SC250KU
Power Conversion System (PCS)
Installation Manual
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1 About this Manual

1.1 Forward

Thank you for purchasing the SC250KU device from Sungrow Power Supply Co., Ltd. We hope that the device will meet with your satisfaction when you use it. Your commands and feedbacks on the performance and function of the device are very important for our further improvement.

1.2 Validity

This Installation Manual is valid for the following device types:

- SC250KU

The SC250KU device is referred to as “PCS” hereinafter unless otherwise specified.

1.3 Content

This manual contains the following information:

- Safety Instructions
- Safety instructions for installation of the PCS.
- Delivery and product introduction

Introduce the delivery and check after receiving the PCS. The appearance and functions of the PCS are also described.

- Installation guide

Introduce the PCS mechanical installation, electrical installation, communication connection and installation check methods. The suggestions for installation space and cable connection are also mentioned.

- Commissioning

The safety instructions of commissioning and commissioning processes are introduced.

- Others

Technical data of the PCS, exclusion of liability and the way to contact Sungrow.

1.4 Target Group

This manual is aimed at technical personnel who are responsible and qualified for the PCS installation and commissioning. Readers should be familiar with the electrical and mechanical diagrams and characteristics of the electrical components.

1.5 How to Use This Manual

Read this manual and other related documents carefully before any work on the PCS.
Documents must be stored carefully and available at all times. Additional documents are also available to the users:

- Operation Manual (in the scope of delivery)

All rights reserved including the pictures, markings and symbols used. Any reproduction or disclosure, even partially, of the contents of this manual is strictly forbidden without prior written authorization of Sungrow.

1.6 SymbolsExplanation

This manual contains important safety and operational instructions that must be accurately understood and followed during the installation and maintenance of the equipment.

To ensure optimum use of this manual, note the following explanations of symbols used.

**DANGER**

DANGER indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

**WARNING**

WARNING indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.

**CAUTION**

CAUTION indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

**NOTICE**

NOTICE indicates a situation which, if not avoided, could result in equipment or property damage.

**NOTE**

NOTE indicates additional information, emphasized contents or tips to help you solve problems or save time.

The symbols below may be pasted on the electrical parts of the PCS. Make sure to read the following symbols and fully understand them before installing the equipment.

<table>
<thead>
<tr>
<th>Symbols</th>
<th>Explanations</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Warning]</td>
<td>Risk of electric shock!</td>
</tr>
<tr>
<td>![Warning]</td>
<td>Hot surface!</td>
</tr>
<tr>
<td>![Information]</td>
<td>Connection point for earth conductor</td>
</tr>
<tr>
<td>![Information]</td>
<td>Protective conductor terminal</td>
</tr>
</tbody>
</table>
2 Safety Instructions

2.1 Intended Usage

SC250KU, researched and developed by Sungrow Power Supply Co., Ltd., is a PCS for energy storage system with transformer. It provides an interface for the grid and battery for energy storage system charging and discharging. Through step up by the transformer, the PCS AC side can connect to the grid.

With IP21 protection rate, the PCS can be installed indoors only.

The charging and discharging system with SC250KU is shown below:

![Energy storage system diagram]

**Fig. 2-1 Energy storage system**

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Energy storage batteries (lead-acid battery, lithium battery and etc.)</td>
</tr>
<tr>
<td>B</td>
<td>SC250KU PCS</td>
</tr>
<tr>
<td>C</td>
<td>Utility grid</td>
</tr>
<tr>
<td>D</td>
<td>Loads</td>
</tr>
</tbody>
</table>

⚠️ **WARNING**

* Installation described in this section must be strictly observed. Any other or additional installation other than the described installation is not permitted.
* A device that can completely disconnect the DC circuit should be equipped in the DC side of PCS.
* Installation and connections other than the contents described in this section may lead to device damages and void warranty claims from Sungrow.
2.2 Important Safety Instructions

SAVE THESE INSTRUCTIONS—This manual contains important instructions for Model(s) SC250KU that shall be followed during installation and maintenance of the power conversion system.

This section introduces the safety instructions during installing or commissioning of the PCS. Read the safety instructions in this section before installing. Please also respect all warnings, instructions, and cautions in respective chapters before installation and commissioning.

