



新奥光伏能源有限公司  
ENN Solar Energy Co. Ltd

EST Series 电池板安装手册  
EST SERIES SOLAR MODULE  
INSTALLATION MANUAL

Revision	Change ECO #	Originator/Approver	Date
A		Wang Xiqiao/Tang Qing	06/11/2009
B		Wang Xiqiao/Tang Qing	22/03/2010
C		Wang Xiqiao/Tang Qing	24/05/2010
D	Section 4.6&7	Guo Rui/Tang Qing	31/03/2011

## 1. OBJECTIVE

The purpose of this procedure is to provide installation instructions for EST SERIES thin film solar module for field installation.

## 2. SCOPE

This procedure establishes the key installation requirements to mount EST SERIES thin film solar modules in the field which includes, but is not excluded to, roof tops, solar farms, and commercial buildings.

## 3. RESPONSIBILITY

ENN Solar Energy Co. Ltd. shall maintain the engineering change control of this product.

End installer of the thin film Photovoltaic (PV) modules is responsible for the design and integrity of the mounting structure of the modules. The PV module manufacturer is responsible for the design and structural integrity of the PV modules. Installation of the PV modules must be performed by appropriately trained and equipped installers.

Supplier is responsible for maintaining and supporting the bill of materials on the Supplier database.

## 4. INSTALLATION

### 4.1. Unpacking and handling

The site and personnel must obtain the proper handling and transport equipment to install the PV modules.

### 4.2. Personnel

Only trained personnel are to handle, transport, and install the PV modules. Immediate exposures to sunlight instantly energize the modules and pose a shock risk.

### 4.3. Safety

It is the responsibility of the supplier to provide adequate safety to its employees while performing the procedures.

Under normal conditions, a photovoltaic module may experience conditions that produce more current and/or voltage than reported at Standard Test Conditions. Accordingly, the values of Isc and Voc marked this module should be multiplied by the following factors: The multiplying factors at conditions of an irradiance of 125 mW/cm<sup>2</sup>, AM 1.5 spectrum is 1.19, and at a cell temperature of minus 10 deg C for Voc is 0.895 and at plus 75 deg C for Isc is 1.05.

Refer to Section 690.8 of the National Electrical Code for an additional multiplying factor of 125 percent (80 percent derating) which may be applicable

Artificially concentrated sunlight shall not be directed on the module or panel.

#### **4.4. Tools/Materials**

EST series Solar Module

0021-51814 RAIL CLAMP 30 DEG (if end installer has not specified their own clamp)

IlSCO GBL-4DB (Tin Coated)

Sheet Metal Screws #10 x 1/2" with zinc plating

M5 Star Washer

M5 Lock Washer Stainless Ste

M5 Washer Stainless Steel

M5 x .8 x 16mm Socket Head Screw Stainless Steel

M5 Nut

Socket Sets

Wrenches

#### **4.5. Installing the modules**

- 4.5.1. Materials of the mounting structure must be compatible with the PV module rails as to not allow galvanic corrosion to either member (PV rail or mounting structure). The PV rails are made of galvanized steel.
- 4.5.2. PV modules are not to be installed around or near open flames, flammable gases or vapors, constant wetting/moisture (fountains), salt air conditions, or other corrosive chemicals/vapors.
- 4.5.3. Orientation and tilt of the modules are responsibilities of the end installer.
- 4.5.4. Sunlight exposure is the responsibility of the end installer. Care should be taken to place the modules in areas without overshadowing or significant shade.
- 4.5.5. For roof mounting, the module must be mounted over a fire resistant roof covering rated for the application.
- 4.5.6. The modules should be mounted with the junction box connectors facing down to minimize the ingress of water.

