ePump System

Installation Guide
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Purpose of this Guide

This Guide offers the information about the installation and safety utilization of ePump System of Sunman (HongKong) Limited.

Installers must read and understand this guide prior to installation. For any questions, please contact Sunman for more detailed information. Installers must follow all safety precautions as described in this guide. Before installing a solar photovoltaic system, installers should familiarize themselves with its mechanical and electrical requirements. Keep this guide in a safe place for future reference (care and maintenance) and in case of sale or disposal of the modules.

General Safety

Installing solar photovoltaic systems requires specialized skills and knowledge.

- Installation must only be performed by qualified personnel.
- Each ePump system will have an additional control box. For the convenience, Sunman can offer the customized control box according to the customer’s requirements.
- Installers should assume all risks of injury that might occur during installation, including, but not limited to, the risk of electric shock or drowning.
- One single module may generate more than 30V DC when exposed to direct sunlight. Contact with a DC voltage of 30V or more is potentially hazardous.
- Do not disconnect with loading.
- Do not install the pump in the water with the static water level.
- Photovoltaic solar modules convert light energy to direct current electrical energy. They are designed for outdoor use. Modules can be ground mounted, mounted on rooftops, vehicles or boats. The proper design of support structures lies within the responsibility of the system designers and installers.
- Installers must follow all safety precautions as described in this guide as well as local requirement and regulations by law or authorized organizations.
- Do not lift the module by grasping the module’s junction box or electrical leads.
- Do not use mirrors or other magnifiers to concentrate sunlight onto the modules.
- Static water level, dynamic water level: The water level before the draw water of the pump is the static water level. The dynamic water level is when the draw water and influx water achieve the balance point and the water level will
not decline.

- Installers must follow all safety precautions as described in this guide as well as local requirement and regulations by law or authorized organizations.

### Safety and Protection

- Keep children away from the system while transporting and installing mechanical and electrical components.
- Completely cover the module with an opaque material during installation to prevent electricity from being generated.
- Do not wear metallic rings, watchbands, earrings, nose rings, lip rings or other metallic objects while installing or troubleshooting ePump systems.
- Customer can buy the optional accessories including bracket, cable if they need.
- The electrical characteristics are within ±10 percent of the indicated values of \( I_{sc} \), \( V_{oc} \) and \( P_{max} \) under standard test conditions (irradiance of 1000 W/m², AM 1.5 spectrum, and a cell temperature of 25°C (77°F)).
- Do not drill holes in the frame. This may compromise the frame strength, cause corrosion of the frame and void the warranty.
- Work only under dry conditions, and use only dry tools. Do not handle panels under wet conditions unless wearing appropriate protective equipment.
- Do not scratch the anodized coating of the frame (except for grounding connection at the grounding connection point on the back side of the module). It may cause corrosion of the frame or compromise the frame strength.
- Do not work in the rain, snow or in windy conditions.
- Avoid exposing cables to direct sunlight in order to prevent insulation degradation.
- Use only insulated tools that are approved for working on electrical installations.
- Do not use ePump system near the fuel oil equipment or flammable gas.
- Photovoltaic module frame and bracket must reliably connect with grounding system.

### 1. System Installation Notification

#### 1.1 Mechanical Installation

- Do not use junction box or cable to move PV, do not use pump cable to move pump. Do not place any heavy objects
on the module.

- Do not drop the module or allow objects to fall on the module.
- Cannot heavily throw the component of the system, including PV, control box and pump.
- Do not install the pump on the static water level.
- Do not choose the water source with much macadam and sediment. Sediment concentration not higher than 0.5% is recommended.
- Do not install the pump under the condition of high temperature ($T > 35^\circ C$), low PH value ($PH < 6.5$), high PH value ($PH > 8.5$).
- Do not install the pump in hot spring or sea water.
- Do not install the water at the bottom of water source.
- Have to use the suitable cable to fix after the pump installation (like nylon, steel wire, suggest to use nylon within 30 meters and adopt steel wire out of 30 meters.)
- Inappropriate transport and installation may break the module and void the warranty.

1.2 Electrical Installation

- PV of ePump system have to connect in series and become the solar array.
- Cross sectional area of the DC side cable have to satisfy the largest system short-circuit current (The cable for the single PV suggested to 12AWG), otherwise the cable will be overheat by the large current. Pay attention to the upper limit of the cable temperature should be higher than or equal to 85°C. If lack of pump connection lines, AC side cable needs to extend and the cross sectional area cannot be less than the cross section area of the pump cable (suggested to be 18AWG).
- Do not run the pump without water (dry run)
- The end with the junction box should up when installation, and avoid the shower of rain.

