M130W	130	18.72	6.94	22.50	7.35	30
M135W	135	18.90	7.14	22.68	7.54	30
M140W	140	19.08	7.34	22.86	7.73	30
M145W	145	19.26	7.53	23.04	7.92	30
M150W	150	26.90	7.15	22.20	6.76	15
M155W	155	27.10	7.29	22.50	6.89	15
M160W	160	27.30	7.42	22.80	7.02	15

7.0 Illustrations

Illustration 24l - Installation manual

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It is the great honor to provide you with our PV modules.

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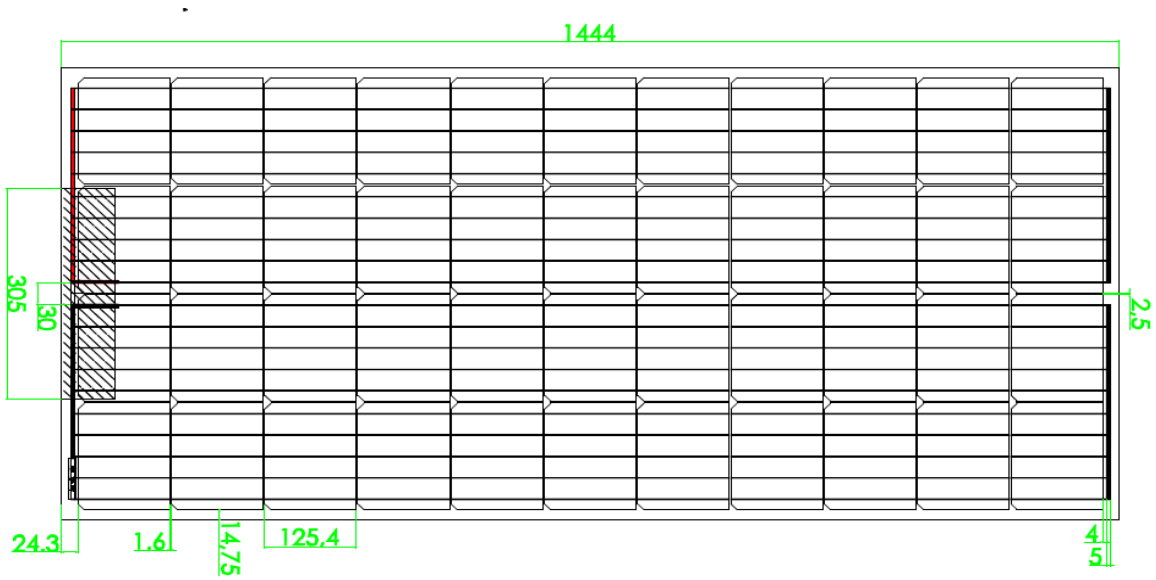
7.0 Illustrations

Illustration 26 - Connectors mated with each other

The modules are equipped with PV wiring connectors that comply with the Standard for Connectors for Use in Photovoltaic Systems, UL 6703, the specific allowable mating connector manufacturer(s) and model number(s) are listed as below, different model connectors couldn’ t be mated with each other to use:

Connector model name	Allowable mating connector model name
Helios H4 Assembled	Helios H4 Assembled

Illustration 27 Laminator Schematic (M150W~M160W)



7.0 Illustrations

Illustration 27A - Laminator Schematic (M145W~M120W)

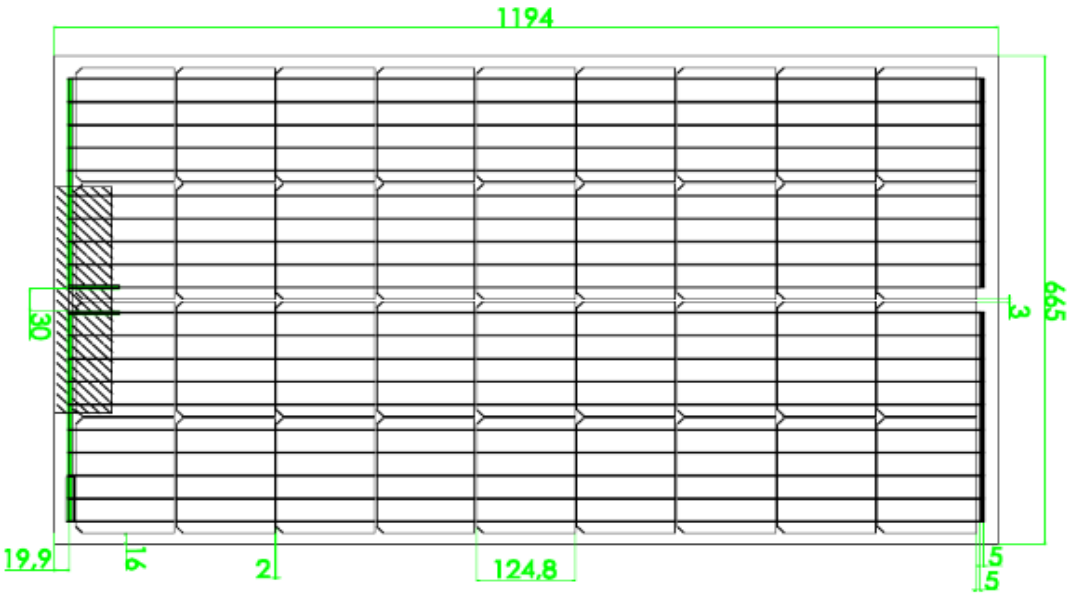
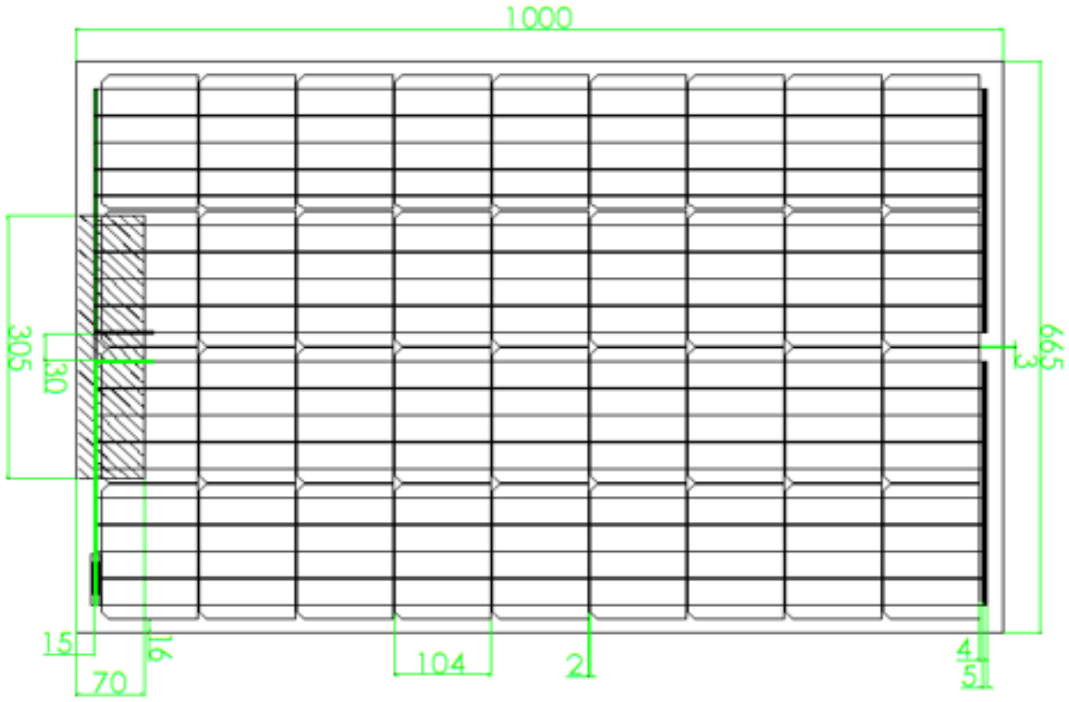
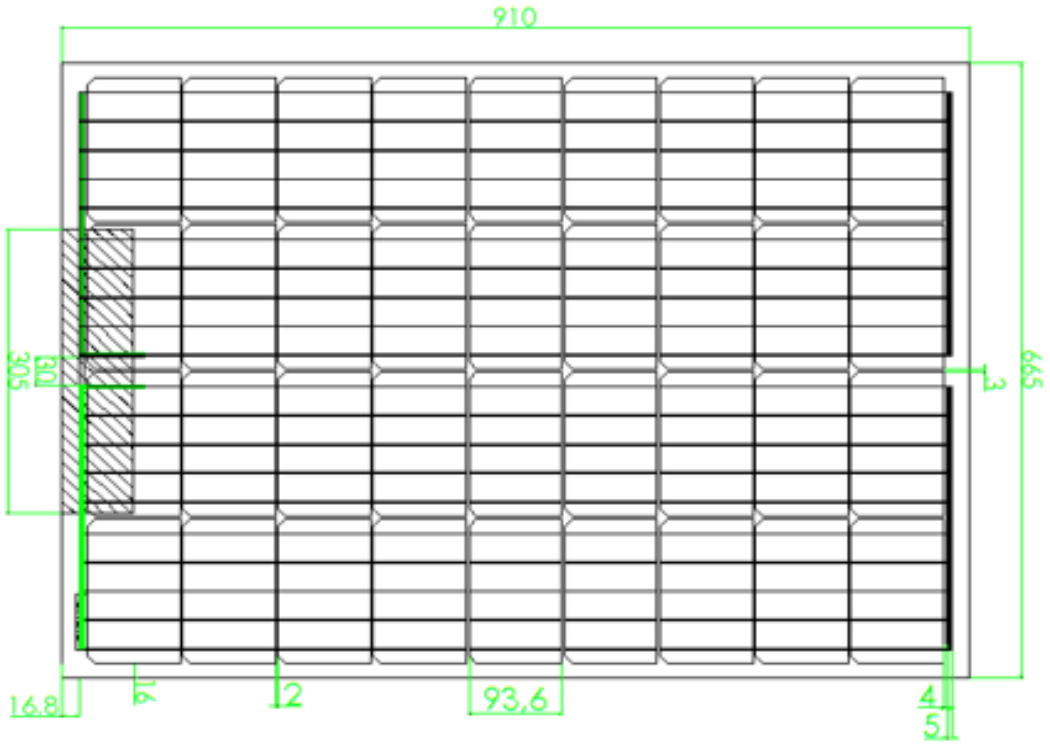