## 4.6. Mounting

4.6.1. PV modules are to be mounted in a minimum of two different locations per rail, as shown in the diagrams below.

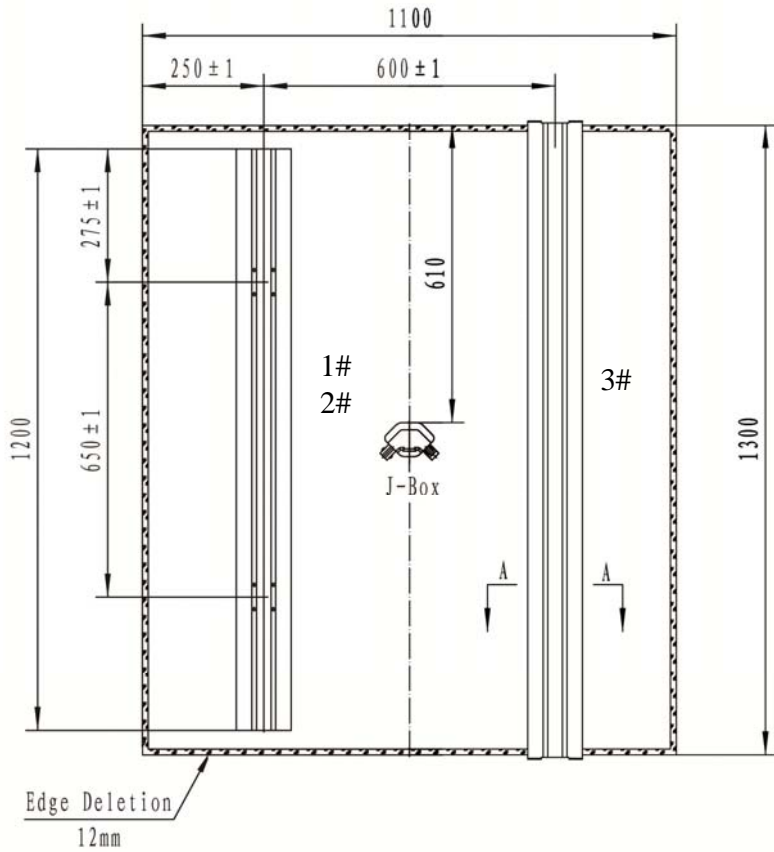
4.6.2. The mounting structure must be capable of supporting the weight of the PV modules and snow loading (if applicable to the site). It should also be able to withstand seismic loading in the corresponding applicable seismic areas.

These modules have been evaluated by Underwriters Laboratories Inc for a maximum positive or negative design loading of 33 lbs/ft<sup>2</sup>.

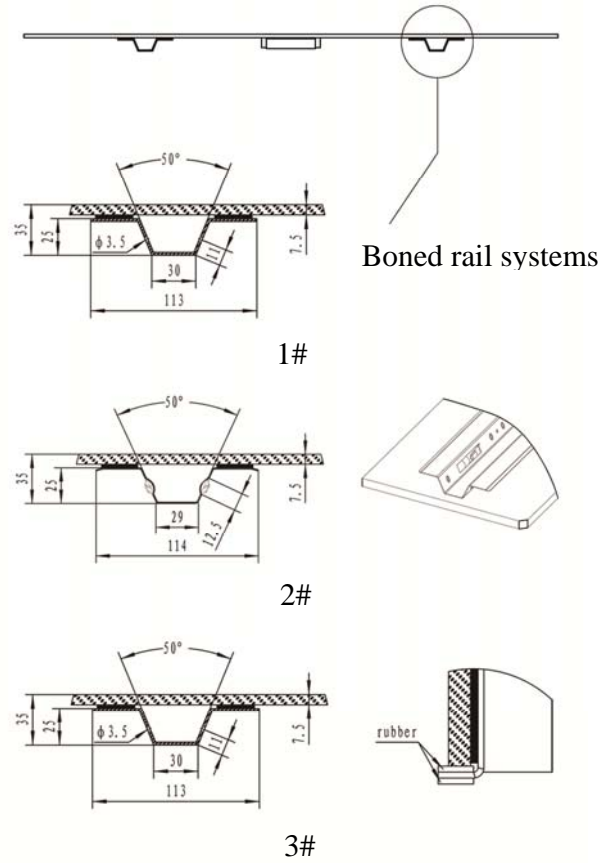
4.6.3. Key Dimensions

4.6.3.1. The key dimensions are shown in **Figure 1, and Figure 2** for a structural engineer to design an infrastructure. Note all dimensions are in millimeter unless otherwise specified.

