SUNPRO PV MODULES INSTALLATION MANUAL

Bifacial double glass Modules

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BIFACIALDOUBLE MODULES INSTALLATION MANUAL

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1、INTRODUCTION FOR USER MANUAL

This manual applies to the installation, maintenance and use of solar modules produced by SUNPRO POWER NORTH AMERICA INC (hereinafter referred to as Sunpro). Failure to comply may result in personal injury or death or property damage.

Installation and operation of PV modules requires professional skills and should only be performed by qualified professionals. Please read the “Safety and Installation Instructions” carefully before using and operating the modules.

The "module" or "PV module" in this manual refers to one or more solar modules. Please keep this manual for future reference.

1.1、DISCLAIMER

1、SUNPRO POWER NORTH AMERICA INC reserves the rights to change this User Manual without prior notice. Please refer to our product lists and documents published on our website at:

https://www.sunpropower.us as these lists are updated on a regular basis.

2、Failure of the customer to follow the requirements outlined in this Manual during the installation of the module will result in the invalidity of product's limited warranty.

3、Sunpro is not responsible for any infringement of third party patents or any other rights arising from the use of Solar PV modules.

4、The information in this manual is based on Sunpro knowledge and experience and is believed to be reliable, but such information including product specification (without limitations) and suggestions. Do not constitute a warranty, expresses or implied.

1.2、LIMITATION OF LIABILITY

Sunpro is not responsible for any form of damage, including but not limited to module operation and system installation error, and personnel injury, hurt, and property loss resulting from failure to follow the instructions in this Manual.

2、SAFETY PRECAUTIONS

2.1、WARNING

Before attempting to install, wire, operate and/or service the module and other electrical equipment, all instructions should be read and understood. Direct current (DC) is generated when the battery surface of the module is exposed to direct sunlight or other light sources, and direct contact with the live parts of the module, such as terminals, may result in death of personnel whether connected to the module or not.

2.2、GENERAL SAFETY

Modules rated for use in this application class may be used in system operating at greater than 50V DC or 240W, where general contact access is anticipated. Modules qualified for safety through IEC 61730-1 and IEC 61730-2 and within this application class are considered to meet the requirements for safety class II equipment.

(1) All installation work must comply with the local codes and the relevant international electrical standards.

(2) Sunpro recommends that PV module installation is conducted by personnel who have been professionally trained in PV system installation. Operation by personnel who are not familiar with the relevant safety procedures will be very dangerous.

(3) Do not allow unauthorized persons to access the installation area or module storage area.

(4) Protective clothing (non-slip gloves, clothes, etc.) must be worn during installation to prevent direct

contact with 30V DC or greater, and to protect hands from sharp edges.

(5) Prior to installation, remove all metallic jewelry to prevent accidental exposure to live circuits.

(6) When installing modules in light rain, morning dew, take appropriate measures to prevent water ingress into the connectors, f. e. using connector endcaps.

(7) Use electrically insulated tools to reduce the risk of electric shock.

(8) Do not use or install broken modules.

(9) External or artificially concentrated sunlight shall not be directed onto the front or back face of the PV module.

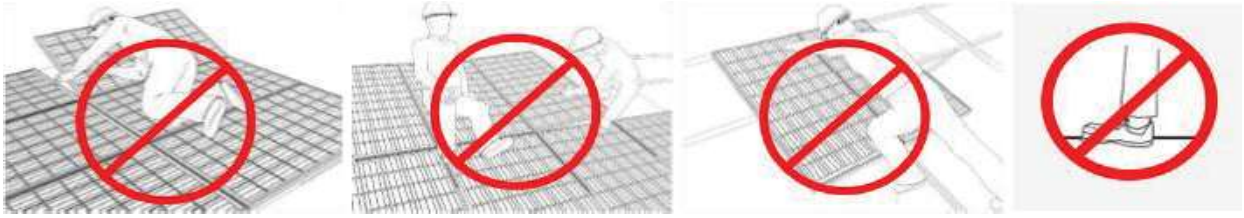
(10) Do not contact module surface if the front or rear glass is broken. This may cause electric shock.

(11) Do not attempt to repair, disassemble or move any part of the PV module. The module does not contain any reusable parts.

(12) Do not connect or disconnect the module when it is energized or connected with an external power supply.

2.3、HANDLING SAFETY

（1） Do not stand, walk on or lean on the module directly.



（2） Do not damage or scratch the front or backside surfaces of the module.

（3） Do not drag. Scratch, bend the output cable with force orwith too tight connection. The insulation of output cable can break and may result in electricity leakage or shock.

（4） If there is an open fire, please extinguish it with a dry powder extinguisher after disconnecting the power supply,can not use liquid such as water to extinguish the fire.

（5） Do not install or handle modules when they are wet or during periods of high wind.

（6） At the installation site, take care to keep modules and in particular their electrical contacts, clean and dry before installation. If connector cables are left in damp conditions then the contacts may corrode. Any module with corroded contacts should not be used.

（7） Please Do not loosen, unscrew or peel the PV module bolts and frame glue. This may lead to a reduction of the module's load rating and potential damage from a fall.

（8） Do not drop PV modules or allow objects to fall down on the PV modules.

（9） Do not touch the terminal box or the ends of the output cables (connectors) with bare hands undersunlight, regardless of whether the PV module is connected to or disconnected from the system.

（10） Do not discard the modules at will; special recycling is required.

3、UNLOAD/TRANSPROTATION/STORAGE

Precautions and general safety rules:

（1） Modules should be stored in a dry and ventilated environment to avoid direct sunlight and moisture and extra precautions should be taken to prevent connectorsfrom being exposed to moisture or sunlight, like usingconnector endcaps.

（2） The modules should be stored in the originalb Sunpro package before installation. Protect the package fromdamage. Unpack the modules as per the recommended unpacking procedures. The whole process of

unpacking, transport and storing should be handled with care.

（3）Before installation, ensure that all modules and electrical contacts are clean and dry。

（4）Unpacking must be carried out by two or more persons at the same time.

（5）Handling the modules requires two or more people with nonslip gloves and both hands.

（6）Do not lift modules by their wires or junction box.

（7）Do not handle the modules over-head or stack the modules.

（8）Do not place excessive loads on the module or twistthe module.

（9）Do not drop or place objects (such as tools) on the modules.

（10）Do not put the modules in a place that is not supported or stable.

（11）Do not allow the modules to come in contact with sharp-pointed objectives to prevent them from scratches, avoiding a direct impact on the safety of modules.

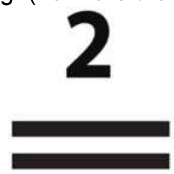
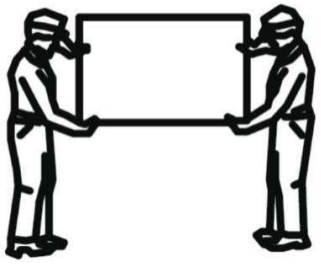
（12）Do not expose the modules and its connectors to anychemical substance (e.g. oil, lubricant, pesticide, etc.).

（13）Before the secondary transportation vehicle is started, it should be bundled with net ropes. The rope should be fastened to preventdamage to the modules during the transportation. The speed of the vehicle carrying the modules should be ≤5 km/h.

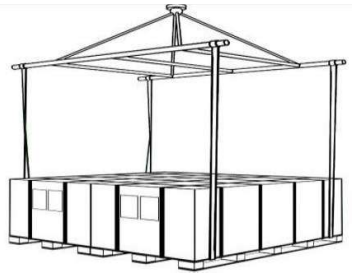
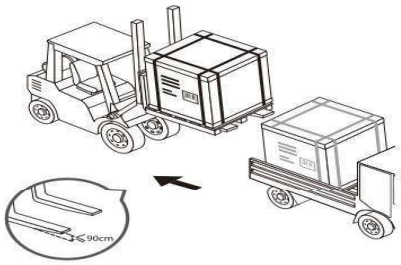
（14）Each individual module has a unique serial number laminated behind the glass and another permanently attached to the back-sheet of the module,The last one is on the aluminum frame on the side of the module. Note all serial numbers in an installation for your future records.

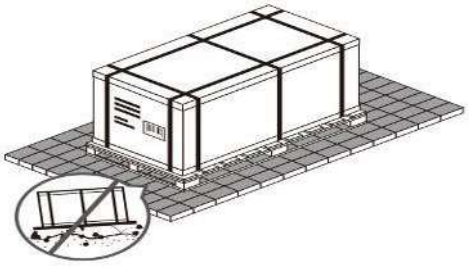
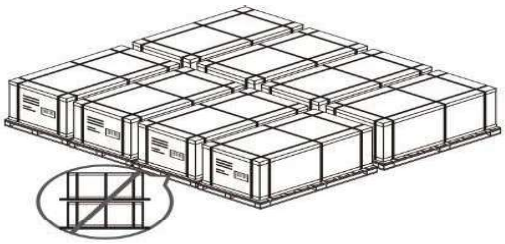
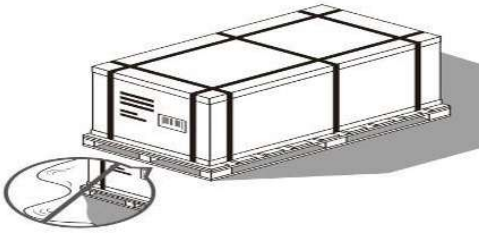
3.1、MAKERS ON OUTER PACKAGING

3.1.1 Need both hands to handle it carefully. 	3.1.2 Uninstalled modules must be kept dry, not expose to rain or moisture. 
3.1.3 Modules in carton are fragile, which must be handled with care. 	3.1.4 The packaging must be transported upright. 

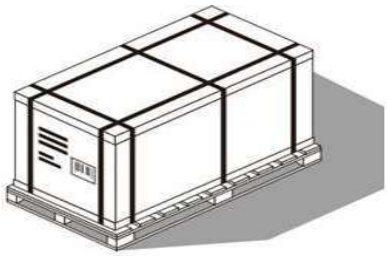
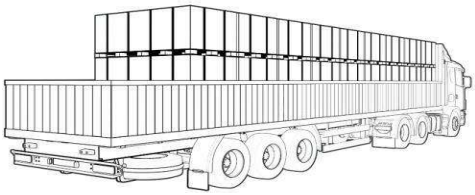
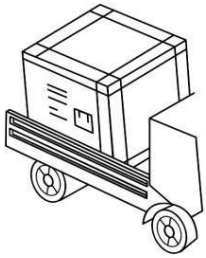
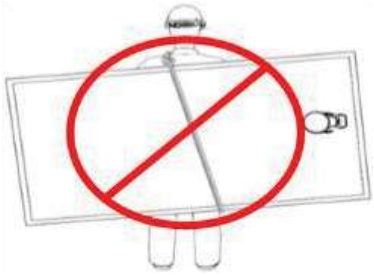
3.1.5 Do not step on the package and module. 	3.1.6 Modules shall be stacked as required, not exceeding the maximum number of layers printed on the outer packaging. (no more than two layers). 
3.1.8 One module shall be handled by at least two persons together. Modules are placed vertically. 	

3.2、UNLOADING WARNNING

3.2.1 Use a suitable lifting fixture to handle, no more than 2 pallets of modules. Before lifting, check whether the tray and the carton are damaged and whether the hoisting ropes are strong and firm. Two people shall support at the two sides of the righting carton gently to place it on the relatively flat position of the project site. 	3.2.2 Use a forklift to remove the module pallets from the truck. 

3.2.3 Put the modules on level ground. 	3.2.4 Do not stack the modules at the project site. 
3.2.5 Store the module in a dry and ventilated place. 	3.2.6 Cover the module with waterproof material to prevent it from moisture. 

3.3、SECONDARY TRANSPORT AND WARNING

3.3.1 Do not remove the original packages if the modules require long-distance transport or long-term storage. 	3.3.2 Packaged products can be transported by land, sea or air. During transportation, make sure that the package is fixed securely to the shipping platform without movement. Do not Stack more than two layers on truck. 
3.3.3 Only one layer stacking is only allowed for transport at the project site. 	3.3.4 No transport or handling by pedi-cab orimproper vehicle as shown below. 
3.3.5 Do not transport the module with rope as shown below. 	3.3.6 Do not carry the modules on the back of one person as shown below. 

3.4、STORAGE

1、Do not remove the original packaging if the module requires long-distance transport or long-termstorage.

2、Do not expose the modules to rain or moisture. Store the finished product in a well ventilated, waterproof, dry and smooth place.

3、Do not stack modules more than 2 layers. (moisture < 85%RH, temperature range from -20°C to + 40 °C)

4、The module must be installed as soon as possible in the project site and must not be exposed to rain or damp. Sunpro Power Solar shall not be responsible for any damage or collapse of the modules caused by moisture in the packaging.