⚠️ DANGER

Shock Hazard!
Death resulting from burns and electric shock upon touching the PCS live components.
• Do not touch the live components of the PCS or the utility grid.
• Observe all safety regulations.

⚠️ DANGER

Shock hazard inside the product!
• Note and respect the warning labels in the product.
• Respect all safety instructions in this manual and other related documents.

⚠️ DANGER

Electric shock or fire due to device damage or system fault!
• Visual check if there is device damage or other potential dangers before operation.
• Check if other external devices or circuit connections are safe.
• Operate the device only when it is safe to do so.

2.2.1 Manuals

Very important information about transportation and installation of the PCS are included in this manual. All the descriptions in this manual, especially those safety-related items, must be complied with.

• Please read all the instructions thoroughly prior to any transportation or installation work on the PCS. Device damage, personal injury and property loss may follow if otherwise.
• This manual and relevant documents should be available for relevant persons at all times. Do not leave any paper or manuals inside the PCS cabinet after the installation.

2.2.2 Personnel

• Only qualified electricians or personnel with professional knowledge can transport or install the device.
• Operators must be familiar with the whole power generation system and its working principle.
• Operators must be familiar with the Installation Manual and Operation Manual.
• Operators must be familiar with country-specific standards and regulations.

2.2.3 Markings on the PCS

• The PCS enclosure and interior contains important warning and safety information. Do not tear or damage it.
• Nameplates located in the back panel and inside the front door contain very important parameter information. Do not tear or damage them.

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
</table>
| • **All safety instructions, warning labels and nameplate on the PCS body must be clearly visible;**
| • **Replace the markings once they damaged or unclear.** |

2.2.4 Safety Warning Signs

Please respect the followings during installation, daily maintenance or troubleshooting of the PCS:

• An obvious marking should be placed in the PCS upstream and downstream to keep the switch from accidental reconnection;
• A temporary warning sign or barrier must be posted around the installation area;
• Remove the door keys and keep them appropriately after installation or maintenance work is finished.

2.2.5 Emergency Escape Route

The emergency escape route is critical during an emergency situation.

• Keep the escape route clear and unblocked at all times.
• Never block or lock the emergency escape route.

2.2.6 Storage Battery Protection

The SC250KU PCS has been evaluated for bidirectional use to provide power to an external battery storage system.

The overcurrent protection for the battery input circuit is to be provided by others.

High Voltages exist between the positive and negative polarities of the storage batteries for large-scale PV plant. Electrical shock or life risk may occur by accidental touch.

<table>
<thead>
<tr>
<th>DANGER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High voltages exist between the positive and negative polarities of the storage batteries!</strong></td>
</tr>
<tr>
<td>• <strong>Ensure the PCS and storage batteries are completely disconnected during device maintenance.</strong></td>
</tr>
<tr>
<td>• <strong>Place warning labels in the disconnection place to avoid accidental reconnection.</strong></td>
</tr>
</tbody>
</table>

2.2.7 Device Installation

Install the PCS by strictly following the description in this chapter.

Install the PCS in electrical control room to avoid the noise produced during PCS operation and
safety accidents.

- The control room should be far from residential areas. Sound insulation measures should be taken if necessary.
- Never place any flammable substance inside or around the control room.
- Unobstructed air flow. Escape route meets the requirements.

**NOTICE**

Smog warning device is recommended to install inside the control room for quick response of plant staff to the potential fire.

### 2.2.8 Electrical Connection

Electrical connection must be in accordance with the circuit diagram and the description in this chapter.

**CAUTION** - To reduce the risk of fire, connect only to an AC output circuit provided with 400 amperes maximum branch-circuit overcurrent protection in accordance with the National Electrical Code, ANSI/NFPA 70.

**WARNING**

- Configuration of the storage batteries, related current, voltage and power must conform to technical data of the PCS.
- Connection to the utility grid must be done after receiving approval from the local utility grid and done by qualified personnel only.
- All the electrical connections must comply with country-specific standards and regulations.

**WARNING**

Follow strictly the internal connection marks to connect cables.