Back View#



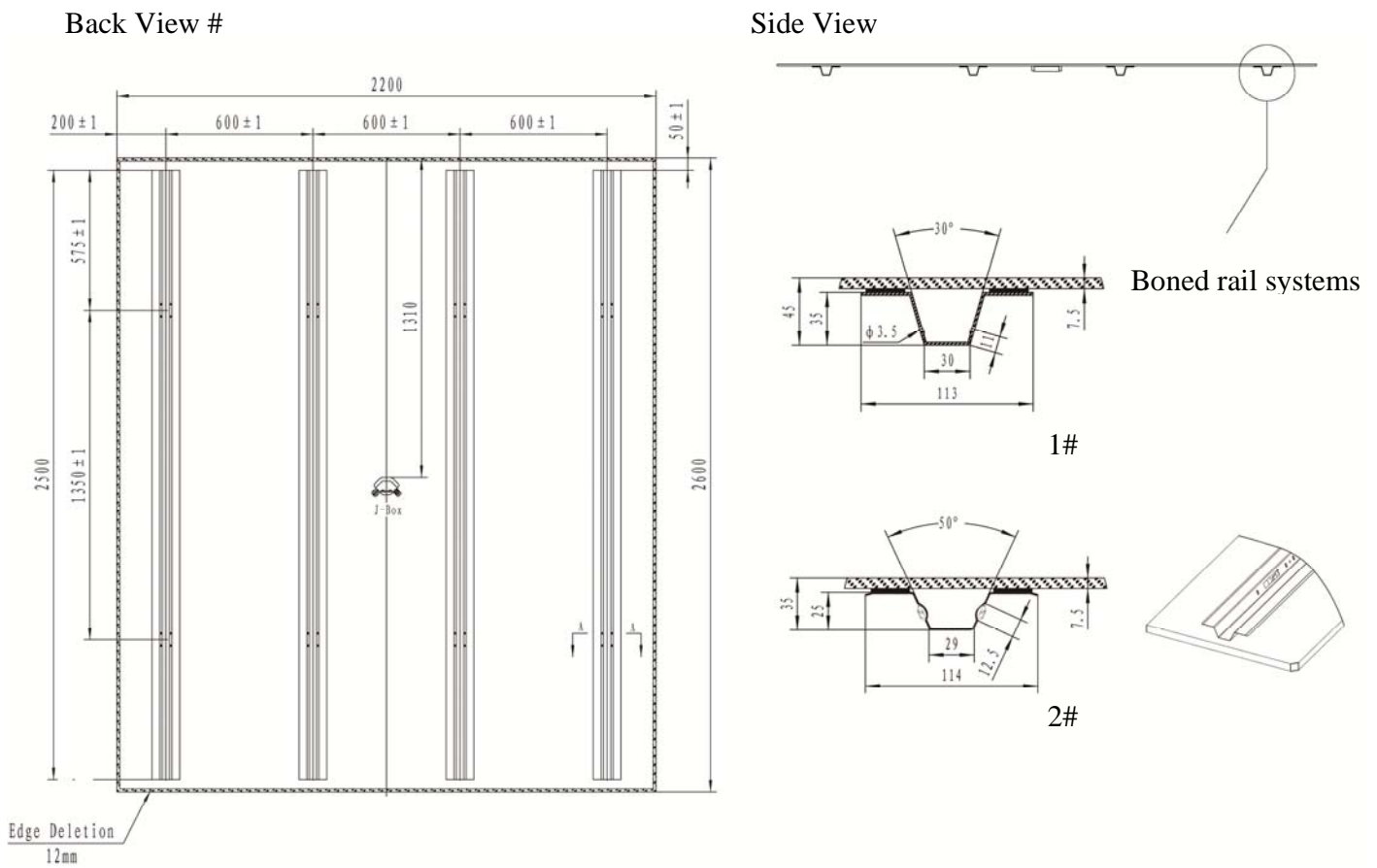
Side View



#Shadow areas are schematic drawing of bonded rail system.