5、If pallets are stored temporarily outside then place a protective covering over the pallet to protect it from direct weathering and do not stack more than one pallet high.

3.5.ELECTRICAL RATING under STC,BNPI and BSI

Model	Test condictio/Side	Voc at STC, (V dc)	Vmmp at STC, (V dc)	Maximum System Voltage, (V dc)	Immp at STC, (A DC)	Isc at STC, (A dc)	Isc at BSI, (A dc)	Pmmp at STC, (Watts)	Protection Class
SPDGxxx-N132M12									
SPDG670-N132M12	STC/Front	47.10	39.33	1500	17.04	18.09	22.43	670	Class II
	BNPI/Front	47.12	39.35	1500	18.88	20.05	-	743	Class II
SPDG675-N132M12	STC/Front	47.30	39.52	1500	17.08	18.13	22.48	675	Class II
	BNPI/Front	47.32	39.54	1500	18.93	20.10	-	749	Class II
SPDG680-N132M12	STC/Front	47.49	39.72	1500	17.12	18.17	22.53	680	Class II
	BNPI/Front	47.51	39.74	1500	18.98	20.14	-	754	Class II
SPDG685-N132M12	STC/Front	47.69	39.91	1500	17.17	18.21	22.58	685	Class II
	BNPI/Front	47.71	39.93	1500	19.02	20.19	-	760	Class II
SPDG690-N132M12	STC/Front	47.88	40.12	1500	17.2	18.25	22.63	690	Class II
	BNPI/Front	47.90	40.14	1500	19.06	20.23	-	765	Class II
SPDG695-N132M12	STC/Front	48.08	40.32	1500	17.24	18.28	22.67	695	Class II
	BNPI/Front	48.10	40.34	1500	19.11	20.26	-	771	Class II
SPDG700-N132M12	STC/Front	48.27	40.51	1500	17.28	18.32	22.72	700	Class II
	BNPI/Front	48.29	40.53	1500	19.15	20.31	-	776	Class II
SPDG705-N132M12	STC/Front	48.46	40.69	1500	17.33	18.36	22.77	705	Class II
	BNPI/Front	48.48	40.71	1500	19.21	20.35	-	782	Class II
SPDG710-N132M12	STC/Front	48.65	40.88	1500	17.37	18.4	22.82	710	Class II
	BNPI/Front	48.67	40.90	1500	19.25	20.40	-	787	Class II
SPDG715-N132M12	STC/Front	48.84	41.07	1500	17.41	18.44	22.87	715	Class II
	BNPI/Front	48.86	41.09	1500	19.30	20.44	-	793	Class II
SPDG720-N132M12	STC/Front	49.03	41.27	1500	17.45	18.48	22.92	720	Class II
	BNPI/Front	49.05	41.29	1500	19.34	20.49	-	798	Class II
SPDG725-N132M12	STC/Front	49.23	41.46	1500	17.49	18.52	22.96	725	Class II
	BNPI/Front	49.25	41.48	1500	19.38	20.53	-	804	Class II

Manufacturer’s stated tolerance for model series, ± 3% for Isc, Voc, Pmax and BSI; ± 0.05 for bifaciality coefficient ϕIsc, ϕVoc, ± 0.1 for bifaciality coefficient ϕPmmp.
Max.series overcurrent protective device rating: 40A
Isc@BSI= Isc* （1+30%*φ_{Isc}）
Bifaciality Coefficient:
φ_{Isc}=[Isc(back)]/[Isc(front)]= 0.80
φ_{Voc}=[Voc(back)]/[Voc(front)]= 0.99
φ_{Pmmp}=[Pmmp(back)]/[Pmmp(front)]= 0.80

Model	Test condictio/Side	Voc at STC, (V dc)	Vmmp at STC, (V dc)	Maximum System Voltage, (V dc)	Immp at STC, (A DC)	Isc at STC, (A dc)	Isc at BSI, (A dc)	Pmmp at STC, (Watts)	Protection Class
SPDGxxx-N120M12									
SPDG610-N120M12	STC/Front	42.62	35.68	1500	17.1	18.18	22.54	610	Class II
	BNPI/Front	42.64	35.70	1500	18.95	20.15	-	676	Class II
SPDG615-N120M12	STC/Front	42.84	35.88	1500	17.15	18.21	22.58	615	Class II
	BNPI/Front	42.86	35.90	1500	19.00	20.19	-	682	Class II
SPDG620-N120M12	STC/Front	43.04	36.07	1500	17.19	18.25	22.63	620	Class II
	BNPI/Front	43.06	36.09	1500	19.05	20.23	-	688	Class II
SPDG625-N120M12	STC/Front	43.23	36.30	1500	17.22	18.3	22.69	625	Class II
	BNPI/Front	43.25	36.32	1500	19.08	20.29	-	693	Class II
SPDG630-	STC/Front	43.44	36.51	1500	17.26	18.34	22.74	630	Class II

N120M12	BNPI/Front	43.46	36.53	1500	19.13	20.33	-	699	Class II
SPDG635-N120M12	STC/Front	43.64	36.71	1500	17.3	18.38	22.79	635	Class II
	BNPI/Front	43.66	36.73	1500	19.17	20.37	-	704	Class II
SPDG640-N120M12	STC/Front	43.84	36.89	1500	17.35	18.41	22.83	640	Class II
	BNPI/Front	43.86	36.91	1500	19.23	20.41	-	710	Class II
SPDG645-N120M12	STC/Front	44.05	37.09	1500	17.39	18.45	22.88	645	Class II
	BNPI/Front	44.07	37.11	1500	19.28	20.45	-	715	Class II
SPDG650-N120M12	STC/Front	44.28	37.3	1500	17.43	18.48	22.92	650	Class II
	BNPI/Front	44.3	37.32	1500	19.32	20.49	-	721	Class II
SPDG655-N120M12	STC/Front	44.52	37.5	1500	17.47	18.51	22.95	655	Class II
	BNPI/Front	44.54	37.52	1500	19.36	20.52	-	726	Class II
SPDG660-N120M12	STC/Front	44.75	37.7	1500	17.51	18.54	22.99	660	Class II
	BNPI/Front	44.77	37.72	1500	19.40	20.55	-	732	Class II

Manufacturer’s stated tolerance for model series, ± 3% for Isc, Voc, Pmax and BSI; ± 0.05 for bifaciality coefficient ϕ Isc, ϕ Voc, ± 0.1 for bifaciality coefficient ϕ Pmmp.
Max.series overcurrent protective device rating: 40A
Isc@BSI= Isc* （1+30%*φ_{Isc}）
Bifaciality Coefficient:
φ_{Isc}=[Isc(back)]/[Isc(front)]= 0.80
φ_{Voc}=[Voc(back)]/[Voc(front)]= 0.99
φ_{Pmmp}=[Pmmp(back)]/[Pmmp(front)]= 0.80

Model	Test condictio/Side	Voc at STC, (V dc)	Vmmp at STC, (V dc)	Maximum System Voltage, (V dc)	Immp at STC, (A DC)	Isc at STC, (A dc)	Isc at BSI, (A dc)	Pmmp at STC, (Watts)	Protection Class
SPDGxxx-N110M12									
SPDG560-N110M12	STC/Front	39.16	32.70	1500	17.13	18.21	22.58	560	SPDG560-N110M12
	BNPI/Front	39.18	32.72	1500	18.98	20.18	-	621	
SPDG565-N110M12	STC/Front	39.37	32.91	1500	17.17	18.24	22.62	565	SPDG565-N110M12
	BNPI/Front	39.39	32.93	1500	19.03	20.22	-	627	
SPDG570-N110M12	STC/Front	39.57	33.14	1500	17.2	18.28	22.67	570	SPDG570-N110M12
	BNPI/Front	39.59	33.16	1500	19.06	20.26	-	632	
SPDG575-N110M12	STC/Front	39.77	33.36	1500	17.24	18.32	22.72	575	SPDG575-N110M12
	BNPI/Front	39.79	33.38	1500	19.10	20.31	-	638	
SPDG580-N110M12	STC/Front	39.96	33.57	1500	17.28	18.36	22.77	580	SPDG580-N110M12
	BNPI/Front	39.98	33.59	1500	19.15	20.35	-	643	
SPDG585-N110M12	STC/Front	40.16	33.78	1500	17.32	18.39	22.80	585	SPDG585-N110M12
	BNPI/Front	40.18	33.80	1500	19.19	20.38	-	649	
SPDG590-N110M12	STC/Front	40.36	34.01	1500	17.35	18.43	22.85	590	SPDG590-N110M12
	BNPI/Front	40.38	34.03	1500	19.23	20.43	-	654	
SPDG595-N110M12	STC/Front	40.57	34.20	1500	17.4	18.47	22.90	595	SPDG595-N110M12
	BNPI/Front	40.59	34.22	1500	19.28	20.47	-	660	
SPDG600-N110M12	STC/Front	40.79	34.39	1500	17.45	18.51	22.95	600	SPDG600-N110M12
	BNPI/Front	40.81	34.41	1500	19.34	20.52	-	665	
SPDG605-N110M12	STC/Front	41.02	34.58	1500	17.5	18.54	22.99	605	SPDG605-N110M12
	BNPI/Front	41.04	34.6	1500	19.39	20.55	-	671	

Manufacturer’s stated tolerance for model series, ± 3% for Isc, Voc, Pmax and BSI; ± 0.05 for bifaciality coefficient ϕ Isc, ϕ Voc, ± 0.1 for bifaciality coefficient ϕ Pmmp.
Max.series overcurrent protective device rating: 40v A
Isc@BSI= Isc* （1+30%*φ_{Isc}）
Bifaciality Coefficient:
φ_{Isc}=[Isc(back)]/[Isc(front)]= 0.80
φ_{Voc}=[Voc(back)]/[Voc(front)]= 0.99
φ_{Pmmp}=[Pmmp(back)]/[Pmmp(front)]= 0.80

Model	Test condictio/Side	Voc at STC, (V dc)	Vmmp at STC, (V dc)	MAXIMUM SYSTEM VOLTAGE, (V DC)	Immp at STC, (A DC)	Isc at STC, (A dc)	Isc at BSI, (A dc)	Pmmp at STC, (Watts)	Protection Class

SPDGxxx-132M12									
SPDG635-132M12	STC/Front	44.64	36.75	1500	17.28	18.32	22.17	635	Class II
	BNPI/Front	44.66	36.77	1500	18.91	20.05	-	695	Class II
SPDG640-132M12	STC/Front	44.85	36.97	1500	17.31	18.36	22.22	640	Class II
	BNPI/Front	44.87	36.99	1500	18.95	20.10	-	701	Class II
SPDG645-132M12	STC/Front	45.06	37.18	1500	17.35	18.40	22.26	645	Class II
	BNPI/Front	45.08	37.2	1500	18.99	20.14	-	706	Class II
SPDG650-132M12	STC/Front	45.27	37.38	1500	17.39	18.44	22.31	650	Class II
	BNPI/Front	45.29	37.4	1500	19.03	20.18	-	712	Class II
SPDG655-132M12	STC/Front	45.48	37.58	1500	17.43	18.48	22.36	655	Class II
	BNPI/Front	45.5	37.6	1500	19.08	20.23	-	717	Class II
SPDG660-132M12	STC/Front	45.69	37.79	1500	17.47	18.52	22.41	660	Class II
	BNPI/Front	45.71	37.81	1500	19.11	20.27	-	723	Class II
SPDG665-132M12	STC/Front	45.91	38.01	1500	17.50	18.56	22.46	665	Class II
	BNPI/Front	45.93	38.03	1500	19.15	20.31	-	728	Class II
SPDG670-132M12	STC/Front	46.13	38.22	1500	17.53	18.60	22.51	670	Class II
	BNPI/Front	46.15	38.24	1500	19.19	20.36	-	734	Class II
SPDG675-132M12	STC/Front	46.34	38.44	1500	17.56	18.64	22.55	675	Class II
	BNPI/Front	46.36	38.46	1500	19.22	20.40	-	739	Class II
SPDG680-132M12	STC/Front	46.56	38.66	1500	17.59	18.68	22.60	680	Class II
	BNPI/Front	46.58	38.68	1500	19.25	20.45		745	Class II

Model	Test condictio/Side	Voc at STC, (V dc)	Vmmp at STC, (V dc)	MAXIMUM SYSTEM VOLTAGE, (V DC)	Immp at STC, (A DC)	Isc at STC, (A dc)	Isc at BSI, (A dc)	Pmmp at STC, (Watts)	Protection Class
SPDGxxx-120M12									
SPDG580-120M12	STC/Front	40.70	33.60	1500	17.27	18.32	22.17	580	Class II
	BNPI/Front	40.72	33.62	1500	18.89	20.05	-	635	Class II
SPDG585-120M12	STC/Front	40.90	33.80	1500	17.31	18.37	22.23	585	Class II
	BNPI/Front	40.92	33.82	1500	18.94	20.11	-	641	Class II
SPDG590-120M12	STC/Front	41.10	34.00	1500	17.35	18.42	22.29	590	Class II
	BNPI/Front	41.12	34.02	1500	18.99	20.16	-	646	Class II
SPDG595-120M12	STC/Front	41.30	34.20	1500	17.40	18.47	22.35	595	Class II
	BNPI/Front	41.32	34.22	1500	19.04	20.21	-	652	Class II
SPDG600-120M12	STC/Front	41.50	34.40	1500	17.45	18.52	22.41	600	Class II
	BNPI/Front	41.52	34.42	1500	19.09	20.27	-	657	Class II
SPDG605-120M12	STC/Front	41.70	34.60	1500	17.49	18.57	22.47	605	Class II
	BNPI/Front	41.72	34.62	1500	19.14	20.32	-	662	Class II
SPDG610-120M12	STC/Front	41.90	34.80	1500	17.53	18.62	22.53	610	Class II
	BNPI/Front	41.92	34.82	1500	19.18	20.38	-	668	Class II
SPDG615-120M12	STC/Front	42.1	35.01	1500	17.57	18.67	22.59	615	Class II
	BNPI/Front	42.12	35.03	1500	19.22	20.43		673	Class II

Manufacturer's stated tolerance for model series,±3% forIsc, Voc and Pmax; ±0.05 for bifaciality coefficient φIsc, φVoc, BSI and φPmmp.