### 2.2.9 Measuring Instrument

To ensure that each electrical parameter meets requirement during electrical connection and commissioning, please use related electrical measurement instruments.

**WARNING**

- Instrument for measurement of the electrical parameters should be high quality instrument with sufficient measuring range
- Make sure the connection and use of the instrument are correct to avoid arc and other dangerous situations
- Personal Protective Equipment (for example, insulation gloves and etc.).

### 2.2.10 Volt-free Operations

Perform operations to the PCS only when it is completely voltage-free and current-free.

- Avoid any accidental re-connections of the PCS.
- Verify that no voltage or current is present inside the PCS with appropriate testing devices.
- Ground and short-circuit whenever necessary.
• Cover possible live parts with insulation cloth to avoid accidental contact.
• Ensure sufficient escape room.
• Wait at least 5 minutes until the inner capacitors discharge completely.

2.2.11 ESD Protection

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>The PCS may be damaged irreversibly by electrostatic discharge (ESD) at its components.</td>
</tr>
<tr>
<td>• During the operation of the PCS, please observe all the ESD-related safety regulations, for example wear antistatic wrist strap.</td>
</tr>
<tr>
<td>• Avoid unnecessary touch of the printed circuit board or other sensitive components.</td>
</tr>
</tbody>
</table>

2.2.12 Moisture protection

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penetrating moisture may damage the PCS! For normal operation of the PCS, please respect the followings:</td>
</tr>
<tr>
<td>• Do not open PCS doors when relative humidity is above 95%.</td>
</tr>
<tr>
<td>• Do not install the PCS in rainy days.</td>
</tr>
<tr>
<td>• The PCS is intended for operation in an environment having a maximum ambient temperature of 45 °C.</td>
</tr>
</tbody>
</table>

2.2.13 Disposal of Waste

When the PCS is end of life, it cannot be disposed of together with household wastes. Please contact the local authorized collection point.

2.2.14 Other Protection

Arc flash

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operate the PCS by strictly following the descriptions in this manual to avoid unnecessary injury to the persons and damage to the device. Arc flash, fire or explosion may follow if otherwise and Sungrow will hold no liability for the damages followed.</td>
</tr>
</tbody>
</table>

At least the following improper operations can cause the arc flash, fire and explosion inside the device. Remember all the time that these accidents can only be handled by qualified personnel. Improper handling of the accidents occurred may lead to more serious fault or accident.
• Plug and unplug the DC side HV fuse when it is alive;
• Touch the end of the cables that has no insulating treatment and may still be alive;
• Touch the connection copper bus bar, terminal or other spare parts inside the device that may be alive;
• The power cable connection is loose;
• Spare parts like the bolts are falling inside the power module;
- Incorrect operation of the non-qualified persons that receives no training;
Before any operation to the device, a beforehand assessment of the possible arc flash in the operation area is necessary. If there is arc flash,
- The operators must receive related safety trainings;
- Try the best to assess the areas that may appear the electric shock;
- Before any operation in the area that may appear electric shock, wear personal protective equipment (PPE) that meets the requirement. A PPE category 2 is recommended.

Other

Use suitable protective equipment (for example safety goggles, earplugs, dielectric gloves, insulating shoes) when transporting or installing the device.

Emergency aid should be prepared beforehand since the PCS is always installed far away from the downtown area.

Every possible auxiliary method should be taken to ensure the safety of personnel and device.

- All the pictures and descriptions in this manual apply to the standard configuration of the PCS. The actual product you receive may differ. Should you have any specific requirements, please inform us.
- This manual may not cover all possible situations. Should a specific problem occur that is not explained in this manual, please contact Sungrow.
3 Delivery

3.1 Scope of Delivery

Materials described in this section should be included in the crate:

<table>
<thead>
<tr>
<th>Item</th>
<th>Name</th>
<th>Quantity</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PCS</td>
<td>1</td>
<td>Including accessories keys</td>
</tr>
<tr>
<td>2</td>
<td>Installation Manual</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>Operation Manual</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>Warranty Card</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>Product Test Report</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>Quality Certificate</td>
<td>1</td>
<td>-</td>
</tr>
</tbody>
</table>

3.2 Identifying the PCS

Identify the PCS from its nameplate. Two identical nameplates are located separately as shown by Item A in the figure below. They provide information on the type of PCS, the most important specifications, marks of certification institutions, website and serial number which are available and identified by Sungrow.