ENN Solar Energy provides various bonded rail systems upon customs' request.

**Figure 1 – 1.3 X 1.1 m Module**



#Shadow areas are schematic drawing of boned rail system.

ENN Solar Energy provides various boned rail systems upon customs' request.

**Figure 2 – 2.6 X 2.2 m Module**

#### 4.6.4. Mounting Position

4.6.4.1. The Bracket is mounted to the rail with #10 sheet metal screws as shown in **Figures 1-2**. The bracket has a U-shape design to hold a structure with a width of 50.8mm. The structure holes (diameter 10mm) are designed for two bolts; size M8 x 1.25 x 65mm, to fasten the brackets to a structure.

4.6.4.2. The modules have been evaluated by UL for mounting using the brackets provided at the mounting locations in the rails.

## 4.7. Wiring

### 4.7.1. Warnings

- 4.7.1.1. If, during self assembly, parts and tools other than those stated by MC are used or if the preparation and assembly instructions described here are disregarded then neither safety nor compliance with the technical data can be guaranteed
- 4.7.1.2. For protection against electric shock, PV connectors must be isolated from the power supply while being assembled or disassembled.
- 4.7.1.3. The end product must provide protection from electric shock.
- 4.7.1.4. The integral output connector should only be used where they will not interrupt current. Unplugging under load: PV plug connections must not be unplugged while under load. They can be placed in a no load state by switching off the DC/AC converter or breaking the AC circuit interrupter. Plugging and unplugging while under voltage is permitted.
- 4.7.1.5. It is inadvisable to use non-tinned cables of type H07RN-F, since with oxidized copper wires the contact resistances of the crimp connection may exceed the permitted limits.
- 4.7.1.6. Disconnected connectors should be protected from dirt and water with sealing caps.
- 4.7.1.7. Plugged parts are watertight IP67. They can not be used permanently under water. Do not lay PV connectors on the roof surface.

### 4.7.2. Tools

- 4.7.2.1. Crimping tool.
- 4.7.2.2. PV-MS Open-end spanner
- 4.7.2.3. PV-PST Test Plug

### 4.7.3. Connectors without cables

#### 4.7.3.1 Connectors

Use only UL recognized connectors which include catalogue numbers PV-KST4 and PV-KBT4 followed by 2.5 or 6, followed by "I" or "II" followed by UR or additional suffixes. See table below for acceptable cable diameters that can be use with each connector.

Series	(TYLZ) Wire types	Wire size (AWG)	Number of strands	Outer Cable Diameter Range
PV-KST4/2.5I-UR	USE or USE-2	8-12	N/A	3.0 – 6.0 mm
PV-KBT4/2.5I-UR	USE or USE-2	8-12	N/A	3.0 – 6.0 mm
PV-KST4/2.5II-UR	USE or USE-2	8-12	N/A	5.5 – 9.0 mm
PV-KBT4/2.5II-UR	USE or USE-2	8-12	N/A	5.5 – 9.0 mm
PV-KST4/6I-UR	USE or USE-2	8-12	N/A	3.0 – 6.0 mm
PV-KBT4/6I-UR	USE or USE-2	8-12	N/A	3.0 – 6.0 mm
PV-KST4/6II-UR	USE or USE-2	<b>8-14</b>	N/A	5.5 – 9.0 mm
PV-KBT4/6II-UR	USE or USE-2	<b>8-14</b>	N/A	5.5 – 9.0 mm

Series	(ZKLA) Wire types	Wire size (AWG)	Number of wire strands (Range)	Outer Cable Diameter (Range)
PV-KST4/6II-UR	PV Wire	12	7 - 52	6.05 - 7.0 mm
PV-KBT4/6II-UR	PV Wire	12	7 - 52	6.05 - 7.0 mm

#### 4.7.3.2 Cable Preparation (Reference: Multi-Contact MA231 Assembly Instructions).

4.7.3.2.1. Use appropriate size and type of UL recognized cable for the connector (14, 12, or 10 AWG with a 90°C temperature rating, marked sunlight resistant).