Max.series overcurrent protective device rating: 40A

Isc@BSI= Isc* （1+30%*φ_{Isc}）

Bifaciality Coefficient:

φ_{Isc}=[Isc(back)]/[Isc(front)]= 0.70

φ_{Voc}=[Voc(back)]/[Voc(front)]= 0.99

φ_{Pmmp}=[Pmmp(back)]/[Pmmp(front)]= 0.70

Model	Test condictio/Side	Voc at STC, (V dc)	Vmmp at STC, (V dc)	MAXIMUM SYSTEM VOLTAGE, (V DC)	Immp at STC, (A DC)	Isc at STC, (A dc)	Isc at BSI, (A dc)	Pmmp at STC, (Watts)	Protection Class
SPDGxxx-110M12									
SPDG530-110M12	STC/Front	37.09	30.80	1500	17.22	18.32	22.17	530	Class II
	BNPI/Front	37.11	30.82	1500	18.83	20.05	-	580	Class II
SPDG535-110M12	STC/Front	37.29	30.99	1500	17.27	18.37	22.23	535	Class II
	BNPI/Front	37.31	31.01	1500	18.89	20.10	-	586	Class II

SPDG540-110M12	STC/Front	37.49	31.19	1500	17.32	18.42	22.29	540	Class II
	BNPI/Front	37.51	31.21	1500	18.95	20.16	-	591	Class II
SPDG545-110M12	STC/Front	37.69	31.39	1500	17.36	18.47	22.35	545	Class II
	BNPI/Front	37.71	31.41	1500	19.00	20.21	-	597	Class II
SPDG550-110M12	STC/Front	37.89	31.59	1500	17.41	18.52	22.41	550	Class II
	BNPI/Front	37.91	31.61	1500	19.05	20.27	-	602	Class II
SPDG555-110M12	STC/Front	38.09	31.79	1500	17.46	18.57	22.47	555	Class II
	BNPI/Front	38.11	31.81	1500	19.10	20.32	-	608	Class II
SPDG560-110M12	STC/Front	38.29	31.99	1500	17.51	18.62	22.53	560	Class II
	BNPI/Front	38.31	32.01	1500	19.16	20.38	-	613	Class II
SPDG565-110M12	STC/Front	38.49	32.18	1500	17.56	18.67	22.59	565	Class II
	BNPI/Front	38.51	32.2	1500	19.21	20.43		619	Class II

Manufacturer's stated tolerance for model series,±3% forIsc, Voc and Pmax; ±0.05 for bifaciality coefficient φIsc, φVoc, BSI and φPmmp.
Max.series overcurrent protective device rating: 40A
Isc@BSI= Isc* （1+30%*φ_{Pmmp}）
Bifaciality Coefficient:
φ_{Isc}=[Isc(back)]/[Isc(front)]= 0.70
φ_{Voc}=[Voc(back)]/[Voc(front)]= 0.99
φ_{Pmmp}=[Pmmp(back)]/[Pmmp(front)]= 0.70

Model	Test condition/Side	Voc at STC, (V dc)	Vmmp at STC, (V dc)	MAXIMUM SYSTEM VOLTAGE, (V DC)	Immp at STC, (A DC)	Isc at STC, (A dc)	Isc at BSI, (A dc)	Pmmp at STC, (Watts)	Protection Class
SPDGxxx-144M10									
SPDG520-144M10	STC/Front	48.94	41.02	1500	12.68	13.53	16.37	520	Class II
	BNPI/Front	48.96	41.04	1500	13.87	14.81	-	569	Class II
SPDG525-144M10	STC/Front	49.11	41.21	1500	12.74	13.61	16.47	525	Class II
	BNPI/Front	49.13	41.23	1500	13.94	14.90	-	575	Class II
SPDG530-144M10	STC/Front	49.26	41.39	1500	12.81	13.69	16.56	530	Class II
	BNPI/Front	49.28	41.41	1500	14.01	14.98	-	580	Class II
SPDG535-144M10	STC/Front	49.42	41.54	1500	12.88	13.76	16.65	535	Class II
	BNPI/Front	49.44	41.56	1500	14.10	15.06	-	586	Class II
SPDG540-144M10	STC/Front	49.58	41.69	1500	12.96	13.84	16.75	540	Class II
	BNPI/Front	49.6	41.71	1500	14.18	15.15	-	591	Class II
SPDG545-144M10	STC/Front	49.74	41.83	1500	13.03	13.92	16.84	545	Class II
	BNPI/Front	49.76	41.85	1500	14.26	15.24	-	597	Class II
SPDG550-144M10	STC/Front	49.90	41.96	1500	13.11	14.00	16.94	550	Class II
	BNPI/Front	49.92	41.98	1500	14.35	15.32	-	602	Class II
SPDG555-144M10	STC/Front	50.06	42.09	1500	13.19	14.08	17.04	555	Class II
	BNPI/Front	50.08	42.11	1500	14.43	15.41	-	608	Class II
SPDG560-144M10	STC/Front	50.22	42.23	1500	13.27	14.16	17.13	560	Class II
	BNPI/Front	50.24	42.25	1500	14.51	15.50	-	613	Class II
SPDG565-144M10	STC/Front	50.38	42.36	1500	13.34	14.24	17.23	565	Class II
	BNPI/Front	50.4	42.38	1500	14.60	15.59	-	619	Class II

Manufacturer's stated tolerance for model series,±3% forIsc, Voc and Pmax; ±0.05 for bifaciality coefficient φIsc, φVoc, BSI and φPmmp.
Max.series overcurrent protective device rating: 30A
Isc@BSI= Isc* （1+30%*φ_{Pmmp}）
Bifaciality Coefficient:
φ_{Isc}=[Isc(back)]/[Isc(front)]= 0.70
φ_{Voc}=[Voc(back)]/[Voc(front)]= 0.99
φ_{Pmmp}=[Pmmp(back)]/[Pmmp(front)]= 0.70

Model	Test condition/Side	Voc at STC, (V dc)	Vmmp at STC, (V dc)	MAXIMUM SYSTEM VOLTAGE, (V DC)	Immp at STC, (A DC)	Isc at STC, (A dc)	Isc at BSI, (A dc)	Pmmp at STC, (Watts)	Protection Class

SPDGxxx-132M10									
SPDG480-132M10	STC/Front	44.97	37.81	1500	12.70	13.58	16.43	480	Class II
	BNPI/Front	44.99	37.83	1500	13.89	14.86	-	526	Class II
SPDG485-132M10	STC/Front	45.12	37.96	1500	12.78	13.68	16.55	485	Class II
	BNPI/Front	45.14	37.98	1500	13.98	14.97	-	531	Class II
SPDG490-132M10	STC/Front	45.27	38.11	1500	12.86	13.76	16.65	490	Class II
	BNPI/Front	45.29	38.13	1500	14.07	15.06	-	537	Class II
SPDG495-132M10	STC/Front	45.42	38.26	1500	12.94	13.83	16.73	495	Class II
	BNPI/Front	45.44	38.28	1500	14.16	15.14	-	542	Class II
SPDG500-132M10	STC/Front	45.57	38.41	1500	13.02	13.90	16.82	500	Class II
	BNPI/Front	45.59	38.43	1500	14.25	15.21	-	548	Class II
SPDG505-132M10	STC/Front	45.72	38.56	1500	13.10	13.96	16.89	505	Class II
	BNPI/Front	45.74	38.58	1500	14.33	15.28	-	553	Class II
SPDG510-132M10	STC/Front	45.87	38.71	1500	13.18	14.02	16.96	510	Class II
	BNPI/Front	45.89	38.73	1500	14.42	15.35	-	558	Class II
SPDG515-132M10	STC/Front	46.02	38.86	1500	13.26	14.08	17.04	515	Class II
	BNPI/Front	46.04	38.88	1500	14.50	15.41	-	564	Class II

Manufacturer's stated tolerance for model series,±3% forIsc, Voc and Pmax; ±0.05 for bifaciality coefficient φIsc, φVoc, BSI and φPmmp.
Max.series overcurrent protective device rating: 30A
Isc@BSI= Isc* （1+30%*φ_{Pmmp}）
Bifaciality Coefficient:
φ_{Isc}=[Isc(back)]/[Isc(front)]= 0.70
φ_{Voc}=[Voc(back)]/[Voc(front)]= 0.99
φ_{Pmmp}=[Pmmp(back)]/[Pmmp(front)]= 0.70

Model	Test condition/Side	Voc at STC, (V dc)	Vmmp at STC, (V dc)	MAXIMUM SYSTEM VOLTAGE, (V DC)	Immp at STC, (A DC)	Isc at STC, (A dc)	Isc at BSI, (A dc)	Pmmp at STC, (Watts)	Protection Class
SPDGxxx-120M10									
SPDG435-120M10	STC/Front	40.80	34.07	1500	12.77	13.55	16.40	435	Class II
	BNPI/Front	40.82	34.09	1500	13.97	14.83	-	476	Class II
SPDG440-120M10	STC/Front	41.10	34.32	1500	12.83	13.60	16.46	440	Class II
	BNPI/Front	41.12	34.34	1500	14.03	14.88	-	482	Class II
SPDG445-120M10	STC/Front	41.30	34.56	1500	12.88	13.65	16.52	445	Class II
	BNPI/Front	41.32	34.58	1500	14.09	14.94	-	487	Class II
SPDG450-120M10	STC/Front	41.50	34.81	1500	12.93	13.70	16.58	450	Class II
	BNPI/Front	41.52	34.83	1500	14.15	14.99	-	493	Class II
SPDG455-120M10	STC/Front	41.70	35.06	1500	12.98	13.75	16.64	455	Class II
	BNPI/Front	41.72	35.08	1500	14.20	15.05	-	498	Class II
SPDG460-120M10	STC/Front	41.90	35.31	1500	13.03	13.80	16.70	460	Class II
	BNPI/Front	41.92	35.33	1500	14.26	15.10	-	504	Class II
SPDG465-120M10	STC/Front	42.10	35.56	1500	13.08	13.85	16.76	465	Class II
	BNPI/Front	42.12	35.58	1500	14.31	15.16	-	509	Class II
SPDG470-120M10	STC/Front	42.30	35.81	1500	13.13	13.90	16.82	470	Class II
	BNPI/Front	42.32	35.83	1500	14.36	15.21	-	515	Class II

Manufacturer's stated tolerance for model series,±3% forIsc, Voc and Pmax; ±0.05 for bifaciality coefficient φIsc, φVoc, BSI and φPmmp.
Max.series overcurrent protective device rating: 30A
Isc@BSI= Isc* （1+30%*φ_{Pmmp}）
Bifaciality Coefficient:
φ_{Isc}=[Isc(back)]/[Isc(front)]= 0.70
φ_{Voc}=[Voc(back)]/[Voc(front)]= 0.99
φ_{Pmmp}=[Pmmp(back)]/[Pmmp(front)]= 0.70