![Fig. 3-1 Nameplate Locations](image)

⚠️ WARNING

Very important parameters and other information are contained in the nameplate. Protect the two nameplates at all times! Do not tear or damage the nameplates.
3.3 Checking for Transport Damage

The PCS has been strictly inspected and tested before delivery. Despite robust packaging, the machine may be damaged during transport. Therefore, once you receive the PCS, a detailed inspection is necessary.

3.3.1 Checking the Package

Check the outer package at first. Check whether the package is damaged during transport.

- Then, check whether the shockwatch label and tiltwatch label on the package have turned to red.
- If the shockwatch label has turned to red, it means that collision may be happened during transportation.
- If the tiltwatch label has turned to red, it means that the tilt angle may be out of range during transportation.

Once any of the two labels have been found to be red, the inside device may be damaged. Please make a record on the bill of lading, and give the PCS a thorough test.

3.3.2 Checking the PCS

After unpacking, check the following items for any possible damages:

- Check to see if the delivery contents are complete as per section 3.1.
- Check to ensure that the PCS type is correct.
- Check the PCS outside and inside components to see if any damage has occurred during transportation.

If any damage is detected, contact the shipping company or Sungrow immediately. A relevant photo is preferred. We will provide you with the fast and best service.

⚠️ WARNING

Only install the PCS when it is technically faultless and safe to do so.

3.4 Storage

If it is not to be installed or commissioned immediately upon reception, the PCS should be stored appropriately.

- The unit must be stored in original packaging with the desiccant inside.
- The PCS must be stored on an even foundation, which must be solid enough to support the PCS.
- The unit must be stored in a clean and dry place to prevent dust and moisture.
- The storage temperature should be always between -40°C and +70°C. The storage relative humidity should be always between 0 and 95% without condensation.
- It is very important to keep the PCS away from harsh environment, for example shock cold, shock hot or crash.
- During the storage time, check periodically (at least once a week) for visible damages by rodents. Replace the packaging if necessary.
• Unpacking check if the storage is longer than half a year. Replace the desiccant bag and pack the PCS.

⚠️ WARNING

• The PCS must be packed!
• No stacking on top of the crate!
• No tilting of the device.

ℹ️ After long-term storage, a thorough and professional test is necessary before installation.
4 Product Description

4.1 Design of the PCS

4.1.1 Mechanical Data

**Dimensions**

![Dimensions of the PCS](image)

<table>
<thead>
<tr>
<th>Width</th>
<th>Height</th>
<th>Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1006mm(39.6inch)</td>
<td>2034(80inch)mm</td>
<td>850mm(33.5inch)</td>
</tr>
</tbody>
</table>

**Weight**

Net weight of the PCS: approx. 1600kg (3520lbs). For the real weight of the product you receive, please refer to the nameplate.

4.1.2 PCS Top and Bottom View

The PCS is equipped with a pedestal on the bottom as shown in Fig. 4-2 (figures in mm). Cool
aircomes inside the PCS through the front and cables through the bottom.
The two holes in the front of Fig. 4-2 are DC cable inlet and AC cable inlet.

Fresh air that the PCS needed comes into the PCS through the bottom air ducts and the bottom windows. Exhaust air comes out of the PCS through the PCS top air ducts. There is drop-proof cover on the top of the PCS to prevent water penetrating inside the device and damage the device. The air outlets on top of the PCS are shown in Fig. 4-3.

4.2 External Components

The external components of the PCS are shown in Fig. 4-4.
Fig. 4-4 External appearance of the PCS

The main external components of the PCS include:

• LED indicator
  Indicate the operation state of the PCS POWER, OPERATION, and FAULT
• LCD touch screen
  LCD displays PCS information, including charge-discharge amount, working mode and etc.
• Emergency Stop Button
  Stop the PCS in emergency situation by pressing this button.
• GRID MAIN SWITCH
  AC side switch to disconnect the AC side input. Rated 600 V ac, 400 A, and the short circuit rating is 200 kA.
4.3 Circuit Diagram

PCS realizes rectification and inversion through 3-phase full bridge conversion. The rectified output feeds to the storage batteries through EMC filter. The inverted output turns to sine-wave voltage through LC filter and then feeds to the grid after step-up by 3-phase transformer. The circuit diagram is shown in Fig. 4-5.
5 Installation Design

5.1 Solution with Optional Devices from Sungrow

The configuration of the energy storage system is shown in Fig. 5-1.