4.7.3.2.2. See table below for additional information important: Cables with class 2, 5 or 6 construction can be connected. It is advantageous to use tinned conductors. It is inadvisable to use non-tinned cables of type H07RN-F, since with oxidized copper wires the contact resistances of the crimp connection may exceed the permitted limits.

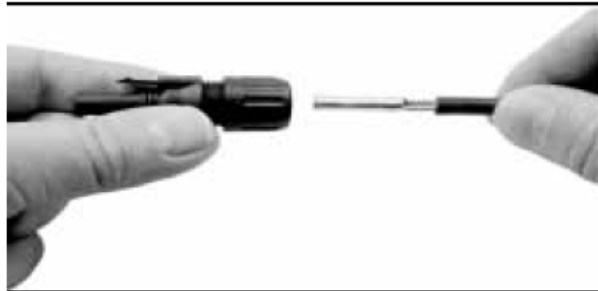
Wire	Class 5, tinned
Outer insulation	UV resistant High wear and abrasion resistance High resistance against oils, greases, oxygen and ozone
Certification	VDE Reg. Nr. 7671 (90°C) TÜV Rep. Nr. E2210251E01
Flame test according to	DIN EN 50265-2-1 UL1581 (VW-1)
Temperature range	-40°C...+110°C (> 10000 Std./hrs)

4.7.3.2.2 Strip cable insulation. L = 6-7.5 mm. Take care not to cut individual strands. Recommended tool: Stripping pliers PV-AZM, Order No. 32.6027

#### 4.7.3.3 Crimping

4.7.3.3.1 Crimp the contact onto the wire using the appropriate tool and procedure.

- 4.7.3.3.2 Push the crimped contact into the socket receptacle/plug insulator until it engages. Pull lightly on the lead to check that the metal part has engaged.



**Figure 5 – Contact insertion.**

#### 4.7.3.4 Assembly Control

- 4.7.3.4.1 Insert the test pin with the corresponding side into the socket or plug to the end position. If the contact is correctly assembled, the white marking on the test pin must be still visible. (Figure 4)
- 4.7.3.4.2 Screw on the cable gland, hand-tight, with the tools PV-MS.
- 4.7.3.4.3 The tightening torque must be adapted to the solar cables used in each specific case. Typical values lie in a range between 2,5Nm to 3Nm

#### 4.7.4. Plugging

- 4.7.4.1 Mount the plug connection until it engages. Check correct engagement by pulling on the coupling.

#### 4.7.5. Unplugging

- 4.7.5.1. The plug connection can only be unlocked with the tool PV-MS (Figure 5)



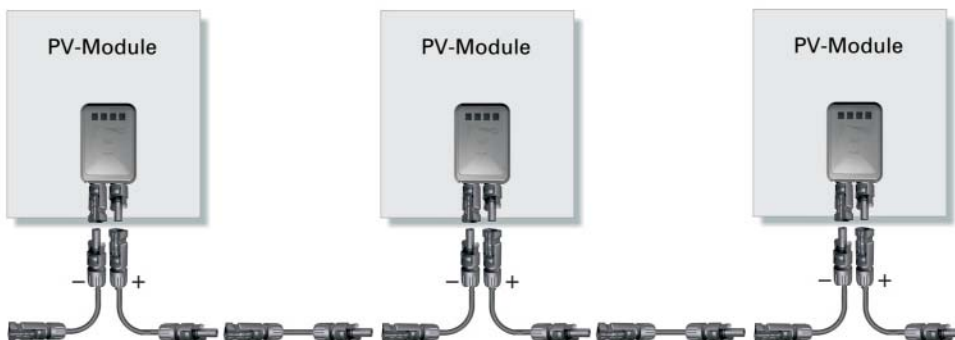
**Figure 6 – Unplugging using PV-MS tool.**