Model	Test condition/Side	Voc at STC, (V dc)	Vmmp at STC, (V dc)	MAXIMUM SYSTEM VOLTAGE, (V DC)	Immp at STC, (A DC)	Isc at STC, (A dc)	Isc at BSI, (A dc)	Pmmp at STC, (Watts)	Protection Class
SPDGxxx-108M10									

SPDG390-108M10	STC/Front	36.53	30.41	1500	12.83	13.62	16.48	390	Class II
	BNPI/Front	36.55	30.43	1500	14.03	14.91	-	427	Class II
SPDG395-108M10	STC/Front	36.73	30.62	1500	12.90	13.69	16.56	395	Class II
	BNPI/Front	36.75	30.64	1500	14.12	14.98	-	433	Class II
SPDG400-108M10	STC/Front	36.93	30.83	1500	12.98	13.76	16.65	400	Class II
	BNPI/Front	36.95	30.85	1500	14.20	15.06	-	438	Class II
SPDG405-108M10	STC/Front	37.13	31.04	1500	13.05	13.83	16.73	405	Class II
	BNPI/Front	37.15	31.06	1500	14.28	15.14	-	443	Class II
SPDG410-108M10	STC/Front	37.33	31.25	1500	13.12	13.90	16.82	410	Class II
	BNPI/Front	37.35	31.27	1500	14.36	15.21	-	449	Class II
SPDG415-108M10	STC/Front	37.53	31.47	1500	13.19	13.97	16.90	415	Class II
	BNPI/Front	37.55	31.49	1500	14.43	15.29	-	454	Class II
SPDG420-108M10	STC/Front	37.73	31.69	1500	13.26	14.04	16.99	420	Class II
	BNPI/Front	37.75	31.71	1500	14.50	15.37	-	460	Class II

Manufacturer's stated tolerance for model series,±3% forIsc, Voc and Pmax; ±0.05 for bifaciality coefficient φIsc, φVoc, BSI and φPmmp.
Max.series overcurrent protective device rating: 30A
Isc@BSI= Isc*（1+30%*φ_{Pmmp}）
Bifaciality Coefficient:
φ_{Isc}=[Isc(back)]/[Isc(front)]= 0.70
φ_{Voc}=[Voc(back)]/[Voc(front)]= 0.99
φ_{Pmmp}=[Pmmp(back)]/[Pmmp(front)]= 0.70

Model	Test condictio/Side	Voc at STC, (V dc)	Vmmp at STC, (V dc)	Maximum System Voltage, (V dc)	Immp at STC, (A DC)	Isc at STC, (A dc)	Isc at BSI, (A dc)	Pmmp at STC, (Watts)	Protection Class
SPDGxxx-N144M10									
SPDG590-N144M10	STC/Front	51.7	42.87	1500	13.77	14.48	17.96	590	Class II
	BNPI/Front	51.72	42.89	1500	15.26	16.05	-	654	Class II
SPDG585-N144M10	STC/Front	51.58	42.72	1500	13.7	14.41	17.87	585	Class II
	BNPI/Front	51.60	42.74	1500	15.18	15.97	-	649	Class II
SPDG580-N144M10	STC/Front	51.43	42.56	1500	13.63	14.34	17.78	580	Class II
	BNPI/Front	51.45	42.58	1500	15.11	15.90	-	643	Class II
SPDG575-N144M10	STC/Front	51.28	42.41	1500	13.56	14.27	17.69	575	Class II
	BNPI/Front	51.30	42.43	1500	15.03	15.82	-	638	Class II
SPDG570-N144M10	STC/Front	51.13	42.26	1500	13.49	14.2	17.61	570	Class II
	BNPI/Front	51.15	42.28	1500	14.95	15.74	-	632	Class II
SPDG565-N144M10	STC/Front	50.98	42.13	1500	13.41	14.13	17.52	565	Class II
	BNPI/Front	51.00	42.15	1500	14.87	15.66	-	627	Class II
SPDG560-N144M10	STC/Front	50.84	41.99	1500	13.34	14.07	17.45	560	Class II
	BNPI/Front	50.86	42.01	1500	14.78	15.60	-	621	Class II
SPDG555-N144M10	STC/Front	50.70	41.86	1500	13.26	14.01	17.37	555	Class II
	BNPI/Front	50.72	41.88	1500	14.70	15.53	-	615	Class II

Manufacturer's stated tolerance for model series,±3% for Isc, Voc and Pmax; ±0.05 for bifaciality coefficient φIsc, φVoc and φPmmp.
Max.series overcurrent protective device rating: 30A
Isc@BSI= Isc*（1+30%*φ_{Isc}）
Bifaciality Coefficient:
φ_{Isc}=[Isc(back)]/[Isc(front)]= 0.80
φ_{Voc}=[Voc(back)]/[Voc(front)]= 0.99
φ_{Pmmp}=[Pmmp(back)]/[Pmmp(front)]= 0.80

Model	Test condictio/Side	Voc at STC, (V dc)	Vmmp at STC, (V dc)	Maximum System Voltage, (V dc)	Immp at STC, (A DC)	Isc at STC, (A dc)	Isc at BSI, (A dc)	Pmmp at STC, (Watts)	Protection Class

SPDGxxx-N132M10									
SPDG540-N132M10	STC/Front	47.50	39.08	1500	13.82	14.48	17.96	540	Class II
	BNPI/Front	47.52	39.10	1500	15.32	16.05	-	599	Class II
SPDG535-N132M10	STC/Front	47.35	38.97	1500	13.73	14.4	17.86	535	Class II
	BNPI/Front	47.37	38.99	1500	15.22	15.96	-	593	Class II
SPDG530-N132M10	STC/Front	47.19	38.86	1500	13.64	14.32	17.76	530	Class II
	BNPI/Front	47.21	38.88	1500	15.12	15.87	-	588	Class II
SPDG525-N132M10	STC/Front	47.03	38.75	1500	13.55	14.24	17.66	525	Class II
	BNPI/Front	47.05	38.77	1500	15.02	15.79	-	582	Class II
SPDG520-N132M10	STC/Front	46.87	38.64	1500	13.46	14.16	17.56	520	Class II
	BNPI/Front	46.89	38.66	1500	14.92	15.70	-	577	Class II
SPDG515-N132M10	STC/Front	46.71	38.55	1500	13.36	14.08	17.46	515	Class II
	BNPI/Front	46.73	38.57	1500	14.81	15.61	-	571	Class II
SPDG510-N132M10	STC/Front	46.53	38.45	1500	13.29	14.01	17.37	510	Class II
	BNPI/Front	46.55	38.47	1500	14.70	15.53	-	566	Class II

Manufacturer's stated tolerance for model series,±3% for Isc, Voc and Pmax; ±0.05 for bifaciality coefficient φIsc, φVoc and φPmmp.
Max.series overcurrent protective device rating: 30A
Isc@BSI= Isc* （1+30%*φ_{Isc}）
Bifaciality Coefficient:
φ_{Isc}=[Isc(back)]/[Isc(front)]= 0.80
φ_{Voc}=[Voc(back)]/[Voc(front)]= 0.99
φ_{Pmmp}=[Pmmp(back)]/[Pmmp(front)]= 0.80

Model	Test condition/Side	Voc at STC, (V dc)	Vmmp at STC, (V dc)	Maximum System Voltage, (V dc)	Immp at STC, (A DC)	Isc at STC, (A dc)	Isc at BSI, (A dc)	Pmmp at STC, (Watts)	Protection Class
SPDGxxx-N120M10									
SPDG490-N120M10	STC/Front	43.06	35.66	1500	13.75	14.47	17.94	490	Class II
	BNPI/Front	43.08	35.68	1500	15.23	16.04	-	543	Class II
SPDG485-N120M10	STC/Front	42.94	35.52	1500	13.66	14.38	17.83	485	Class II
	BNPI/Front	42.96	35.54	1500	15.13	15.94	-	538	Class II
SPDG480-N120M10	STC/Front	42.80	35.38	1500	13.57	14.29	17.72	480	Class II
	BNPI/Front	42.82	35.40	1500	15.04	15.84	-	532	Class II
SPDG475-N120M10	STC/Front	42.66	35.24	1500	13.48	14.2	17.61	475	Class II
	BNPI/Front	42.68	35.26	1500	14.94	15.74	-	527	Class II
SPDG470-N120M10	STC/Front	42.52	35.11	1500	13.39	14.12	17.51	470	Class II
	BNPI/Front	42.54	35.13	1500	14.84	15.65	-	521	Class II
SPDG465-N120M10	STC/Front	42.38	34.99	1500	13.29	14.03	17.40	465	Class II
	BNPI/Front	42.40	35.01	1500	14.73	15.55	-	516	Class II
SPDG460-N120M10	STC/Front	42.24	34.88	1500	13.19	13.94	17.29	460	Class II
	BNPI/Front	42.26	34.90	1500	14.62	15.45	-	510	Class II
SPDG455-N120M10	STC/Front	42.10	34.76	1500	13.09	13.83	17.15	455	Class II
	BNPI/Front	42.12	34.78	1500	14.51	15.33	-	505	Class II

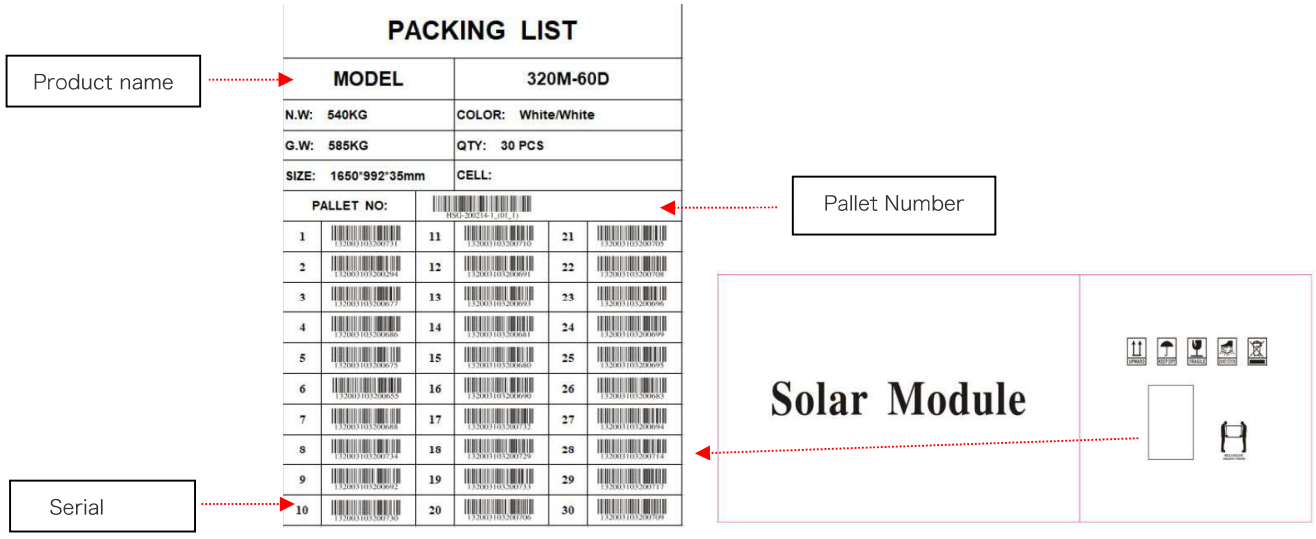
Manufacturer's stated tolerance for model series, ±3% for Isc, Voc and Pmax; ±0.05 for bifaciality coefficient φIsc, φVoc and φPmmp.
Max.series overcurrent protective device rating: 30A
Isc@BSI= Isc* （1+30%*φ_{Isc}）
Bifaciality Coefficient:
φ_{Isc}=[Isc(back)]/[Isc(front)]= 0.80
φ_{Voc}=[Voc(back)]/[Voc(front)]= 0.99
φ_{Pmmp}=[Pmmp(back)]/[Pmmp(front)]= 0.80

Model	Test condition/Side	Voc at STC, (V dc)	Vmmp at STC, (V dc)	Maximum System Voltage,	Immp at STC, (A DC)	Isc at STC, (A dc)	Isc at BSI, (A dc)	Pmmp at STC, (Watts)	Protection Class

				(V dc)					
SPDGxxx-N108M10									
SPDG440-N108M10	STC/Front	38.53	32.09	1500	13.72	14.43	17.89	440	Class II
	BNPI/Front	38.55	32.11	1500	15.20	15.99	-	488	Class II
SPDG435-N108M10	STC/Front	38.43	31.94	1500	13.62	14.34	17.78	435	Class II
	BNPI/Front	38.45	31.96	1500	15.09	15.89	-	482	Class II
SPDG430-N108M10	STC/Front	38.34	31.79	1500	13.53	14.25	17.67	430	Class II
	BNPI/Front	38.36	31.81	1500	14.99	15.80	-	477	Class II
SPDG425-N108M10	STC/Front	38.24	31.64	1500	13.44	14.16	17.56	425	Class II
	BNPI/Front	38.26	31.66	1500	14.89	15.70	-	471	Class II
SPDG420-N108M10	STC/Front	38.13	31.49	1500	13.34	14.07	17.45	420	Class II
	BNPI/Front	38.15	31.51	1500	14.78	15.60	-	466	Class II
SPDG415-N108M10	STC/Front	38.04	31.37	1500	13.23	13.96	17.31	415	Class II
	BNPI/Front	38.06	31.39	1500	14.66	15.47	-	460	Class II
SPDG410-N108M10	STC/Front	37.94	31.25	1500	13.12	13.85	17.17	410	Class II
	BNPI/Front	37.96	31.27	1500	14.54	15.35	-	455	Class II
Manufacturer's stated tolerance for model series, ±3% for Isc, Voc and Pmax; ±0.05 for bifaciality coefficient φIsc, φVoc and φPmmp. Max.series overcurrent protective device rating: 30A Isc@BSI= Isc* （1+30%*φ_{Isc}） Bifaciality Coefficient: φ_{Isc}=[Isc(back)]/[Isc(front)]= 0.80 φ_{Voc}=[Voc(back)]/[Voc(front)]= 0.99 φ_{Pmmp}=[Pmmp(back)]/[Pmmp(front)]= 0.80									

4、UNPACKING SAFETY

（1）At time of receipt, verify that the product delivered is in fact the product ordered the product name, subname, and serial number of each laminate are clearly marked on the outside of each packing box.