Illustration 28 Laminator Schematic (M110W~M115W)



7.0 Illustrations

Illustration 29 - Laminator Schematic (M105W and M95W)



7.0 Illustrations

Illustration 29A - Laminator Schematic (M100W)

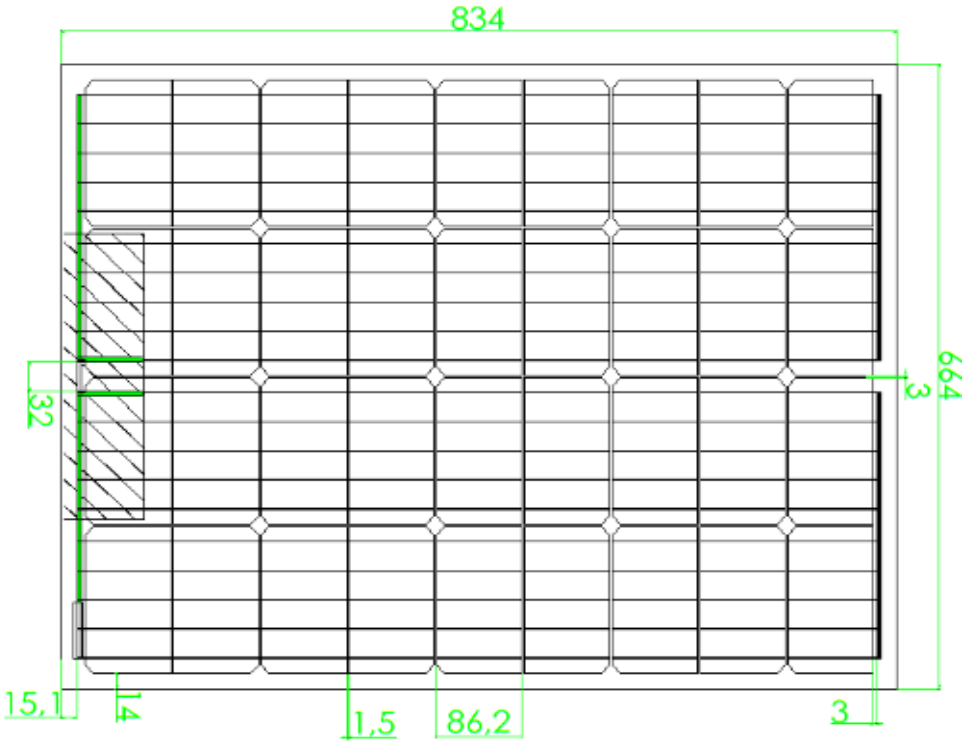
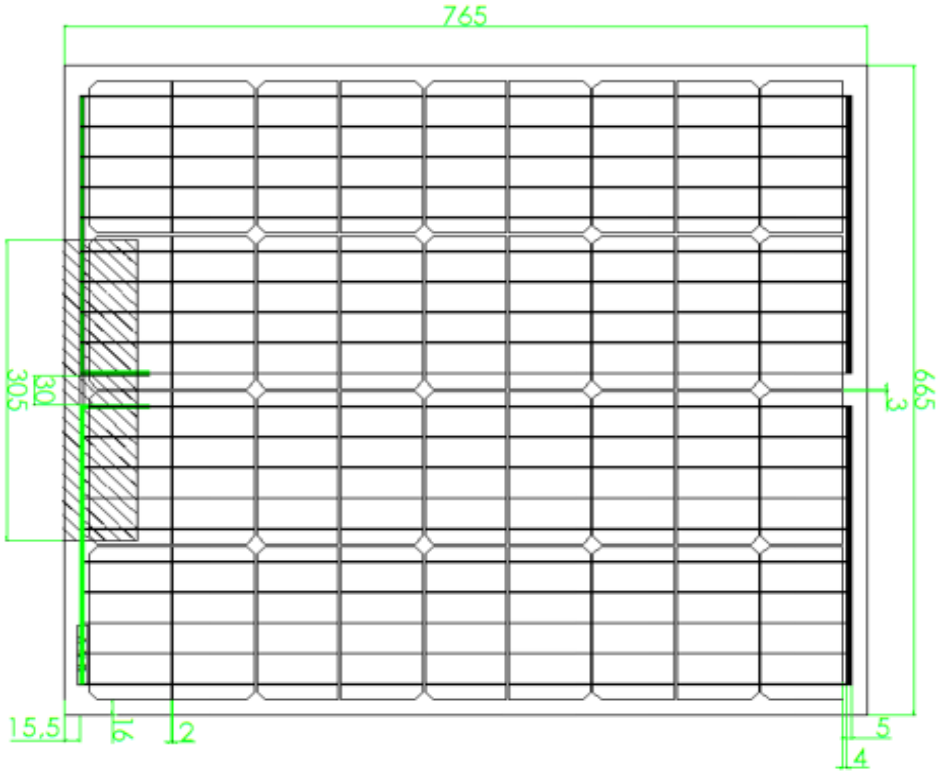
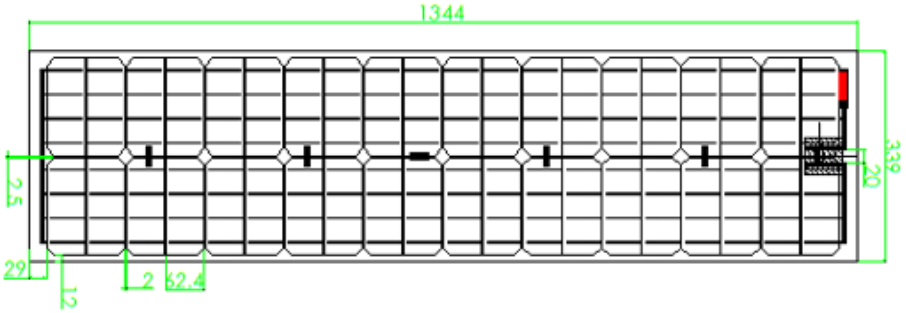