#### 4.7.6. Array Wiring

##### 4.7.6.1. Series

河北省廊坊市经济技术开发区华祥路 106 邮编: 065001  
No.106 Huaxiang Road, E&T Development Zone, Langfang 065001 P. R. China

To wire modules in series use an interconnect cable assemblies that has a female connector on one end and a male connector on the other. The modules can be connected together in a chain forming a series connected circuit. (See Figure 7). The maximum current of fuse for the connected circuit can be found in the section 7.



**Figure 7 – Series connection**

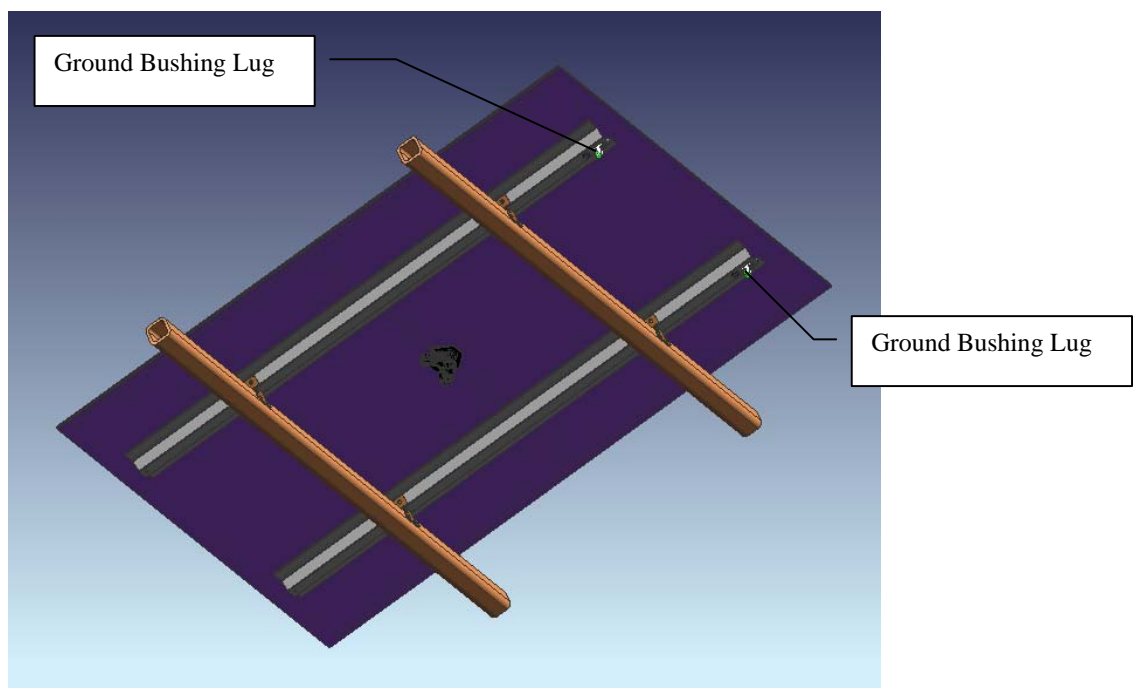
#### 4.7.6.2. Parallel

To wire the modules in parallel it is necessary to connect the module leads using a method that meets national and local electrical codes and to use UL listed hardware