![Diagram showing energy storage system configuration]

PCS can also be used as a micro-grid system with PV system as shown below:

![Diagram showing micro-grid system configuration]

Fig. 5-2 Micro-grid system
5.2 Basic Requirements

With IP21 protection degree, it is suitable to install the PCS in clean and dry indoor plant environment. According to EMC requirements and its noise level, the PCS can be installed in industrial environment.

The following requirements should be met in order to ensure the normal operation of the PCS.

- The PCS must be installed in a specially designed electrical control room.
- Both cooling air inlet and exhaust air outlet of the electrical control room should be protected from dust, sand and rain.
- The installation ground should be dry and stable; prevent water logging; make sure the ground is not shaking and solid enough to support the weight of the PCS.
- Ambient temperature range: -30°C ~ +45°C; Relevant humidity: 0 - 95% (non-condensing).
- Maintain spaces around the PCS for proper ventilation, installation operation and passage (escape route).
- Ground resistance of the PCS should be less than 4Ω.
- Install the PCS in a place where you can see the LED indicators and LCD display conveniently and clearly.
- Never place any flammable substance inside or around the installation place.
- Clean installation environment.

5.3 Installation Environment Design

The PCS should be installed in electrical control room. The floor, clearances, ventilation equipment and precaution devices should be designed by professional personnel and satisfy the following requirements.

5.3.1 Floor

PCS should be installed on cement foundation with flame resistance material or steel channel support. The foundation must be solid and safe enough to position the PCS. It must be able to provide the load-carrying capacity necessary to cope with the weight of the PCS.

Any existing unevenness, depressions or slope must be corrected prior to installation.

During foundation construction, lay cable trench according to the whole situation of the plant and the cable routing method on the PCS bottom.

Drill holes on the ground. The positions of the holes should be exactly the same with the holes on the PCS base to connect the PCS firmly to the foundation.

5.3.2 Clearance Space

The minimum clearance space around the PCS shown below should be maintained for service operation, ventilation and escape route.

The space illustrated in this section is the minimum values. More space is recommended for better ventilation and higher conversion efficiency of the PCS.
Fig. 5-3 Clearance Space around the PCS

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C*</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>1100mm</td>
<td>500mm</td>
<td>500mm</td>
<td>600mm</td>
<td>600mm</td>
</tr>
</tbody>
</table>

*The distance is from the top of the PCS enclosure to the installation site ceiling. If exhaust air ducts are installed, the distance must be designed appropriately.

**NOTICE**

- The PCS can be installed side-by-side with other PCSs. The minimum distance should be kept between the leftmost or the rightmost PCS and the wall.
- Please refer to country-specific codes for escape route requirements.

### 5.3.3 Ventilation Requirements

The heat generated (hot air exhausted) by the PCS must be dissipated out of the electrical control room as soon as possible, in order to guarantee safe operation and high feed-in power.

**WARNING**

Ventilation ducts must be installed if the electrical control room is airtight (for example, no windows with air ducts or air grid).

**NOTICE**

High temperature inside the control room can lead to power limitations of the PCS!

Please observe the following items:

- Clean filter screens, cotton and grids of air inlet/outlet windows periodically.
- Check whether the ventilation fans of the PCS are working normally periodically.

It is recommended that ventilation ducts are installed in electrical control room, to ensure that the PCS is in good-working conditions.

For well-ventilation, the PCS installation environment should meet the following requirements:
• Plenty of pure and dust-free air should be available.
• Do not install the PCS in places with bad ventilation or low air flow; install fans to increase the ventilation rate;
• Dust-proof and rain-proof measures, for example filter must be taken to maintain the air quality.