Illustration 30 - Laminator Schematic M90W~M80W



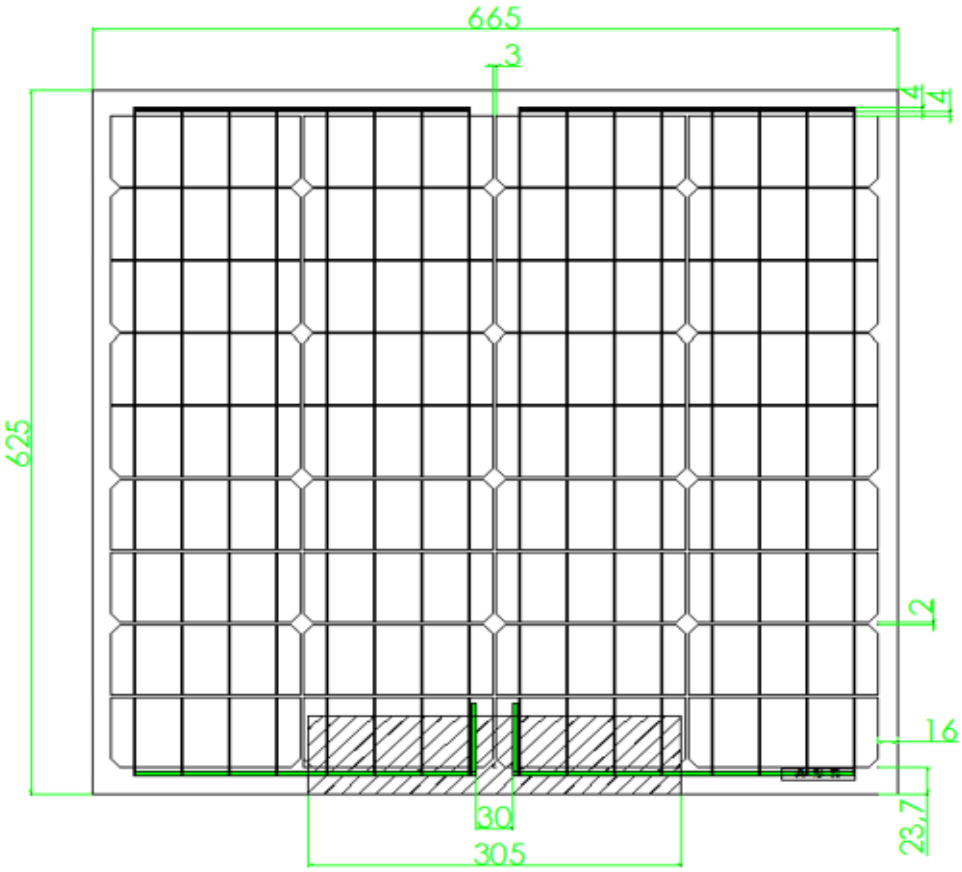
7.0 Illustrations

Illustration 31 - Laminator Schematic M70W~M75W



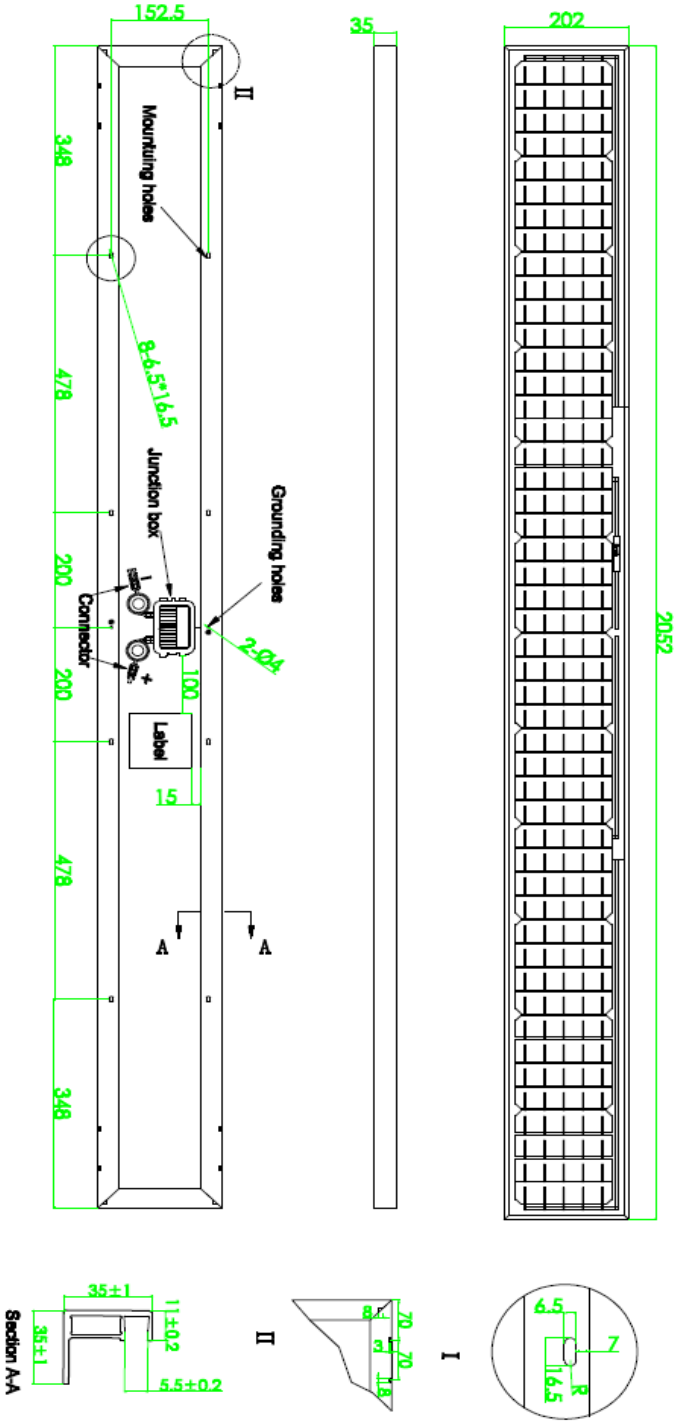
7.0 Illustrations

Illustration 32 - Laminator Schematic M65W



7.0 Illustrations

Illustration 32a - Laminator Schematic M60W



7.0 Illustrations

Illustration 33-Laminator Schematic M50W~M55W