（2）For unpacking outdoors, it is prohibited to operate in rainy conditions. Because the carton will become soft and damaged after it gets wet in the rain. The stacked PV modules (hereinafter referred to as "modules") may tip over, which may cause damage or injury to personnel.

（3）For a windy site, it is necessary to pay special attention to safety. Especially, it is not recommended to transport orunpacking the modules in high wind conditions. The unpacked modules must be tied down to avoid

any unwanted movement.

（4） The work surface is required to be level to ensure that the package can be placed stably, avoiding sliding.

（5） Wear protective gloves during unpacking to avoid hand injury and fingerprints on the glass surface.

（6） Each module shall be handled by two persons. It is forbidden to pull the wires or junction boxes andframe of the modules to carry the module.

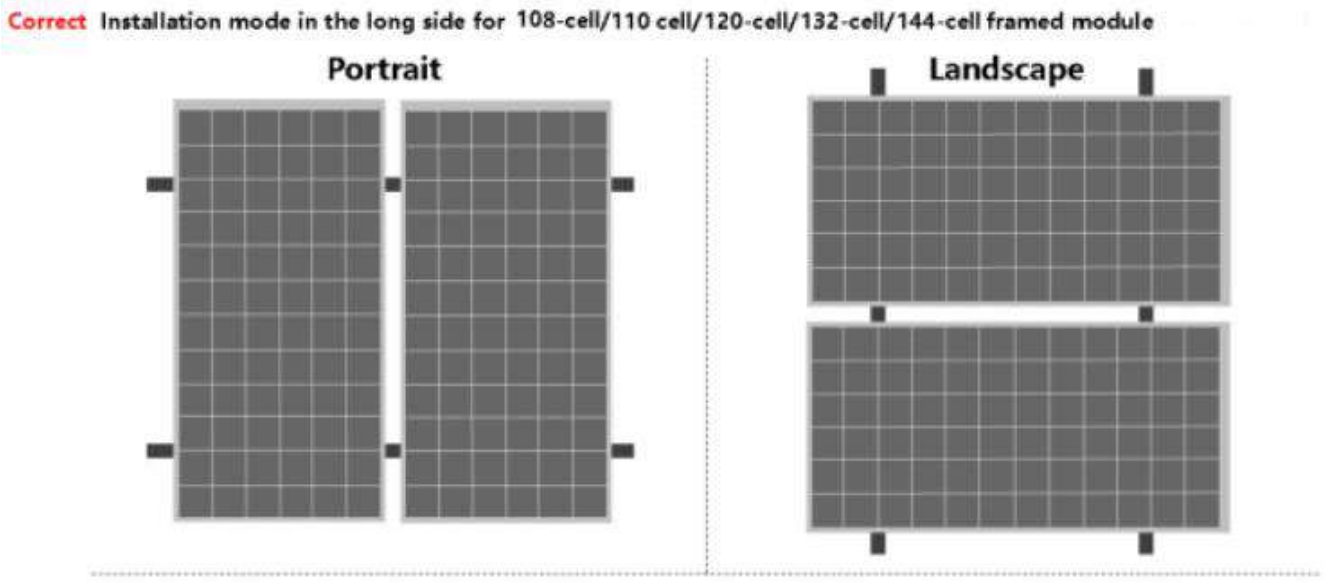
（7） Do NOT use a knife to cut the zip-ties, but use wire cutting pliers.

（8） Do NOT place modules directly on top of each other.

5、INSTALLATION

5.1、INSTALLATION SAFETY

（1） Sunpro modules can be mounted in landscape orientation, the impact of dirt shading the Solar cells can be minimized by orienting the product in landscape. Please pay attention that can only be installed in the long side frame on vertical racking not horizontal racking when customers choose landscape mode, and they cannot be installed in the short frame side. (***size module: 108-cell/120-cell/132-cell/144-cell***)



（2） Always wear dry insulation protection equipment: insulated tools, head gear, insulated gloves, safety belt and safety shoes (with rubber soles).

（3） Make sure flammable gasses are not generated or present near the installation site.

（4） Do not install modules under rain, snow or windy conditions. Place disassembled PV modules correctly.

（5） Keep the PV module packed in the carton until installation. Please install immediately after unpacking. Please keep the connector dry and clean during installation to avoid the risk of electric shock. Do not perform any work if the terminals of PV module are wet, until they are dry.

（6） Please take measures to insulate during PV module installation and wiring.Do not unplug the connector if the system circuit is connected to a load.

（7） Do not touch the junction box and the end of the interconnect cables (connectors) with bare handsduring installation or under sunlight, regardless if the PV module is connected to or disconnectedfrom the system.

（8） During installation, if PV modules are touched by bare hands, there is a risk of scalding or electric shock.

（9）Do not hit or put excessive load on the front or back of PV modules, this may break the cells or cause microcracks.

（10）Make sure that the polarity of each module or a string is not reversed considering the rest of the modules or strings.

（11）Do not stand on the module glass. There is a risk of injury or electric shock if glass isbroken.Do not work alone (always work as a team of 2 or more people).

（12）Ensure sure that all connections are securely made with no gap between the contacts. Any gap can result in electrical arcing that can cause a fire hazard and/or an electric shock.

（13）Do not damage the back sheet of PV modules when fastening the PV modules to a support with bolts.

（14）Do not drill holes in the frame. It may cause corrosion of the frame or PV modules burst.

（15）Do not damage the surrounding PV modules or mounting structure when replacing a PV module.

（16）Cables should be fixed in the area not exposed to direct sunlight to prevent cables aging.

（17）Protective measures must be taken in the process of installation to avoid force extrusion or impact on the modules.

（18）When installing modules on roof mounted structures, please try to follow the “from top to bottom”and/or “from left to right” principle, and don’t step on the module. This will damage the module andwould be dangerous for personal safety.

（19）The design loading of modules have been evaluated by TUV according to IEC61215 with 1.5 times safety factor; The mechanical load bearing is dependent upon the mounting methods used and failure to follow the instructions of this manual may result in different capabilities to withstand snow and wind loads;The system installer must ensure that the installation methods used meet these requirements and any local codes and regulations.

（20）We recommend that you insure your Solar system against natural hazards (e.g. against lightning strikes).

（21）Sunpro power modules are certified to be installed and operated in safety level II at voltages lower than 1500Vdc. This maximum voltage should not be exceeded at any time and, as the voltage of the module increases, above data sheet values, at operating temperatures below 25°C, then these need to be taken into account when designing a PV system.

（22）Under normal conditions, a solar photovoltaic module is likely to produce more current and /or voltage than reported under standard test conditions. Accordingly, the value of Isc marked on this module should be multiplied by a factor of 1.25 when determining the conductor current ratings, fuse sizes and size of controls connected to the SPV output.

（23）Do not install modules in a location where they will be immersed in or continually exposed to water.

（24）Advising that artificially concentrated sunlight shall not be directed on the module.

5.2、ENVIRONMENT CONDITIONS AND SITE SELECTION

Sunpro module should be installed in the following environmental conditions.

Table 5-1 operation condition

NO	Environmental conditions	Range
1	Recommended Working temperature	-40℃ ~ +40℃
2	Storage temperature	-20℃ ~ +50℃
3	Humidity	< 85RH%

Remarks: The working environment temperature is the monthly average maximum temperature and minimum temperature of the installation site. The mechanical load bearing capacity of the Solar PV modules determined based on the installation method. Mechanical Load Pressure: The design pressure is 3600 (front)/1600 (back) and the safety factor is 1.5.

Notes:

- The mechanical load bearing is dependent upon the mounting methods used and failure to follow the instructions of this manual may result in different capabilities to withstand snow and wind loads. The system installer must ensure that the installation methods used meet these requirements and any local codes and regulations.

If you are planning to use the PV modules where the water damage (Humidity: ＞85RH%) may be possible, please consult with Sunpro technical support firstly to determine an appropriate installation method, or to determine whether the installation is possible.

The operator needs to consider the effect of the high altitude on the operation of the module, when the modules are installed at high altitude. The maximum altitude allowed for PV Module installation is 2000m.

For most places, Sunpro PV modules should be installed where the sunlight can be maximallyacquired throughout the year.In the Northern Hemisphere, the PV modules should typically face south, and in the SouthernHemisphere, the PV modules should typically face north.

When selecting the installation location, avoid areas with trees, buildings, or obstacles because these objects will form shadows on Solar PV modules, especially when the sun is at the lowest position onthe horizon in winter. The shadow will cause the loss of the output power of the Solar photovoltaic system. Although the bypass diode installed in the PV module can reduce this loss tosome extent, do not ignore the shadow factor.

Position the modules to minimize the chances of shading at all times of the day. Try to install modules in a location where there is rare shading throughout the year. Shading can normally be minimized by ensuring that the distance between the obstruction and solar array is greater than three times the obstruction's height.

The module must not be soaked in the water or in the environment (i.e., fountain, spindrift, etc.) where the module would touch water (pure water or brine) for a long term. If the modules are placed in an environment of salt fog (i.e., marine environment) or sulfur (i.e., sulfur sources, volcanoes, etc.), there is a risk of corrosion. It's not recommended to install the modules, when the distance is less than 100m ; and it'srecommended to install the modules with the anti-salt function, when the distance is between 100m and 1km. So stainless steel or aluminum materials must be used to contact the PV modules, and the installation position must be processed with anti-corrosion treatment.

According to the surrounding environment of the project, use the appropriate protective measures to ensure the safety of the module installation and reliable. For example, it needs to have around the windproof measures like design of windbreaks in strong wind area.

The system design needs to have the lightning protection function, it must pay more attention especially in the installation ground where are more lightning strike.

When installing Solar modules on a roof, the roof must be covered with a layer of fireproof material applicable to this class, and adequate ventilation must be ensured between the back of the module and the installation surface. A safe working area also must be left between the edge of the roof and the external edge of the Solar array.

In the case of residential installations on the ground, modules must be installed following local regulations, e.g. using fence.

This module has a Class C Fire Rating (Canada) or Module Fire performance type 29 (United States of America) and must be installed over a roof which has appropriate fire resistance.A minimum slope of 5 in/ft. for installation over a roof, is required to maintain the fire class ratings.

Sunpro Power Modules can be mounted in landscape and portrait orientation however the impact of dirt shading the solar cells can be minimized by orienting the product in portrait.

Avoid using a mounting method that will block the drainage holes in the module frame.

5.3、TILT ANGLE OF INSTALLATION

The installation of Solar PV module string should be in the same orientation and the same installation angle. Different installation directions and installation angles will lead to the mismatches in current and voltage which is caused by different light absorption of different Solar modules, this mismatch will cause the PV system power output loss.

When all solar modules are mounted in the same plane and orientation then all can be expected to have similar performance throughout the day and can be connected together to the same inverter channel.

If solar modules on the same installation are mounted at different angles or orientations then energy production can normally be optimized by connecting the different orientations to different inverters (or different MPPT if the inverter has more than one MPPT). Refer to inverter manufacturers for further guidelines.