2 ePump System Installation

ePump system mainly including PV, bracket (optional), pump, control box. Solar array is made up of PV and bracket is the power source. Water source consists of Pump and pipe. The control box supply water by convert the power from the power source and drive the whole water source.
2.1 PV installation

2.1.1 Location Selection

- Choose the suitable location to install the PV and pump.
- The orientation of PV should face south in the Northern Hemisphere Latitude area and face north in the southern Hemisphere Latitude area.
- About the information of the PV optimum angle of installation, can refer to the standard solar PV installation guide or consult the local dealer.
- PV should not be shielding at any time. If shielded, even partial shielded, it cannot work at ideal condition and lead to low output power. Permanent shadow of the PV will cause void warranty.

2.1.2 Bracket Installation

- In general case, bracket installed on the ground. Please contact local dealer to offer the solutions if there is no suitable place or need to install the modules on the roof.
- Choose the suitable installation height for the PV system, prevent the accumulated snow cover the bottom of modules in winter for long time.
- Actually, bracket will have many installation type based on the different type PV. ( like support type, length and quantity ).
Main components consist of bracket as the following:

- Hinge
- Junction plate
- Pedestal
- Beam A
- Beam B
- Bolt
- Edge briquetting
- Middle briquetting

Steps of bracket installation and attention points:

1. Prefabricate concrete pedestal, gap assignment as the following:

2. Install the vertical support module on the concrete pedestal, adjust the coincidence of the vertical central line and brace central line, use level gage or horizontal pipe to measure the levelness of the front and back brace.
And use the levelling gage to adjust the vertical perpendicularity of the brace. Adopt the bolt connection to consist of the frame with vertical support. Longitudinal bracing, hinge and substrate. After the fastening of each bolt, the exposure length of bolt should be 2/3 of bolt’s diameter.

Figure 3: Vertical bracket assignment diagram

3. Install Lateral bracing after installing all of the vertical support, adopt junction plate to connect if the beam need to be extended.

Figure 4: Lateral support assignment diagram
4. Begin to install diagonal bracing after Lateral bracing installation. In order to guarantee upright and foursquare of the cant beam, should do gauge party of beam in advance and adjust and measure the diagonal, ensure the bias within in allowable bias range. Fastening pull rod bolt and making the parts of the whole bracket afforded the uniform stress.

<table>
<thead>
<tr>
<th>Item</th>
<th>Allowable bias (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central line bias</td>
<td>≤2</td>
</tr>
</tbody>
</table>
### 2.1.3 Components Installation

- Insert strip bolt into the beam, move to the suitable position, coordinate the briquetting and fix PV module.

<table>
<thead>
<tr>
<th>Item</th>
<th>Allowable Bias</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meter bias (same group)</td>
<td>≤ 3</td>
</tr>
<tr>
<td>Poling surface bias (same group)</td>
<td>≤ 3</td>
</tr>
</tbody>
</table>

Table 1: bracket installation allowable bias

- Module must be fixed on the bracket correctly, make it can afford the dynamic load. The installer must ensure the clamp splice fixed correctly.

- The requirements of PV module’s installation as the following:
  1. PV module should be installed based on the specification of the design drawing.
  2. The Torque value of the fixed bolt should conform to the regulations of the product or design documents.
  3. The allowable bias of the module installation should conform to Figure 2 as the following:

<table>
<thead>
<tr>
<th>Item</th>
<th>Allowable Bias</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bias for angle of Inclination</td>
<td>± 1°</td>
</tr>
<tr>
<td>module edge height</td>
<td></td>
</tr>
<tr>
<td>adjacent module</td>
<td>≤ 2mm</td>
</tr>
<tr>
<td>same group module</td>
<td>≤ 5mm</td>
</tr>
</tbody>
</table>

Figure 2: The allowable bias of the module installation

- Module should light moving and light put, cannot be heavily shocked, vibrated and loaded during transportation and storage.

- Please handle gently in case of breaking the glass surface. The installation of solar panel have to be flat homogeneous and steady. Solar panel edge in the same square should be the same. Pay attention to the direction...
of the junction box. It will be better for the construction if adopt the “head to head” way to install and the line sink is in the middle.

2.2 Control box Installation

- Control box suggested to be installed indoor or on the bracket under the module.

![Control box installation diagram](image)

Figure 7: Control box Installation Diagram

2.3 Pump and Water System Installation

2.3.1 Pump Installation

- Choose the reasonable pump. Different pumps have different lifts and flow. If have questions, please consult with Sunman global customer service.
- Pump Diagram as the following:
Figure 8: Pump Installation Diagram

- If pump stuck, cannot continue to transfer to a lower level during the process of pump descending into the well, otherwise pump will be stuck deadly or damaged.