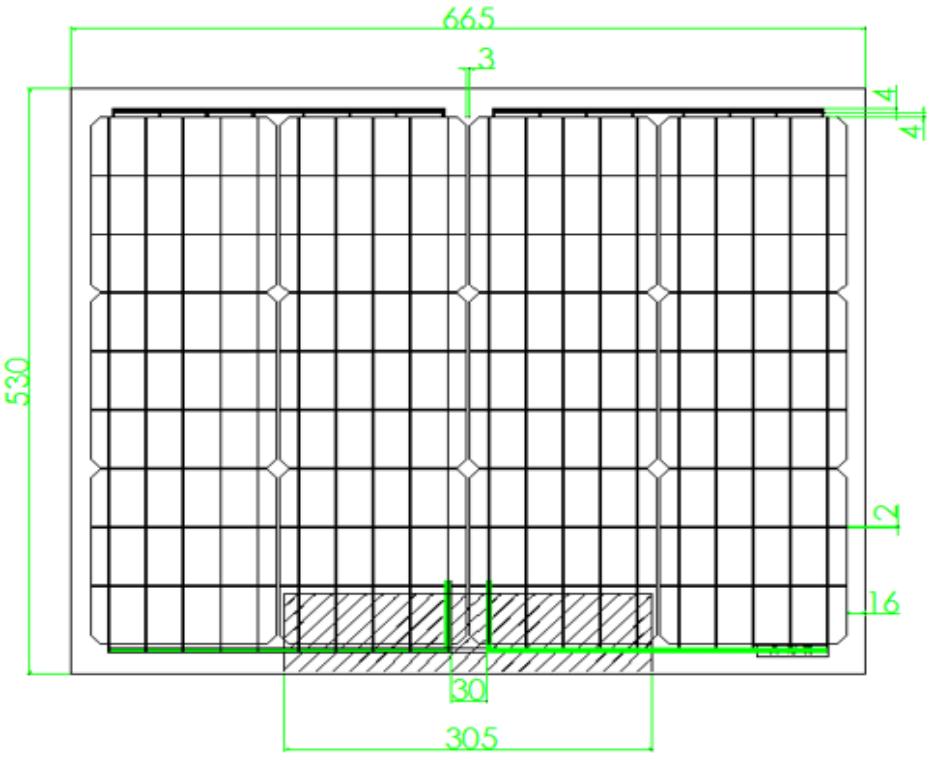
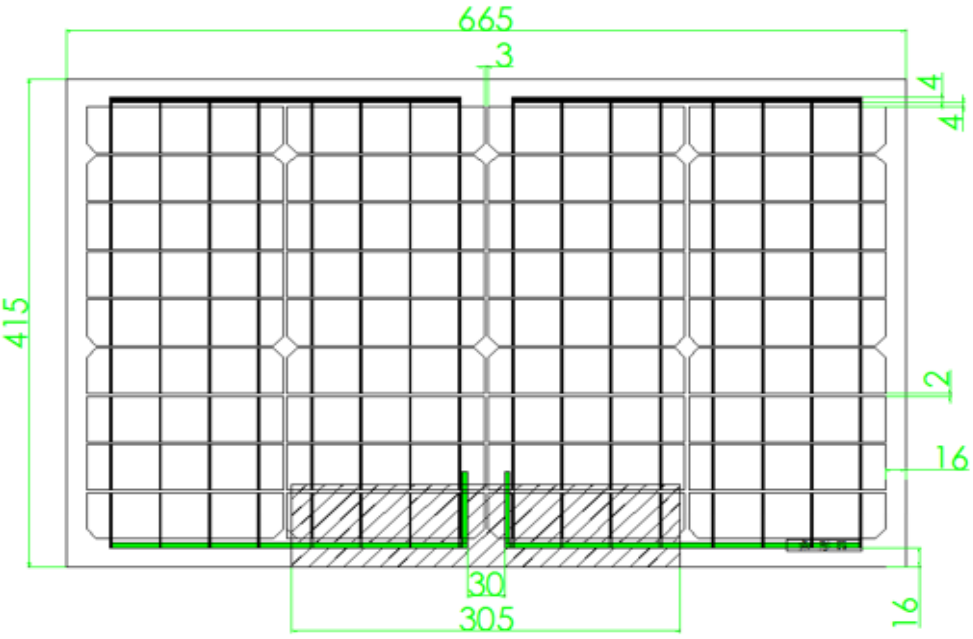


Illustration 34 - Laminator Schematic M45W~M40W



7.0 Illustrations

Illustration 35 - Laminator Schematic M35W~M30W

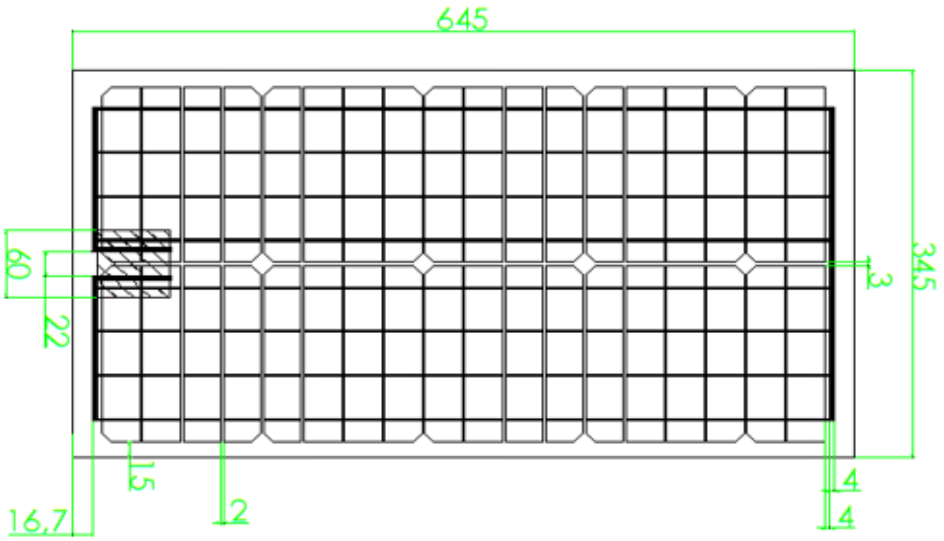


Illustration 36 - Laminator Schematic M20W

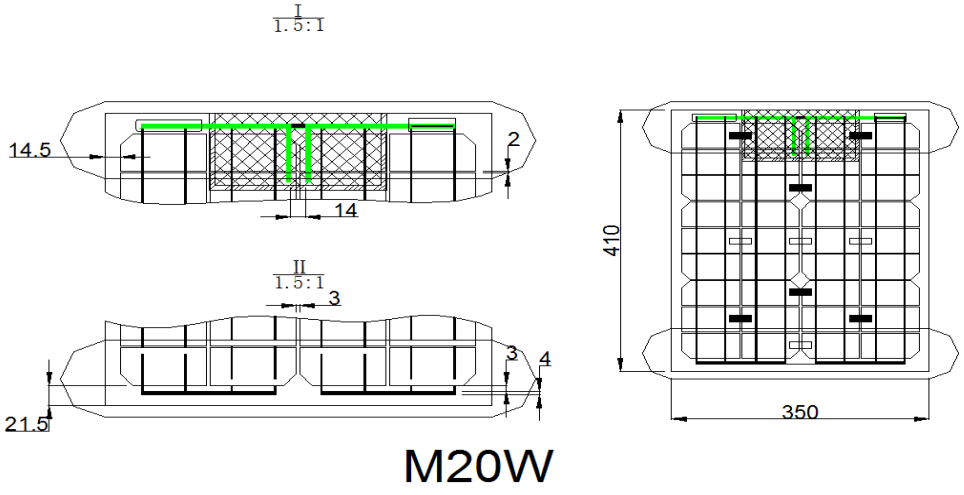
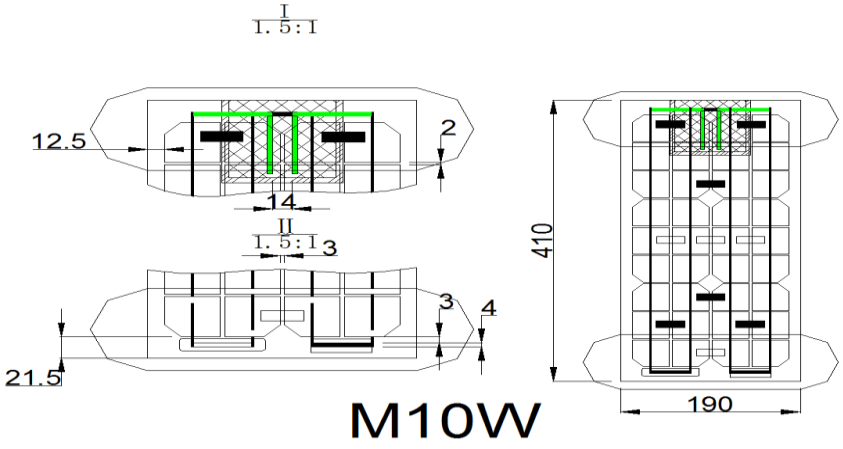
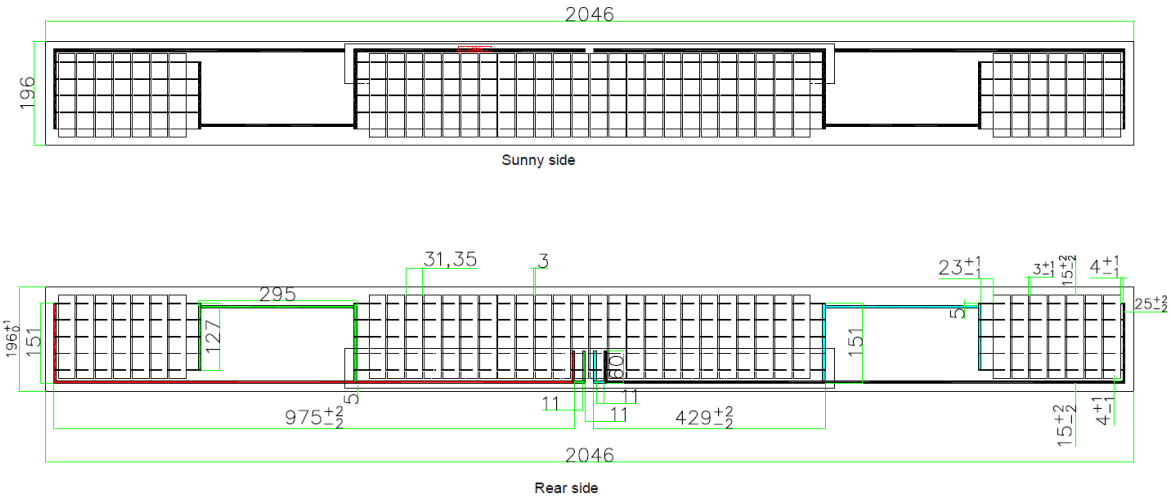