The largest power will be generated When direct sunlight on Solar PV module. For modules which are installed on the fixed brackets, the best installation angle should be selected to ensure the maximum power output can be generated at winter time, if the angle can guarantee enough power output during the winter, it will make the whole Solar PV system in the rest of the year can have enough power output also.

Solar modules are recommended to be installed at an optimized tilt angle to maximize the energy output. For detailed information on the best installation angle, please refer to standard solar photovoltaic installation guides or consult a reputable Solar installer or systems integrator. Dust building up on the surface of the modules can impair module performance. Sunpro recommends installing the modules with a tilt angle of at least 10°, making it easier for dust to be washed off by rain.Any faults caused by and/or attributable to tilt angle less than 10 degrees are not covered by manufacturer's warranty. It is roughly equal to the latitude of the project site as a rule of thumb, facing toward the equator. Optimized system designs must incorporate other local requirements.

A minimum slope of 5 in/ft. for installation over a roof, is required to maintain the fire class ratings.

Installation inclination refers to the Angle between the PV module and the ground plane, The reflectivity of the two-sided solar module installation site shall not exceed 30%, as shown in Figure 5-1.

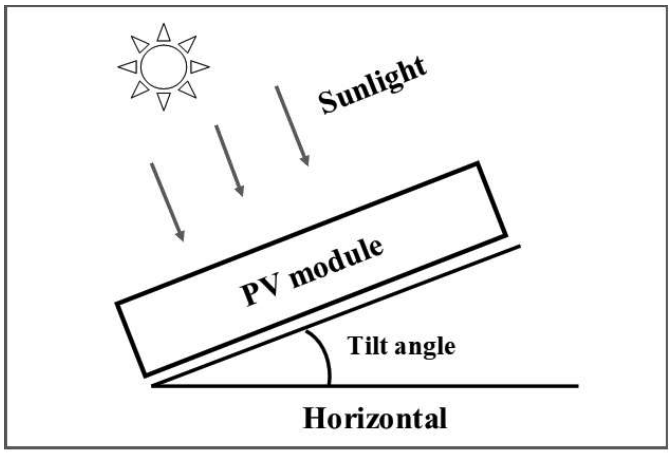


Fig. 5-1 Tilt angle

Table 5-2 Recommended tilt angle for fixed systems

Latitude	Tilt angle
0° ~ 15°	15°
15° ~ 25°	The same latitude

25° ~ 30°	Same latitude +5°
30° ~ 35°	Same latitude +10°
35° ~ 40°	Same latitude +15°
40°+	Same latitude +20°

5.4、INSTALLATION REQUIREMENTSFORBIFACIALCELLS MODULE

Under the certain installation conditions, the backside of bifacial cells module will also generateelectricity power after receiving the reflected light, which will bring additional power generation gain tothe power station system.

The shading on the module surface will affect the power generation much, the module should beinstalled in the place where the module cannot be shadowed totally (such as the shadow frombuilding, chimney and tree etc.), and even the partially shading (such as the dirt, snow and aerial wireetc.) should be avoided.

The generation gain is related to the ground reflectivity, the module installation height to the ground,the array spacing and the shadow shading to the module backside.

Generally speaking, the reflectance is various with the different ground (See table 5-3), and this willlead to different power generation gain.

Table 5-3 reflectivity of different surfaces

The ground type	Water	Grassland	Ground	Concrete	Sand	Snow
Reflectivity range （%）	5-12	12-25	20-33	20-40	20-40	80-85

Due to the different ground clearance height will affect the power generation gain, it is recommended toinstall the module at a height from 0.5m to 2m. See Fig. 5-2.

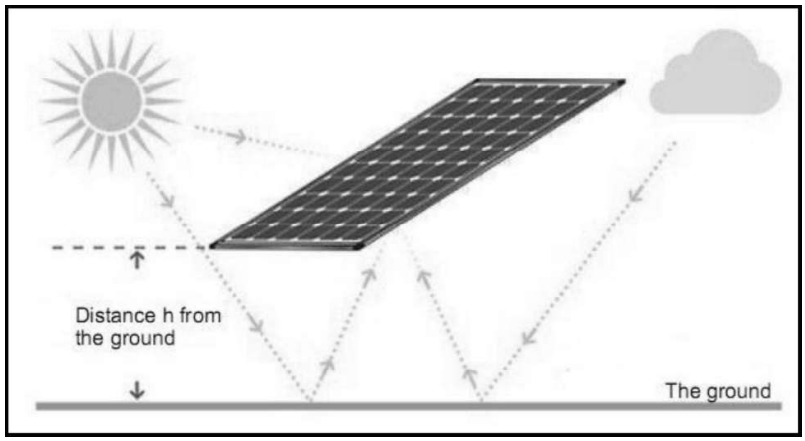


Fig. 5-2 Distance from the earth

In the system design, besides the ground type and the module installation height to ground, the properarray spacing and how to avoid shadow shading on the back need to be considered too, please consult withthe professional system designer.

5.5、INSTALLATION METHOD

5.5.1 MECHANICAL INSTALLATION AND WARNING

PV modules can be installed through clamp method.The modules must be installed according to the following examples and recommendations. If a different installation method is desired, please contact Sunpro solar

customer service or technical support team for consultation. Improperly mounted modules maybe damaged. If alternative mounting method is used that has not been approved by Sunpro, the modules will not continue to carry a valid warranty.

Modules shall not be subjected to wind or snow loads which is exceeding the maximumpermissible designed loads, and shall not be subjected to excessive forces due to the thermalexpansion of the support structures. The selection and design of mounting bracket shall be carriedout by professional system engineers after the load calculation according to the climatic conditionsof the installation site.

The modules depicted are mounted on continuous rails that extend beneath the modules. If modules are mounted without continuous rails below them, the maximum allowable loading will be reduced and needs to be subjected to review by Sunpro.

Please ensure that the modules with the same color cells to be installed together.

A clearance of at least 115mm (recommended) is provided between modules and the surface of the wall or roof.

The minimum clearance between two adjacent modules must not be less than 10mm.

The module frame drain holes cannot be blocked in any situation during installation or use.

To maximize mounting longevity, Sunpro strongly recommends the use of corrosion proof (stainless steel) attachment hardware.

The installation method listed below are for your reference only, the PV system installer or the trained professionals should take the responsibility of the PV system design, mechanical load calculation, install,maintenance and safety, Sunpro will not supply the related material for system installation.

The System Fire Class Rating of the module or panel in a mounting system in combination with a roof covering complete with requirements to achieve the specified System Fire Class Rating for a non-BIPV module or panel.Any module or panel mounting system limitations on inclination required to maintain a specific System Fire Class Rating.

. Mounting with Clamps

Sunpro Power has tested its modules with a number of clamps from different manufacturers, with a mounting bolt of at least M8. The length of clamp ≥60mm, thickness ≥3mm. If the customer needs a different size of clamps, it should be fully evaluated and approved by Sunpro Solar.

The clamp must overlap the module frame by at least 7mmbut no more than 10mm.

Use at minimum 4 clamps to attach modules to the mounting rails.

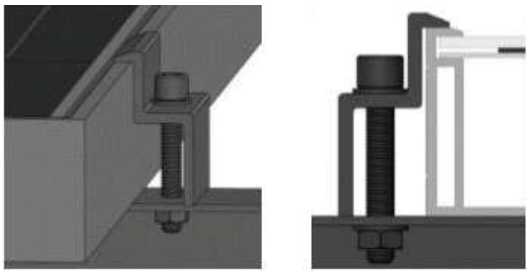
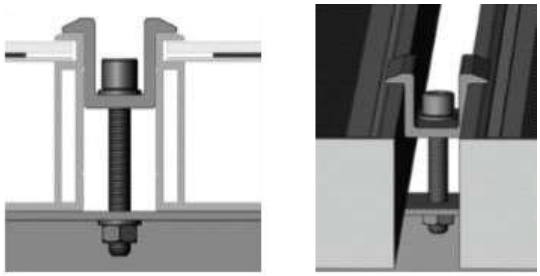
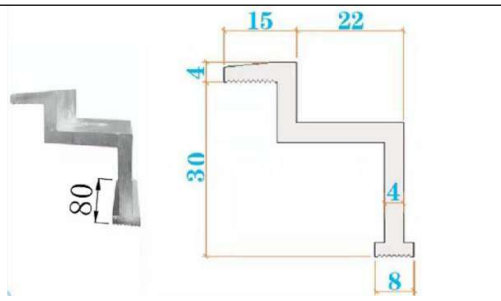
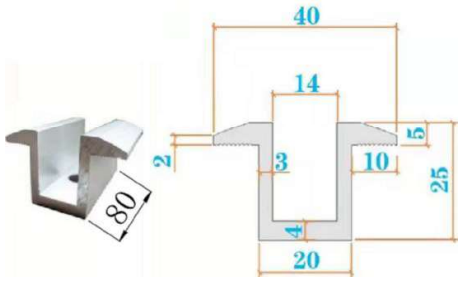
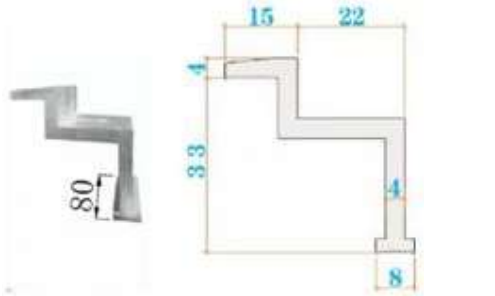
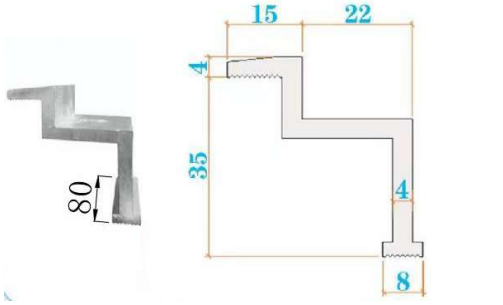
Modules clamps should not come into contact with the front glass and must not deform the frame.

Be sure to avoid shadowing effects on the solar cells from the module clamps.

The module frame is not to be modified under any circumstances.

When choosing this type of clamp-mounting method, use at least four clamps on each module, two clamps should be attached on each long sides of the module (for portrait orientation) Depending on local wind and snow loads, additional clamps may be required to ensure that modules can bear the load.

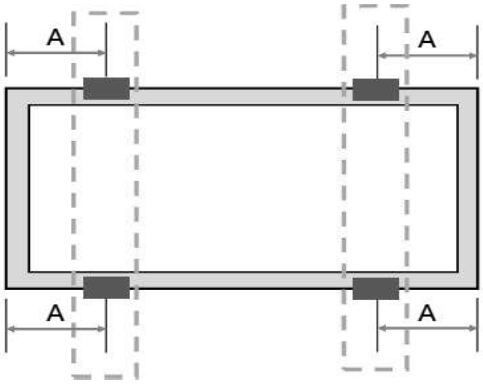
Applied torque should refer to mechanical design standard according to the bolt customer is using, ex: M8 16-20N.m (140-180lbf.in)

End Clamp installation	Middle Clamp installation
	
 For 30mm height Frame	 For 30/33/35mm height Frame
 For 33mm height Frame	
 For 35mm height Frame	

Clamp type	Dimension (mm)	Frame height (mm)	Composition material	ILL. No.
End Clamp	37.0 x 80.0 x 39.0	35	Aluminum alloy	11
Middle Clamp	40.0 x 80.0 x 25.0			
End Clamp	37.0 x 80.0 x 37.0	33		
Middle Clamp	40.0 x 80.0 x 25.0			
End Clamp	37.0 x 80.0 x 34.0	30		
Middle Clamp	40.0 x 80.0 x 25.0			

The following mounting hardware is combined together with above clamps.

Model series	Mounting hardware configuration			
	Hardware	Material	Size	Number provided
All	bolt	Stainless steel	M8	4
	washer	Stainless steel	M8	4
	nut	Stainless steel	M8	4

Module	Mechanical Load Pressure	Mounting Direction
108/110/120/132/144pcs**Module**	+5400Pa/-2400Pa	 A=1/4L±50mm; L=Module length ***NOTE:** 1.The crossbeam is perpendicularto the long side frame. 2. The above described distance is from the module edge to the middle of the clamp.Clamps length ≥80mm. 3. Need two support rails below the PV module to make sure the Mechanical load. 4. The load is an empirical value of a standard module based on a standard installation mode, and the specific information shall be consulted by Sunpro Power Solar.

***NOTES:**

Other mounting configurations can be used. However, failure to comply with the above recommendations will result in a lowering of the load handling capabilities below the empirical value, and product failure as a result of an overload situation will not be covered by the Sunpro warranty.