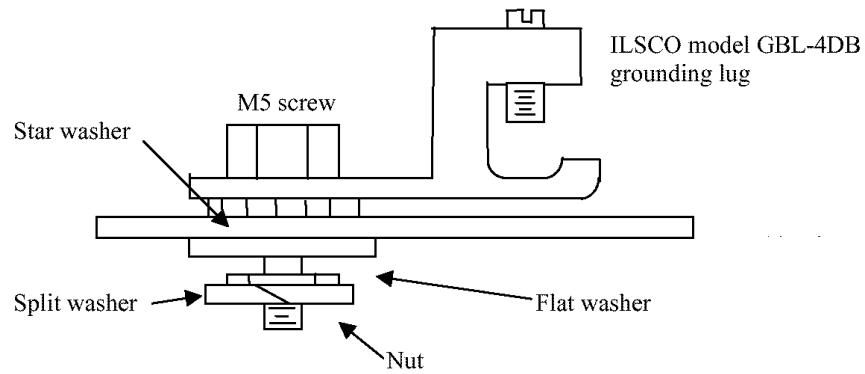
Each module (or series string of modules so connected) shall be provided with the maximum series fuse as specified in Section 7.

#### 4.7.7. Grounding

Attach a ground conductor to two grounding bushing lug mounted at the designated location shown in **Figure 8 (An IlSCO GBL-4DB is shown in the Figure)**. Use an IlSCO GBL-4DB (Tin Plated) , and M5 stainless steel hardware (screw, lock washer, star washer, flat washer and nut) as shown in **Figure 9**. The assembly must be torque to 6.1 Nm. The copper conductor must be attached to the ground lug using the stainless steel set screw provided by the lug manufacturer. The electrical wiring of the ground circuit should be such that the negative leg of the array circuit shall have the same voltage as earth ground, and when performing a DC voltage measurement between the positive leg of array circuit and earth ground the meter shall read a positive DC voltage, or when performing a DC voltage measurement between the negative leg of array circuit and earth ground the meter shall read zero volts DC voltage. Please refer to NEC Article 690 on grounding PV arrays for specific requirements.



**Figure 8 – Ground Bushing Lug Locations**



**Figure 9 – Ground Bushing Lug Installation**

## **5. REFERENCES**

### **5.1. Acronyms/Definitions**

PV – Photovoltaic

TF – Thin Film

### **5.2. Documents**

Not Applicable

## **6. METHODS**

Not Applicable

## 7. ELECTRICAL RATINGS

Stabilized ratings (**Displayed on label**):

Model	Open Circuit Voltage at STC, (V dc)+	Rated Voltage at STC, (V dc)+	Maximum System Voltage, (V dc)+	Rated Current at STC, (A dc)+	Short Circuit Current at STC, (A dc)+	Rated Maximum Power at STC, (Watts)+	Maximum Series Fuse, (A)
EST-110 1.3 X 1.1 m	139	100	UL 600 IEC 1000	1.10	1.40	110	3
EST-115 1.3 X 1.1 m	140	103	UL 600 IEC 1000	1.12	1.41	115	3
EST-120 1.3 X 1.1 m	141	105	UL 600 IEC 1000	1.14	1.42	120	3
EST-125 1.3 X 1.1 m	142	108	UL 600 IEC 1000	1.16	1.43	125	3
EST-130 1.3 X 1.1 m	143	111	UL 600 IEC 1000	1.18	1.44	130	3
EST-135 1.3 X 1.1 m	146	113	UL 600 IEC 1000	1.20	1.46	135	3
EST-440 2.6 X 2.2 m	280	200	UL 600 IEC 1000	2.20	2.80	440	5
EST-460 2.6 X 2.2 m	282	206	UL 600 IEC 1000	2.24	2.82	460	5
EST-480 2.6 X 2.2 m	284	210	UL 600 IEC 1000	2.28	2.84	480	5
EST-500 2.6 X 2.2 m	286	216	UL 600 IEC 1000	2.32	2.86	500	5
EST-520 2.6 X 2.2 m	288	222	UL 600 IEC 1000	2.36	2.88	520	5
EST-540 2.6 X 2.2 m	292	226	UL 600 IEC 1000	2.39	2.92	540	5

Note: A. During initial 6 weeks of operation, the module has higher electrical output than the rated output. The Pmax may be higher by 15% and the Impp may be higher by 10%.

B. The electrical ratings recorded in the Electrical Rating Label are stabilized values.

## **8. ATTACHMENTS**

Not Applicable

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