Illustration 37 - Laminator Schematic M10W



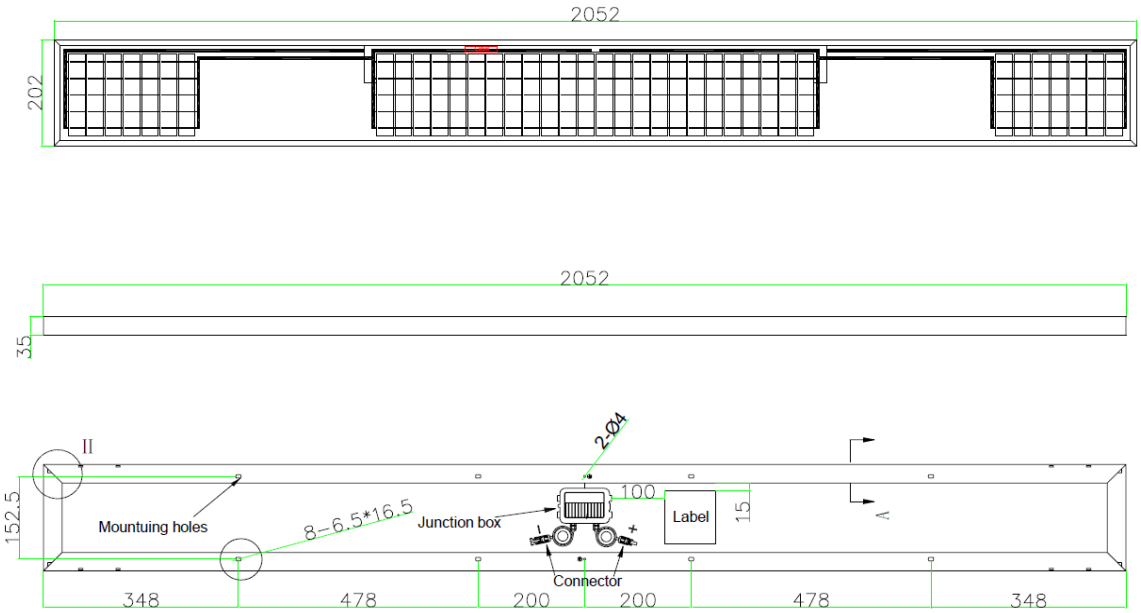
7.0 Illustrations

Illustration 38 - Laminator Schematic 30W-L



7.0 Illustrations

Illustration 38A - Module Schematic (30W-L)



8.0 Test Summary						
Evaluation Period	2015-11-16~2015-11-17				Project No.	150601876SHA
Sample Rec. Date	13-Nov-2015	Condition	Prototype		Sample ID.	0150717-58-002~006
Test Location	1-2F, No. 2, Alley 1218, Wan Rong Road, Shanghai, China 200436					
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:						

Test Description	UL 1703 2002/03/15 Ed:3 Rev:2015/5/19 UL Standard for Safety Flat-Plate Photovoltaic Modules and Panels	ULC/ORD-C1703-01 Second Edition 2001/08/01 Amd.1:2001 Standard for Safety Flat-Plate Photovoltaic Modules and Panels
Temperature test	Cl. 19	Cl. 5.2
Voltage, current and power measurements test	Cl. 20	Cl. 5.3
Strain relief test	Cl. 22	Cl. 5.5
Bonding path resistance test	Cl. 25	Cl. 5.8
Dielectric voltage-withstand test	Cl. 26	Cl. 5.9

Evaluation Period	2017-09-12 to 2017-09-12	Project No.	170901014SHA
Due to the previous testing performed and reported above no additional testing was necessary for Flat-Plate Photovoltaic Modules And Panels [UL 1703:2002 Ed.3+R:10Mar2017].			

Evaluation Period	July 3, 2018 to July 9, 2018			Project No.	180602190SHA
Sample Rec. Date	2-Jul-2018	Condition	Prototype	Sample ID.	180702-08
Test Location	1-2F, No. 2, Alley 1218, Wan Rong Road, Shanghai, China 200436				
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.					
Due to the Samples of a module or panel with a system open-circuit voltage rating less than 30 V and a short-circuit current rating less than 8 A, following tests were performed:					

Test Description	Standard For Flat-Plate Photovoltaic Modules And Panels [UL 1703:2002 Ed.3+R:13Sep2017]	Flat Plate Photovoltaic Modules And Panels [ULC ORD C1703:2011 Ed.1]
Temperature test	Cl. 19	Cl. 5.2
Voltage, current and power measurements test	Cl. 20	Cl. 5.3
Strain relief test	Cl. 22	Cl. 5.5
Push test	Cl. 23	Cl. 5.6
Bonding path resistance test	Cl. 25	Cl. 5.8
Dielectric voltage-withstand test	Cl. 26	Cl. 5.9

8.0 Test Summary					
Evaluation Period	January 18, 2019 to January 30, 2019			Project No.	190100545SHA
Sample Rec. Date	25-Dec-2018	Condition	Prototype	Sample ID.	0181225-05
Test Location	1-2F, No. 2, Alley 1218, Wan Rong Road, Shanghai, China 200436				
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.

Tests were performed on sample M60W for adding model M60W dimension of 2050mm*202mm*35mm and adding junction box 15T11A, manufactured by ZHEJIANG FORSOL ENERGU CO LTD, and PV wire, manufactured by Wuxi Xinhongye Wire & Cable Co., LTD. Due to modules in this report have a open-circuit voltage rating which are less than 30 V and a short-circuit current rating less than 8 A, therefore following tests were performed:

Test Description	Flat-Plate Photovoltaic Modules And Panels [UL 1703:2002 Ed.3 +R:26Sep2018]	Flat Plate Photovoltaic Modules And Panels [ULC ORD C1703:2011 Ed.1]
Temperature test	Cl. 19	Cl. 5.2
Voltage, current and power measurements test	Cl. 20	Cl. 5.3
Strain relief test	Cl. 22	Cl. 5.5
Push test	Cl. 23	Cl. 5.6
Bonding path resistance test	Cl. 25	Cl. 5.8
Dielectric voltage-withstand test	Cl. 26	Cl. 5.9

Tests were performed on sample M160W for expanding upper range of power output to 160W, and due to modules in this report have a open-circuit voltage rating which are less than 30 V and a short-circuit current rating less than 8 A, therefore following tests were performed:

Test Description	Flat-Plate Photovoltaic Modules And Panels [UL 1703:2002 Ed.3 +R:26Sep2018]	Flat Plate Photovoltaic Modules And Panels [ULC ORD C1703:2011 Ed.1]
Temperature test	Cl. 19	Cl. 5.2
Voltage, current and power measurements test	Cl. 20	Cl. 5.3
Strain relief test	Cl. 22	Cl. 5.5
Push test	Cl. 23	Cl. 5.6
Bonding path resistance test	Cl. 25	Cl. 5.8
Dielectric voltage-withstand test	Cl. 26	Cl. 5.9

8.0 Test Summary					
Evaluation Period	July 05, 2020 to July 28, 2020			Project No.	200700811SHA
Sample Rec. Date	25-Dec-2018	Condition	Prototype	Sample ID.	0200701-08
Test Location	1-2F, No. 2, Alley 1218, Wan Rong Road, Shanghai, China 200436				
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.