- Pump cable cannot be tensioned tightly. Natural and loose status will be good.

- Based on the sludge status to determine the depth of the pump into the water. Cannot embed the pump into the sludge. The distance between pump and the bottom of the well recommended to be more than 3 meters. The distance for pump submerging into the dynamic water cannot be less than 1 meter (based on the flow), otherwise pump will be damaged because of dry run.

### 2.3.2 Pipe Installation

- Pipe Installation based on the local actual situation.

- Sunman default accessories including the pump splice.

- Sunman Pump has a check valve. If no special requirements, no need to add another one in the pump exhalent siphon.
2.4 Electrical Installation

2.4.1 Grounding Connection

- Module connection is always series.
- System Wiring Diagram

![System Wiring Diagram](image1)

Figure 9: photovoltaic module and grid dual power input

![System Wiring Diagram](image2)

Figure 10: only photovoltaic module input

- Pump cables can be extended and must adopt the waterproof tape. Method of application: wipe off the seal coat, pull up the adhesive tape to the double size of the original one, continuously overlapping. After that, use electrical adhesive tape and overlap the waterproof tape to increase the insulating property.
Pump cable and cable of the well liquid level switch into the pump controller. Sunman suggest conduit buried line way. If line length is too long, recommend to wrap wire with insulating tape, in case of paint ageing or animal bite.

### 2.4.2 Grounding

- ePump system must correctly grounding and connect grounding cables well, fixed to PV module frame.
- Among module frame must have ground loop.
- Must insure the reliability of the grounding of the control box.
- The grounding wire of pump should connect to the pump controller of the control box.

### 3 Setting and Maintain

#### 3.1 Testing and Debug

**PV Module**

- Protect yourself from electric shock during testing or maintain ePump system.
- The testing before Series connection module connect to system: use digital multimeter and check the open-circuit voltage. Measured value should be equal to the sum total of the single module open-circuit voltage.
- Identify the normal low voltage and fault low voltage. Normal low voltage means lower the module open-circuit voltage. It caused by rising the solar cell temperature and lower the irradiance. Fault low voltage usually caused by incorrectly terminal connection or bypass diode damage.

Please check the module according to the following steps:

- Firstly, check all cables connection, ensure no open circuit and connect well.
- Check each module open circuit voltage.
- Use one opaque material totally cover module.
- Disconnect the guide line of two ends of module.
- Take off the opaque material from the module, check and measure the terminal open circuit voltage.
- If measuring voltage is only the half of the rating value, indicating the bypass diode has been broken.
- The irradiance is not too low, if the difference between the terminal voltage and the rating value is over 5%, indicates have problems on module connection.
Pump Controller

- Close DC switch, check the LED screen can normal display or not. Pump will automatically try to start after 1 minute, continually to wait about 1 minutes and Pump will start. (please refer to the controller user manual in case of error).
- If irradiance is not enough, solar pump controller cannot depend on PV module to supply water.
- In a certain range, the irradiance more strong, the flow more large.
- Controller can be opened by manual operation or automatic.
- The function of controller is improve the performance of motor and track the solar irradiance.

Pump

- Same power pump, rated flow more bigger, rated lift more smaller. Please choose pump based on the catalogue and actual situation.
- After pump installation, checking the status of the insulation resistance and the cable conduction from the switch or the control box, then test and run pump after confirming there is no fault.
- 5 hours after the first operation, please close down the pump to test the hot insulation resistance. The value cannot be lower than 0.5MΩ.
- When pump reverse rotates, still have the ability to draw some water. If the irradiance is good, the flow of pump is too small, can try to reverse the connection of any two phases of the pump tap in the control box.

3.2 Maintenance

Clean the glass surface of the module when required. Always use clean water and soft non-abrasive sponge or cloth for cleaning. A mild, non-abrasive cleaning agent may be used to remove stubborn dirt.

Check the electrical, grounding and mechanical connections every six months to verify that they are clean, secure, undamaged and free of corrosion.

- Take out the pump from the well and clean the sundries when pump runs over each year.
- Periodically check the control box, insure there is no sundries or animals in the control box on the occasion of outage in case of the accidents.
- If any problem arises, consult a professional solar service providers for suggestions.
4 Disclaimer

Sunman will not take responsibility for the damage, destruction or cost caused by these installation, operations, use or maintenance which exceed Sunman’s control range. Due to the use of ePump system products may lead to the infringement of third party patents or other rights, does not belong to the scope of Sunman’s responsibility. Customers are not authorized to use any patent or patent right to use the Sunman product, whether expressed or implied.

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