5.5.2 ELECTRICAL INSTALLATION

1、Cable layout

The recommended vertical installation connection methods for module with split J-Box are as follows(The extension cable is required).

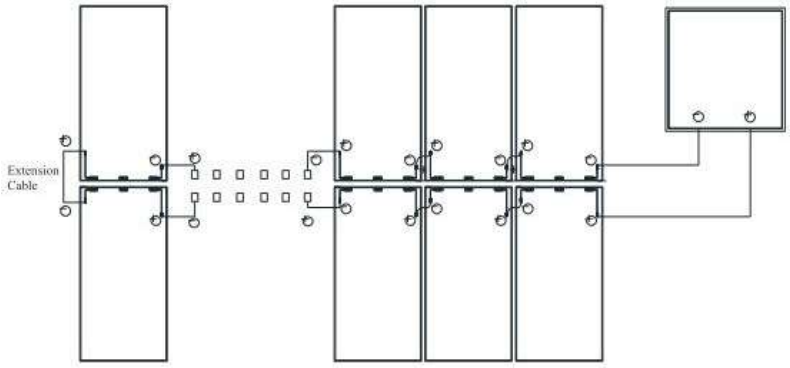


Fig.1 Split J-Box at module side position for vertical direction

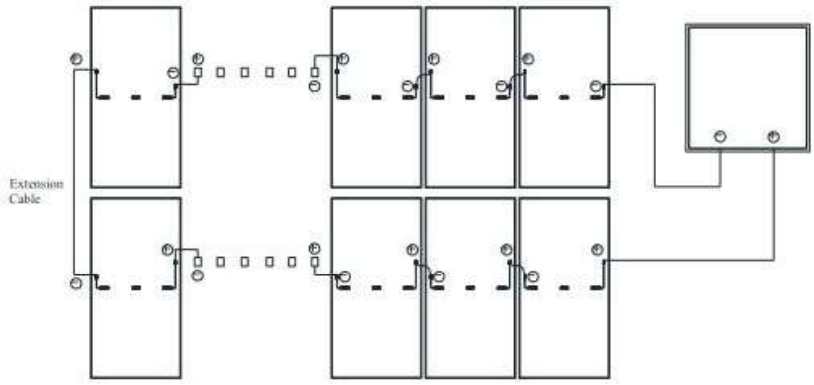


Fig.2 Split J-Box at module middle position for vertical direction

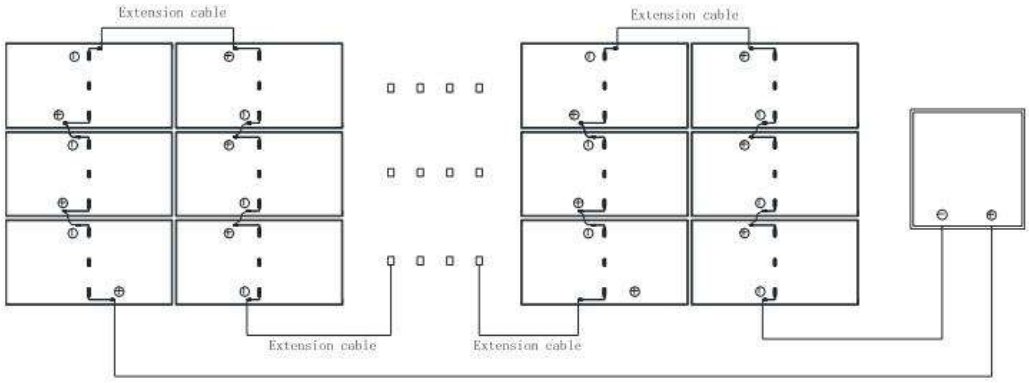


Fig.3 Split J-Box at module middle position for horizontal direction

Precautions: To minimize risk in the event of an indirect lightning strike, avoid forming loops when designing the system. In order to avoid bad or damaged connection of the cable and connector, the cable and junction box caused by human factors, affecting the electrical safety or service life of the product, it is recommended that the force applied between the cable and connector, cable and junction box shall not be greater than 60N during the

installation, dismantling, maintenance and any other related process of the Product.

Pay attention to the direction of the wire when installing the modules. It should beconnected along the wire direction to avoid bending the wire.

2、Electrical Connection

The Direct Current (DC) generated by the PV system can be converted to Alternating Current (AC)and connected to the public power grid. Different regions may have different policies, laws andregulations to stipulate the installation and grid-connection requirements of PV systems. Therefore,during the design, installation and grid-connection of PV system, please comply with the local policies,laws and regulations.

PV modules can obtain different current and voltage outputs through series connection and parallel connection. Read this installation manual carefully before electrical connection and installation. Please design and connect according to the current and voltage required by customers. Before connection,please ensure that the connection part is free from corrosion, and keep it clean and dry.

Different types of modules cannot be connected in series. Modules connected in series should ensurethe consistency of their current. The voltage of the module string should not exceed the allowablesystem voltage value, which can be found on the nameplate or datasheet of the module.

Sunpro Power modules are provided with stranded copper cables with a cross sectional area of 4mm² which are rated for 1500V dc, 90°C and are UV resistant. All other cables used to connect the DC system should have a similar (or better) specification. Sunpro Power recommend that all cables are run in appropriate conduits and sited away from areas prone to water collection.

The maximum number of modules in series depends on the system design, the type of converter usedand the environmental conditions. In general, the maximum number (N) of PV modules in series canbe calculated by dividing the maximum system voltage by the open circuit voltage of the relevant Solar PV modules. When designing the Solar PV system, it is necessary to take into account thecharacteristic that the voltage of the Solar PV module changes with the temperature. Considering thevoltage increase caused by temperature drop in extreme environment in winter, the maximum seriesconnection number of Solar PV modules can be calculated by the following formula.

Table 5-4 maximum series connection number calculation

Formula	Maximum system voltage $V \geq N*V_{oc}*[1+\beta*(T_{min}-25)]$
V	Maximum system voltage
N	The number of maximum Solar PV modules in series
$\mathbf{V_{oc}}$	The open circuit voltage of each module (see product label or datasheet)
β	Temperature coefficient of open circuit voltage of the module (refer to datasheet)
$\mathbf{T_{min}}$	The lowest ambient temperature at installation site

If the modules are allowed to be installed in parallel electrically, each module (or series string of modules so connected) shall be provided with the maximum series fuse as specified. For applications requiring high currents, several photovoltaic modules can be connected in parallel; the total current is equal to the sum of individual currents, each module (or series string of modules so connected) shall be provided with the maximum series fuse as specified. The recommended number of module in parallel is only one. The modules' electrical performance in a system is the same. When connected in series, all modules must have the same amperage. When connected in parallel, the modules must all have the same voltage. Connect the quantity of modules that match the voltage

specifications of the devices used in the system. The modules must not be connected together to create a voltage that is higher than the permitted system voltage.

Product can be irreparably damaged if an array string is connected in reverse polarity to another. Always verify the voltage and polarity of each individual string before making a parallel connection. If you measure a reversed polarity or a difference of more than 10V between strings then check the string configuration before making the connection.

Before wiring the module, ensure that the contact points are corrosion resistant, clean and dry; If astring of modules is reversed, irreparable damage can be caused.

Each Sunpro PV module has two PV cables which can withstand 85℃ temperature and they aresunlight resistant(UV). The cross-sectional area of the cable is 4mm² or 12AWG, and the externaldiameter is 5mm ~ 7mm. The minimum bending radius of the cables must be 43mm. Any cable damage caused by bending too much or cable management system is not covered under Sunpro Power Solar's warranty. Plug & Play connectors are included at the end of each cable. All other cablesused to connect the direct current system shall have similar (or higher) specifications, and shouldhave the suitable insulation ability which can suffer the possible maximum system V_{oc}(as defined inTUV 2PfG1169 or EN50618 (H1Z2Z2-K)). Sunprorequires all cables and electrical connections tocomply with the electrical regulations of the countries where the PV system is installed.

Under normal conditions, a PV module is likely to experience conditions that produce higher current and/or voltage than reported at standard test conditions. Accordingly, the values of I_{sc} and V_{oc} . marked on this PV module should be multiplied by a factor of 1.25 atleast when determining component voltage ratings, conductor current ratings, and size of controls (e.g. inverter) connected to the PV output.

When selecting a cable, the minimum current-carrying capacity of the cable can be calculated by thefollowing formula.

Minimum current-carrying capacity of the cable $=1.25*I_{sc}*N_p$

I_{sc}: short-circuit current of PV module (unit: A)

N_p: the number of modules in parallel or module strings

Photovoltaic (electric) systems operate automatically and require very little day-to-day supervision. The solar array generates DC electricity whenever light falls on it similarly the inverter automatically turns ON as soon as there is sufficient energy from the solar array to efficiently convert this into grid quality AC power.

Caution:

The module is rated to operate at potentially lethal DC voltages which have the potential can cause severe electrical shock, arcing and fire hazards. Whilst some solar modules, manufactured by Sunpro Power, are certified to operate up to 1500V always check the module label to confirm the actual rating of your product before making connections.

Always use a suitably rated isolator (DC switch) to interrupt the current flow before disconnecting the connectors.

To ensure proper system operation the correct cable connection polarity (Figures 1 & 2) should be observed when connecting the modules to each other or to a load, such as inverter, a battery etc. If modules were not connected correctly, the bypass diodes could be destroyed. PV modules can be wired in series to increase voltage. A series connection is made when the wire from the positive terminal of one module is connected to the negative terminal of the next module. A parallel connection is made when the wire from the positive terminal of one module is connected to the positive terminal on the next module. Do not connect Fuse in Combiner Box with two or more strings in parallel connection.

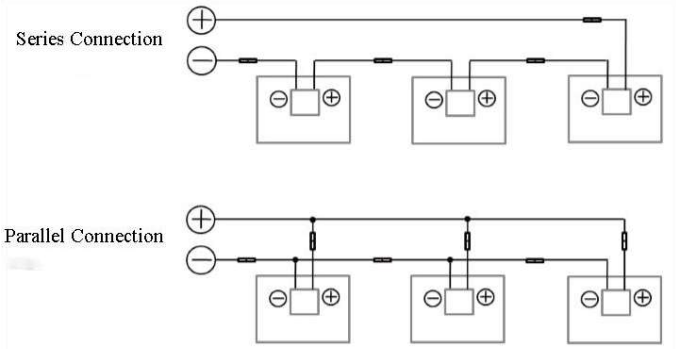


Fig 1

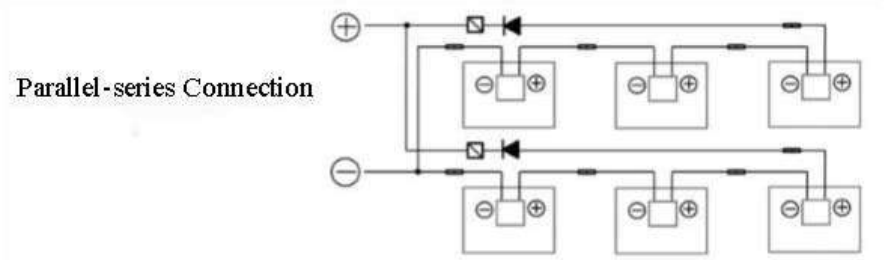


Fig 2

The number of modules in series and in parallel shall be designed reasonably according to the system configuration.

To clear or trim excess cables and Sunprorecommends that all cables be placed in proper pipework and away from standing water.

Sunpro recommends using lightning protection devices which are complied with local laws andelectrical regulations.

All the above instructions must be followed to meet Sunpro Solar warranty conditions.

3、Bypass secondary

If PV module part by shadow block, which can lead to reverse voltage related to Solarcells, PV modules in other unaffected battery string or other PV modules in thesystem and current will force through keep out part of the power loss and heat affected cell. When the PV module is connected in parallel with the bypass diode, the current in the system willflow directly through the diode, so as to bypass the blocked part of the PV module and minimize the heating degree and power consumption of the PV module.

Each module has three diodes. Please donot try to open the junction box to replace the diode, or even when the diode problem, please do thiswork by professionals.

Bypass Diode Model: MK6045

Connector Type：PV-TT02，factory：Taizhou Chuangda Electronic Co.,Ltd

Connector model name(Male)	Allowable mating connector model name(Female)
PV-TT02	PV-TT02

Bypass Diode Model: MK6045

Connector Type：PV-KBT4-EVO 2/6I-UR，factory：STAUBLI ELECTRICAL CONNECTORS AG

Connector model name(Male)	Allowable mating connector model name(Female)
PV-KBT4-EVO 2/6I-UR	PV-KBT4-EVO 2/6I-UR

Bypass Diode Model: QCM5045B

Connector Type：QC4.10，factory：QC Solar (Suzhou) Corporation

Connector model name(Male)	Allowable mating connector model name(Female)
QC4.10	QC4.10

4、FUSING

When fuses are fitted they should be rated for the maximum DC voltage and connected in each, non-grounded pole of the array (i.e. if the system is not grounded then fuses should be connected in both the positive and negative poles).