Tests were performed on sample 30W-L for adding model 30W-L, and adding frame, manufactured by Tanglong Technology Co.,Ltd, and Encapsulation Material, manufactured by Hangzhou First PV Material Co., Ltd, and Substrate, manufactured by Cybrid Technology INC, and Cell to Cell Connectors, manufactured by Yaoheng Technology Co.,Ltd, and String Connector, manufactured by Yaoheng Technology Co.,Ltd, and Bypass Diode, manufactured by YANGZHOU YANGJIE ELECTRONIC TECHNOLOGY CO.,LTD, and Label, manufactured by AVERY (CHINA) CO LTD and due to modules in this report have a open-circuit voltage rating which are less than 30 V and a short-circuit current rating less than 8 A, therefore following tests were performed:

Test Description	Flat-Plate Photovoltaic Modules And Panels [UL 1703:2002 Ed.3 +R:26Sep2018]	Flat Plate Photovoltaic Modules And Panels [ULC ORD C1703:2011 Ed.1]
Temperature test	Cl. 19	Cl. 5.2
Voltage, current and power measurements test	Cl. 20	Cl. 5.3
Strain relief test	Cl. 22	Cl. 5.5
Push test	Cl. 23	Cl. 5.6
Bonding path resistance test	Cl. 25	Cl. 5.8
Dielectric voltage-withstand test	Cl. 26	Cl. 5.9

Evaluation Period	December 08,2020	Project No.	201200388SHA

Flat Plate Photovoltaic Modules And Panels [ULC ORD C1703:2011 Ed.1] update to Flat Plate Photovoltaic Modules And Panels [ULC ORD C1703:2018 Ed.2]. No test necessary.

Evaluation Period	March 04,2021	Project No.	210202079SHA

Flat-Plate Photovoltaic Modules And Panels [UL 1703:2002 Ed.3 +R:26Sep2018] updata to Flat-Plate Photovoltaic Modules and Panels [UL 1703:2002 Ed.3+R:25Nov2019]. No test necessary.

8.0 Test Summary

Evaluation Period	April 27,2021 to April 30,2021			Project No.	210403808SHA
Sample Rec. Date	26-Apr-2021	Condition	Prototype	Sample ID.	PVPTC20211731497_NX_60954_05~PVPTC20211732972_NX_60954_05
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.

Tests were performed on sample P30W-L for adding Bypass Diode, manufactured by ZHEJIANG FORSOL ENERGY CO., Ltd. and due to modules in this report have a open-circuit voltage rating which are less than 30 V and a short-circuit current rating less than 8 A, therefore following tests were performed:

Test Description	Flat-Plate Photovoltaic Modules and Panels [UL 1703:2002 Ed.3+R:25Nov2019]	Flat Plate Photovoltaic Modules And Panels [ULC ORD C1703:2018 Ed.2]
Voltage, current and power measurements test	Cl. 20	Cl. 5.3
Bypass Diode Thermal test	Clause 11.18 of UL 61215-1-1	-

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:	*Signature on file*	Signature:	*Signature on file*

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 Modules

MULTIPLE LISTEE 1	TOENERGY SOLAR SDN BHD
Address	No.6,JALAN MUTIARA6,TAMAN PERINDUSTRIAN PLENTONG,81750,JOHOR BAHRU,JOHOR.
Country	Malaysia
Brand Name	TOENERGY
ASSOCIATED MANUFACTURER	All manufacturers shown in Section 1.0
Address	
Country	

MULTIPLE LISTEE 1 MODELS	BASIC LISTEE MODELS
P followed by 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 130, 135, 140 or 145; followed by W. M follow by 10, 20, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 125, 130, 135, 140, 145, 150, 155 or 160; followed by W. 30W followed by -L.	P followed by 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 130, 135, 140 or 145; followed by W. M follow by 10, 20, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 125, 130, 135, 140, 145, 150, 155 or 160; followed by W. 30W followed by -L.

MULTIPLE LISTEE 2	Xantrex LLC
Address	541 Roske Drive, Suite A, Elkhart, Indiana, 46516-9323
Country	United States
Brand Name	Xantrex
ASSOCIATED MANUFACTURER	All manufacturers shown in Section 1.0
Address	
Country	

MULTIPLE LISTEE 2 MODELS	BASIC LISTEE MODELS
P followed by 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 130, 135, 140 or 145; followed by W. M follow by 10, 20, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 125, 130, 135, 140, 145, 150, 155 or 160; followed by W.	P followed by 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 130, 135, 140 or 145; followed by W. M follow by 10, 20, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 125, 130, 135, 140, 145, 150, 155 or 160; followed by W.

9.0 Correlation Page For Multiple Listings	
MULTIPLE LISTEE 3	SUNSHARE TECHNOLOGY, INC.
Address	10655 NE 4TH ST STE 703, BELLEVUE, WA, 98004-5037
Country	United States
Brand Name	SUNSHARE
ASSOCIATED MANUFACTURER	Toenergy Technology Hangzhou Co.,Ltd
Address	No.3, Gaoxin 9 Road, Xiaoshan Economy and Technology Development Zone, Hangzhou, 311215
Country	China

MULTIPLE LISTEE 3 MODELS	BASIC LISTEE MODELS
P followed by 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105,110, 115, 120, 130, 135, 140, or 145; followed by W. M follow by 10, 20, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115,120, 125, 130, 135, 140, 145,150,155, or 160; followed by W.	P followed by 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105,110, 115, 120, 130, 135, 140, or 145; followed by W. M follow by 10, 20, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115,120, 125, 130, 135, 140, 145,150,155, or 160; followed by W.

MULTIPLE LISTEE 4	NEXTracker
Address	6200 Paseo Padre Parkway Fremont,CA 94555
Country	United States
Brand Name	NEXTracker
ASSOCIATED MANUFACTURER	Toenergy Technology Hangzhou Co.,Ltd
Address	No.3, Gaoxin 9 Road, Xiaoshan Economy and Technology Development Zone, Hangzhou, 311215
Country	China

MULTIPLE LISTEE 4 MODELS	BASIC LISTEE MODELS
P followed by 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105,110, 115, 120, 130, 135, 140, or 145; followed by W. M follow by 10, 20, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115,120, 125, 130, 135, 140, 145,150,155, or 160; followed by W.	P followed by 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105,110, 115, 120, 130, 135, 140, or 145; followed by W. M follow by 10, 20, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115,120, 125, 130, 135, 140, 145,150,155, or 160; followed by W.

MULTIPLE LISTEE 5	Rural Power Systems Inc.
Address	40250 County Road 27, Woodland, 95776
Country	United States
Brand Name	Back40 Solar
ASSOCIATED MANUFACTURER	All manufacturers shown in Section 1.0
Address	
Country	

MULTIPLE LISTEE 5 MODELS	BASIC LISTEE MODELS
P followed by 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 130, 135, 140 or 145; followed by W. M follow by 10, 20, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 125, 130, 135, 140, 145, 150, 155 or 160; followed by W. 30W followed by -L.	P followed by 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 130, 135, 140 or 145; followed by W. M follow by 10, 20, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 125, 130, 135, 140, 145, 150, 155 or 160; followed by W. 30W followed by -L.

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 and/or

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 assessment in your facility.

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

Factory Dielectric Voltage Withstand Test, Factory Voltage, Current, and Power Measurements Test, Grounding Continuity Test

11.1 Factory Dielectric Voltage Withstand Test

Method

Each module or panel shall withstand for 1 min without electrical breakdown as a routine production line test, the application of a dc test potential as specified as following between parts involving a risk of electric shock and accessible metal parts.

Connect the shorted output terminals of the module to the positive terminal of a DC insulation tester with a current limitation. Connect the exposed metal parts of the module to the negative terminal of the tester. If the module has no frame or if the frame is a poor electrical conductor, wrap a conductive foil around the edges and over the back of the module. Connect the foil to the negative terminal of the tester.

The voltage is to be increased from zero at gradually and smoothly so as to reach the specified test potential in approximately 5s, and then is to be held at ghe required test voltage until the leakage current is stabilized for at least 1 min. The module or panel is to be observed during the test and there are to be no signs of arcing or flash-over.

The DC test potential shall be 2"V"+1000V, "V" is the rated maximum acceptable system voltage.

Exception 1: The test period may be reduced to 1s if the test potential is increased to 120percent of the value specified before.

Exception 2: A module or panel with a system voltage rating of 30V or less need not be tested.

The test shall be conducted on products, which are fully assembled. Prior to applying the test potential, all switches, contractors, relays, etc., should be closed so that all primary circuits are energized by the test potential. If all primary circuits cannot be tested at one time, then separate applications of the test potential shall be made.

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 shall incorporate a transformer with an essentially sinusoidal output, a means to indicate the applied test potential, and an audible and/or visual indicator of dielectric breakdown.

The test equipment shall incorporate a voltmeter in the output circuit to indicate directly the applied test potential if the rated output of the test equipment is less than 500VA.

If the rated output of the test equipment is 500VA or more, the applied test potential may be indicated by either:
1 - a voltmeter in the primary circuit;
2 - a selector switch marked to indicate the test potential; or
3 - a marking in a readily visible location to indicate the test potential for test equipment having a single test potential output.

In cases 2 and 3, the test equipment shall include a lamp or other visual means to indicate that the test potential is present at the test equipment output. All test equipment shall be maintained in current calibration.

Products Requiring Factory Dielectric Voltage Withstand Test:

Product	Test Voltage	Test Time
All products covered by this Report.	N/A	N/A

11.2 Factory Voltage, Current, and Power Measurements Test
Method The short-circuit current (ISC), maximum power (Pmax), and open-circuit voltage (VOC) of each production module are to be measured in accordance with the appropriate test procedure (Standard Methods of Testing Electrical Performance of Nonconcentrator Terrestrial Photovoltaic Modules and Arrays Using Reference Cells, ASTM E1036-85, or Photovoltaic Devices, Part 1: Measurement of Photovoltaic Current-Voltage Characteristics, IEC 904-1) and the results recorded at STC using the appropriate correction procedure. The recorded values of ISC, Pmax, and VOC shall be within the marked tolerance.
Products Requiring Factory Voltage, Current, and Power Measurements Test:
All products covered by this Report.

11.3 Grounding Continuity Test
Method Each module or panel provided with a connection for grounding accessible conductive parts shall be subjected to a routine production line test to demonstrate electrical continuity between the grounding connection and all accessible conductive parts. If all accessible dead metal is connected, only a single test need be performed. A visual or audible device (ohmmeter, buzzer, etc.) may be used to indicate grounding continuity.
Products Requiring Grounding Continuity Test:
All products 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
12-Apr-2016	Ken Gu	Section 9.0 MLS	MULTIPLE LISTEE 1	Added Multiple Listee 1: TOENERGY SOLAR SDN.BHD
160303289#SHA	William Cheng	Section 7.0 Illustrations	Illustration 25A	Added illustration 25A: Marking example of Multiple listee1 TOENERGY SOLAR SDN.BHD
22-Sep-2017	Rimon Li/ Ken Gu	1.0	-	Updated UL standard from 'UL 1703 2002/03/15 Ed:3 Rev:2015/5/19 UL Standard for Safety Flat-Plate Photovoltaic Modules and Panels ' to 'Flat-Plate Photovoltaic Modules And Panels [UL 1703:2002 Ed.3+R:10Mar2017]'. Admin change, no need to do any test. Revised standard entry due to per GSSQ request from 'ULC/ORD-C1703-01 Second Edition 2001/08/01 Amd.1:2001 Standard for Safety Flat-Plate Photovoltaic Modules and Panels ' to 'ULC ORD C1703 Issued:2001/08/01 FLAT PLATE PHOTOVOLTAIC MODULES AND PANELS; Amd. 1: 2001'.
170901014SHA#SHA		7.0	Ill2	Updated Illustration 2 - Example of Marking by added 'Connector Mating: See Module Installation Instructions for Appropriate Mating Connectors'.
			Ill25A	Updated Illustration 25A Marking example of Multiple listee1by added 'Connector Mating: See Module Installation Instructions for Appropriate Mating Connectors'.
			Ill26	Added Illustration 26 - Connectors mated with each other
		8.0	-	Added test summary for period September 12, 2017 through September 12, 2017. project No.170901014SHA
23-Jul-2018	Sherwin Zhu/ Ken Gu			
180602190SHA		1	--	UL standard Updated standard from: Flat-Plate Photovoltaic Modules And Panels <Expires: 22Oct2018> [UL 1703:2002 Ed.3+R:10Mar2017] To: Standard For Flat-Plate Photovoltaic Modules And Panels [UL 1703:2002 Ed.3+R:13Sep2017]
			--	ULC standard Updated standard from: ULC ORD C1703 Issued: 2001/08/01 Flat Plate Photovoltaic Modules and Panels; Amd. 1: 2001 To:Flat Plate Photovoltaic Modules And Panels [ULC ORD C1703:2011 Ed.1]

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
		2	Models	Modified the model type description
				Added new model type 'M follow by 10, 20, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 125, 130, 135, 140 or 145; followed by W.'
			Model Similarity	Added new model similarity due to new model type added
			Ratings	Fuse rating of model P145W, P140W, P135W, P130W, P120W and P115W, were Modified from 10A to 15A to compliance with standard requirement
				Added new electric ratings due to new model type added
			Other Ratings	Added new model dimensions due to new model type added
		4	2a	Added Cell(mono) 156M-210 manufactured by Jinko Solar Co.,Ltd
			4a	Added Encapsulation Material SKB825T, manufactured by HANGZHOU SUOKANGBO ENERGY TECHNOLOGY CORP LTD
			8a	Added Junction Box BM-90xy manufactured by Renhe Photovoltaic technology Co., Ltd.
			11a	Added Sealing compound JS-1184A/JS-1184B, manufactured by HANGZHOU ZHIJIANG SILICONE CHEMICAL CO LTD
			13a	Added Edge Sealing material JS-606, manufactured by HANGZHOU ZHIJIANG SILICONE CHEMICAL CO LTD
		7	24K	Added new model types in this illustration of installation manual
			27~37	Added laminator schematic Illustrations of all newly added model types
		8	-	Added new test period from July 3, 2018 to July 9, 2018 for project 180602190SHA
		9	MULTIPLE LISTEE 1	Modified the model type description
				Added new models 'M follow by 10, 20, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 125, 130, 135, 140 or 145; followed by W', for MULTIPLE LISTEE 1: TOENERGY SOLAR SDN.BHD.
19-Feb-2019	Sherwin Zhu/ Ken Gu			
190100545SHA		1	--	UL standard Updated standard from: Standard For Flat-Plate Photovoltaic Modules And Panels [UL 1703:2002 Ed.3+R:13Sep2017] To: Flat-Plate Photovoltaic Modules And Panels [UL 1703:2002 Ed.3 +R:26Sep2018]
		2	Models	Added new model type 'M follow by 150, 155 or 160; followed by W.'
			Model Similarity	Added new model similarity due to new model type added
			Ratings	Added ratings for newly added models
				modified ratings of model 'M60W' and 'M100W'
			Other Ratings	Added dimensions for newly added models, and Modified model M100W dimension

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	8b	Added junction box 15T11A, manufactured by ZHEJIANG FORSOL ENERGU CO LTD
			9a	Added new PV wire, manufactured by Wuxi Xinhongye Wire & Cable Co., LTD
		7	25B	Added Marking example of Multiple listee2 Xantrex LLC
			27A	Added schematic of M150W ~ M160W
			29A	Modified schematic of M100W
			32a	Added schematic of M60W
		8	-	Added new test period from January 18, 2019 to January 30, 2019 for project 190100545SHA
		9	2	New ML2, ML name Xantrex LLC
10-Apr-2019	Sherwin Zhu/ Ken Gu			
190400269SHA		1	-	Manufacturer address changed from: No.358,Hongxing Road,Xiaoshan Economy and Technology Development Zone,Hangzhou,311215 To: No.3, Gaoxin 9 Road,Xiaoshan Economy and Technology Development Zone,Hangzhou,311215
			-	Manufacturer contact information changed from: contact person: Ms. Susie Zhang Phone: +86-571-22831033 Email: susie@toenergysolar.com changed to: contact person: Mr. Chengrong Lu Phone: +86-177-0652-2667 Email: luchengrong@toenergysolar.com
		9	2	ASSOCIATED MANUFACTURER address changed correspondingly.
23-Mar-2020	Sherwin Zhu/ Ken Gu	1	-	Applicant address changed form: No.358,Hongxing Road,Xiaoshan Economy and Technology Development Zone,Hangzhou,311215 to: No.3, Gaoxin 9 Road,Xiaoshan Economy and Technology Development Zone,Hangzhou,311215
191102185SHA			-	Applicant contact information changed form: Ms. Susie Zhang, +86-571-22831033, susie@toenergysolar.com to: Luker Lu, +86-13777408006, luchengrong@toenergysolar.com
			-	Added manufacturer 2: Toenergy Solar SDN BHD
		6	9	Added description of manufacturers' control no. 5017110
		7	2, 25A,25B	use"XXXXXXX" instead of control number,added new note