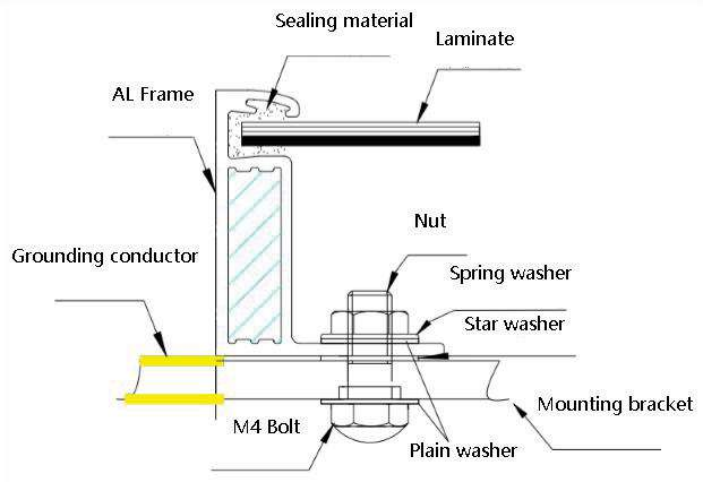
The maximum rating of a fuse connected in series with an array string is typically 25A or 30A, but the actual module specific rating can be found on the product label and in the product datasheet.

This fuse rating value also corresponds to the maximum reverse current that a module can withstand (when one string is shaded then the other parallel strings of modules will be loaded by the shaded string and current will flow) and therefore impacts the number of strings in parallel. Parallel module configurations: fuse rating/Isc.

All PV module frames and mounting brackets must be properly grounded in accordance with NFPA 70, National Electrical Code.

Correct grounding is achieved by continuously connecting the PV module frame and all metalmodules together using the appropriate grounding conductor. The grounding wire may be copper,copper alloy or other materials that can be used as conductors and meet the requirements of thenational electrical code. It is recommended to use the copper wire (4-14mm^2 or AWG 6-12) as thegrounding wire. The signal" ⏚ " can be found at the grounding hole position. The ground wire mustalso be connected to ground through a suitable ground electrode. The tight connection of all the jointpoint should be ensured.

On a grounding hole with a diameter of φ4 mm, use a separate grounding wire and relatedaccessories to connect the aluminum frame of the Solar PV module and connect the grounding wire tothe ground. The grounding uses the M4*12mm bolts and M4 nuts, star washers and plain washers,this ensures that the modules are firmly grounded. You can find the corresponding product drawing inmodule datasheet to know the detailed number, size and position of the grounding holes. The torqueapplied to ground fixation is 4N·m ~ 8N·m.



Grounding

Model series	Grounding hardware configuration			
	Hardware	Material	Size	Number provided per set

All	Bolt	Stainless steel	M4	1
	Spring washer	Stainless steel	M4	1
	Nut	Stainless steel	M4	1
	Star Washer	Stainless steel	M4	1
	Plain Washer	Stainless steel	M4	2

When grounding, each module can be grounded directly or in series or in parallel. If you choose thelatter two options, it is recommended that the maximum number of modules connected in parallel shouldnot exceed four, and in series should not exceed eight.

In addition to use the grounding hole, you can also choose the following grounding ways:

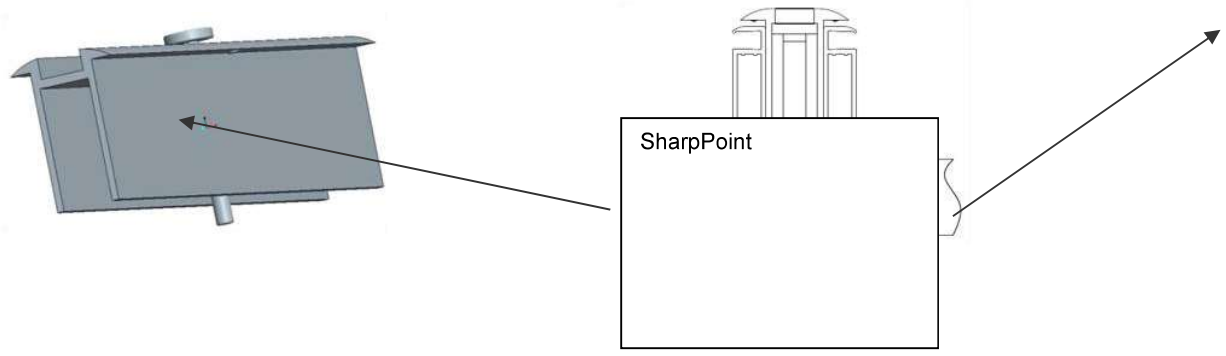
（1）Grounding by unused mounting holes

（2）Other professional grounding devices

The electrical contact points of all the above grounding methods should penetrate the anodized film ofthe aluminum frame. PV modules can be grounded by other grounding devices, which must be reliableand certified. The manufacturer's requirements should be followed.

Sunpro Power recommends using the following grounding ways：

a）Using Schleter for grounding. Connecting modules to the support structure according to the picture below. (Grounding accessories need pass the UL467 standard test.)



Recommended torque is 20.5Nm

For more information, please contact the supplier Schletter（http：//www.solar.schletter.de）

b)The traditional way of grounding（Grounding accessories need pass the UL467 standard test and UL E34440/E6207 test.）

For fully grounding, grounding hardware should penetrate the anodic oxidation layer of frame.

Recommended 10-12 AWG bare copper grounding wire.

6、MODULE MAINTENANCE

In order to ensure the long-term using of the installed PV system and maximize the Power outputperformance

of the modules, the installed PV modules need to be inspected and maintained regularly. The inspection and maintenance of modules in the PV array shall be carried out by personnel who have received professional PV system maintenance training and obtained relevant qualifications and authorization.

6.1、PANEL VISUAL INSPECTION AND REPLACEMENT

The modules in a PV array should be regularly checked for damage. Factors such as glass breakage, cable breakage, junction box damage and the terminals cannot be connected well may lead to function and safety problems. In the case of a damaged module, replace it with the same type of module. Do not touch live parts of cables and connectors. Use appropriate safety equipment (insulated tools, insulating gloves, etc.) when handling modules. Refer to the appropriate Product Installation Manual for installation and disassembly of module.

Check the electrical, grounding and mechanical connections every 6 months to ensure they are cleanand safe, free from damage or rust. Check that all string fuses in each non/earthed pole are operating. Check that the mounting parts are tight. Check all cables andmake sure that the connectors are securely. PV modules frames and bracket should be wellmechanically connected.

Check whether there is any foreign body on the surface of the PV modules and whether there is anyshielding. Trim any vegetation which may shade the PV array, thus impacting performance.

When repairing PV modules, cover the surface of PV modules with opaque material to prevent electricshock. Exposure of PV modules to sunlight will generate high voltages, this is dangerous. Please payattention to safety when maintenance and it must be done by professionals.

Wear cut resistant gloves and other personal protective equipment required for the particular installation. Isolate the impacted array string to prevent current flow before attempting to remove the module. Disconnect the connectors of the affected module using the related disconnect tool provided by suppliers. Replace the damaged module with a new functional module of the same type.

In a system using a battery, blocking diodes are typically placed between the battery and the PV module output to prevent battery discharge at night.

Diodes that are used as blocking diodes must have a:

a) Rated Average Forward Current [IF(AV)] above the maximum system current at the highest module operating temperature.

b) Rated Repetitive Peak Reverse Voltage [VRRM] above the maximum system voltage [Vmax] at the lowest module operating temperature（IEC：Vmax=1500V；）

When the irradiance is no less than 200W/m², if the terminal voltage is more than 5% different thanthe rated value, it illustrates the connection of the modules is not good.

Comply with maintenance instructions for all modules used in the PV system, such as brackets,charging rectifiers, inverters, batteries, lightning protection systems, etc.

Warning: The warning signs on the PV modules must not be lost.Any electrical maintenance must shut down the PV system firstly. Improper systemmaintenance may cause fatal dangers such as electric shock and burning.Observe the safety precautions listed earlier in this Manual.

6.2、CONNECTOR AND CABLE INSPECTION

It's recommended to implement the following preventive maintenance every 6 months:

（1）Check the sealing gels of the junction box for any damage.

（2）Examine the PV module(s) for signs of deterioration. Check all wiring for possible rodent damage, weathering and that all connections are tight and corrosion free. Check electrical leakage to ground.

（3）Inspect all cables to verify that connections are tight, the cables are protected from direct sunlight andsited away from areas of water collection.

（4）Check the torque of terminal bolts and the general condition of wiring. Also, check that mounting

hardware is properly torqued. Loose connections will result in damage to the array.

6.3、CLEANING

Dust accumulation on the glass surface of the module will reduce its power output and may cause hotspots. So the surface of PV modules should be kept clean. Maintenance work should be performed at least once six months or frequently.

Warning: It should be carried out by trained personnel. Workers should wear PPE, such as goggles,electric insulation gloves and safety shoes. The gloves should withstand DC voltages of no less than2000V.

Use dry or wet soft cloths, sponges, etc. to clean the modules during the cleaning process, but do notput any modules directly into the water, do not use corrosive solvents and do not wipe the PV moduleswith hard objects. When the pressure water is used, the water pressure on the glass surface of themodule must not exceed 700 KPa. The module must not be subjected to additional external force. If there is greasy dirt and other substances on the surface of the PV module which are difficult to clean, conventional household glass cleaning agents can be used; Do not use the alkaline and strong acid solvents.Ifnecessary, use isopropyl alcohol (IPA) orothersolution according to the safety instructions to clean and ensure that no solution flows into the gap between the edge of the module and the module frame.

Clean PV modules when the irradiance is below 200W/m^2. When cleaning the modules, use a soft cloth together with a mild detergent and clean water. Take care to avoid severe thermal shocks which might damage the module by cleaning modules with water which has a similar temperature to the modules being cleaned. For example, do not use cold water to clean themodule when the temperature of it is high during the day, otherwise there will be the risk of moduledamage.

It is forbidden to clean PV modules under the weather conditions of wind more than 4 grades, heavy rain or heavy snow.

When cleaning PV modules, Do not step on the modules; Do not spray water on the backside of the module or the cables; keep the connectors clean and dry; prevent fire and electrical shock from occurring; Do not use as steam cleaner.

The back surface of the module normally does not need to be cleaned but, in the event this is deemed necessary, avoid the use of any sharp projects that might damage the penetrating the substrate material.

When cleaning the back surface of the module, take care to avoid penetrating the substrate material. Modules that are mounted flat (0° tilt angle) should be cleaned more often, as they will NOT "self-clean" as effectively as modules mounted at a 10° tilt or greater.

Do not scrape or grind stains off surfaces while PV modules are dry, as this can cause minor scratches on the surface.

Water requirements when cleaning:

（1）PH: 5～7;

（2）Chloride or salt content: 0 - 3000 mg/L

（3）Turbidity: 0-30 NTU

（4）Conductivity: 1500～3000 μs/cm

（5）Total dissolved solids: ≤1000 mg/L

（6）Water hardness: 0-40 mg/L

（7）Non-alkaline water must be used, and softened water can be used when conditions permitted.

6.3.1 MODULE INSPECTION AFTER CLEANING

（1）Ensure that the module under visual inspection is clean, bright and free of stains;

（2）Spot check to verify whether there is soot deposit on the module surface;

（3）Check to whether there are visible scratches on the surface of the module or not;

（4）Check whether there is no man-made cracks on the module surface or not;

（5）Check whether the module support structure is leaning or bent or not;

（6）Check whether the connectors of the module are detached or not;

（7）After cleaning, fill out the PV module cleaning record.

6.3.2 TROUBLESHOOTING

If the PV system does not work properly, please inform your installer immediately. It is recommended to perform a preventive inspection every six months, please don't change any modules of the modules. If electrical or mechanical properties are required for inspection or maintenance, qualified professionals should be advised to avoid any electric shock or loss of life.

a)Contact your installer

b) Contact Sunpro Power after sales service team at:www.sunpropower.us

WARNING: For any electrical maintenance, the PV system must first be shut down. Improper maintenance can cause lethal electric shock and/or burns.

Contact information:

SUNPRO POWER NORTH AMERICA INC

ADD: 206 N RANDOLPH ST STE 2, CHAMPAIGN IL 61820-3976

E-mail: info@sunpropower.com

Web Site: www.sunpropower.us