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
		9	Basic Listee	Basic Listee address changed form: No.358,Hongxing Road,Xiaoshan Economy and Technology Development Zone,Hangzhou,311215 to: No.3, Gaoxin 9 Road,Xiaoshan Economy and Technology Development Zone,Hangzhou,311215
13-Aug-2020	Eddie Shang/ Ken Gu	2	Models	Added new model type '30W-L'
200700811SHA			Model Similarity	Added new model similarity due to new model type added
				updated from 'M60W with 48 cells (39.19mm*156.75mm; Mono-Si)' to 'M60W with 48 cells (39.6mm*158.75mm Mono-Si) '
			Ratings	Modified the ratings of 'M60W'
				Added ratings for newly added models
			Other Ratings	Added dimensions for newly added models
		4	1	Added new frame '6063-T5', manufactured by Tanglong Technology Co.,Ltd
			2	Added Technical data of 'P50W~P5W' to 'MM156P220'
			2	Added new cell(poly) '156.75', manufactured by JA SOLAR
			2a	Added new cell(mono) '158.75', manufactured by JA SOLAR
			4b	Added new Encapsulation Material 'F806P', manufactured by Hangzhou First PV Material Co.,Ltd
			5	Added new Substrate 'Cynagard275A', manufactured by Cybrid Technology INC
			6	Added new Cell to Cell Connectors 'Solder plated copper ribbons (Sn60%Pb40%), 1.2 mm wide by 0.16 mm min. thick', manufactured by Yaoheng Technology Co.,Ltd
			7	Added new String Connector 'Solder plated copper ribbons (Sn60%Pb40%), 5.0 mm wide by 0.3 mm min. thick', manufactured by Yaoheng Technology Co.,Ltd
			12a	Added new Bypass Diode 'GF3045MG', manufactured by YANGZHOU YANGJIE ELECTRONIC TECHNOLOGY CO.,LTD
			14a	Added new Label '72826T', manufactured by AVERY (CHINA) CO LTD
		7	38	Added laminator schematic Illustrations of newly added model type
			2, 25A	Updated Marking example, added new note
			25B	Added new note
		8	-	Added new test period from July 05, 2020 to July 28, 2020 for project 200700811SHA

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
201200388SHA	Zach Zhou/ Ken Gu	1	-	Flat Plate Photovoltaic Modules And Panels [ULC ORD C1703:2011 Ed.1] update to Flat Plate Photovoltaic Modules And Panels [ULC ORD C1703:2018 Ed.2]
8-Dec-2020			-	Change Manufacturer 2 Toenergy Solar SDN BHD Address from No.39, Jalan Perniagaan 6, Taman Perniagaan Setia, Johor Bahru Johor, 81100 to NO.39 & No.48 ,JALAN PERNIAGAAN Setia 6 & 7 TAMAN PERNIAGAAN SETIA 81100,JOHOR BAHRU,JOHOR
			-	Change Manufacturer 2 Toenergy Solar SDN BHD Phone from +60-13 7238199 to +607-6799918
		2	Brand name	Replace Brand name from image to words.
		8	-	Added new block for project 201200388SHA.
		9	3	Added MULTIPLE LISTEE 3:SUNSHARE TECHNOLOGY, INC.
201201645SHA	Zach Zhou/ Ken Gu	7	25C	Added illustration 25C: Marking example of Multiple listee3: SUNSHARE TECHNOLOGY, INC.
26-Jan-2021			25D	Added illustration 25D: Marking example of Multiple listee4: NEXTracker
		9	4	Added MULTIPLE LISTEE 4:NEXTracker
210202079SHA	Zach Zhou/ Ken Gu	1	-	Flat-Plate Photovoltaic Modules And Panels [UL 1703:2002 Ed.3 +R:26Sep2018] updata to Flat-Plate Photovoltaic Modules and Panels [UL 1703:2002 Ed.3+R:25Nov2019]
4-Mar-2021		4	9b	Added new PV wire 'Rated sunlight resistant, 90°C, 1000 V, 12 AWG conductor size, with nominal 6.3 mm outer diameter' ,manufactured by Wuxi Xinhongye Wire & Cable Co., LTD
		8	-	Added new block for project 210202079SHA.
210303523SHA	Zach Zhou/ Ken Gu	4	1	Change Manufacturer/ trademark2 from The zhangs' sports federation chang pv co., LTD to Zhangjiagang Xiechang photovoltaic Co., Ltd
8-Apr-2021			10a	Added new connectors ‘DJ2011-4ab’, manufactured by NINGBO SHIHE NEW ENERGY 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
			10b	Added new connectors ‘RHc2xyzA’, manufactured by ZHEJIANG RENHE PHOTOVOLTAIC TECHNOLOGY CO LTD
		6	9	Delete ETL control number
			10	Delete 'Refer to Ill 2, Ill 25A , Ill25B , Ill25C , Ill25D in section 7.'
		7	2	Delete 'Example of Marking'
			25A	Delete 'Marking example of Multiple listee1':Toenergy Solar SDN BHD
			25B	Delete 'Marking example of Multiple listee2': Xantrex LLC
			25C	Delete 'Marking example of Multiple listee3':SUNSHARE TECHNOLOGY, INC.
			25D	Delete 'Marking example of Multiple listee4':NEXTracker
210403808SHA	Zach Zhou/ Ken Gu	4	8b	Delete 'Only apply for M60W (dimension 2050mm*202mm*35mm) '
6-May-2021			9	change Mark(s) of conformity3 from 'UR' to 'UL'.
			9a	change Mark(s) of conformity3 from 'UR' to 'UL'.
			9b	change Mark(s) of conformity3 from 'UR' to 'UL'.
			9c	Added new PV wire, manufactured by WUXI XINHONGYE WIRE & CABLE CO LTD
			12b	Added new Bypass Diode 'FSL3045', manufactured by ZHEJIANG FORSOL ENERGY CO., Ltd.
		8	-	Added new test period from April 27, 2021 to April 30, 2021 for project 210403808SHA

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
220700482SHA	Zach Zhou/ Ken Gu	1	-	Changed Manufacturer 2 Toenergy Solar SDN BHD address from 'NO.39 & No.48 ,JALAN PERNIAGAAN Setia 6 & 7 TAMAN PERNIAGAAN SETIA 81100,JOHOR BAHRU,JOHOR' to 'No.6,JALAN MUTIARA6,TAMAN PERINDUSTRIAN PLENTONG,81750,JOHOR BAHRU,JOHOR.'
19-Sep-2022	Zach Zhou		-	Changed Manufacturer 2 Toenergy Solar SDN BHD phone from '+607-6799 918' to '+6013-723 8199'.
		9	1	changed MULTIPLE LISTEE 1 TOENERGY SOLAR SDN BHD address from 'No.39, Jalan Perniagaan 6, Taman Perniagaan Setia, Johor Bahru Johor, 81100' to 'No.6,JALAN MUTIARA6,TAMAN PERINDUSTRIAN PLENTONG,81750,JOHOR BAHRU,JOHOR.'
				Changed MULTIPLE LISTEE 1 TOENERGY SOLAR SDN BHD brand name from ' N/A ' to ' TOENERGY'.
				Changed model form 'P followed by 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 130, 135, 140 or 145; followed by W. M follow by 10, 20, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 125, 130, 135, 140 or 145; followed by W.' to 'P followed by 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 130, 135, 140 or 145; followed by W. M follow by 10, 20, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 125, 130, 135, 140, 145, 150, 155 or 160; followed by W. 30W followed by -L.'
			5	Added MULTIPLE LISTEE 5:Rural Power Systems Inc. Brand name: Back40 Solar P followed by 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 130, 135, 140 or 145; followed by W. M follow by 10, 20, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 105, 110, 115, 120, 125, 130, 135, 140, 145, 150, 155 or 160; followed by W. 30W followed by -L.