5.3.4 Cable Trench

The external cables can route into or out of the cabinet through the bottom of the PCS. Cable trenches or steel supports above the floor are recommended (Refer to relevant design guides or standards). If cable trenches are designed, fix the PCS with foot screw or steel channel; if steel supports are designed, fix the PCS directly to the steel support.

Cable trenches should be dimensioned and designed by construction party and take the device weight and dimensions into consideration.

Good electrical connection is preferred among the cable trenches and between cable trenches and grounding electrodes.

Cable trenches are shown as below. Cable support arms can be used to support cables. Signal cables should be separated from power cables and DC loop should be separated from the AC loop for enough distance to avoid interference.

<table>
<thead>
<tr>
<th>Item</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Cable trench</td>
</tr>
<tr>
<td>B</td>
<td>Cable Support Arms</td>
</tr>
</tbody>
</table>

![Fig. 5-4 Cable trench design](image)

5.3.5 Other Requirements

**Room temperature**

Too high or too low temperature may affect the PCS normal operation! Take proper methods to make the PCS meet its operation requirements (temperature, humidity and etc.).

• High ambient temperature may affect the PCS output. Please properly design the ventilation method.
• Too low ambient temperature will also affect PCS normal operation. Heater equipment is needed when the ambient temperature is lower than -25°C.

**Firefighting requirements**

• Design of the electrical control room must be in accordance with firefighting requirements.
• Place no flammable or blast materials within 5m of the electrical control room.

**Surge protection and others**

• Surge protection measures should be taken into account when designing the electrical control room.
• Ensure the roof rain-proof of the control room and check the roof periodically.

5.4 Wiring Specification

Cables in the PCS can be classified into power cables, control cables and data cables.

It is recommended that the power cables and data cables be installed on separate cable support arms for at least 200mm. Avoid long parallel runs of the two kinds of cables in order to decrease electromagnetic interference.

Where data cables must cross power cables make sure they are arranged at an angle as near to 90° as possible. Do not run extra cables through the PCS.

The following table shows the recommended minimum distances between different parallel lengths of shielded data cables and power cables.

<table>
<thead>
<tr>
<th>Parallel length (inch, m)</th>
<th>Min. Distances (inch, mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7874 inch (200m)</td>
<td>12 inch (0.3m)</td>
</tr>
<tr>
<td>11811 inch (300m)</td>
<td>20 inch (0.5m)</td>
</tr>
<tr>
<td>19685 inch (500m)</td>
<td>48 inch (1.2m)</td>
</tr>
</tbody>
</table>

Data cable must be routed as near to the ground or supports (i.e. support beam, steel channel or metal rail, etc.) as possible.

5.5 Tightening Torques and Cable Protection

5.5.1 Cable Fixing

Tighten the cable with proper torque shown below to prevent the poor contact, high contact resistance, or fire caused by the looseness of cable lugs.

<table>
<thead>
<tr>
<th>Screw size</th>
<th>Torque (N·m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M4</td>
<td>18 in-lbs(2 N·m)</td>
</tr>
<tr>
<td>M5</td>
<td>28 in-lbs(3.2 N·m)</td>
</tr>
<tr>
<td>M6</td>
<td>62 in-lbs(7 N·m)</td>
</tr>
<tr>
<td>M8</td>
<td>177 in-lbs(20N·m)</td>
</tr>
<tr>
<td>M10</td>
<td>301 in-lbs (34 N·m)</td>
</tr>
</tbody>
</table>

Secure the cable at proper place to reduce the stress of the cable lug.

5.5.2 Cable Protections

Cable protections include the communication cable protection and power cable protection.

• Protection of communication cables

Communication cables are thin and easily to be broken. Lay power cables first and then communication cables.

Communication cables should be laid in cable trenches or cable support arms and tightened up by cable ties.

Avoid heating elements and the strong electric fields.

• Protection of power cables

Strong electric currents are present in the power cables. Protect the insulating layer from scratches and damages.

Fix the power cable properly.
6 Mechanical Installation

6.1 Transport and Shipping

6.1.1 Attention

**WARNING**
- The PCS should be transported and installed as an integrated unit. Disassembly without the permission of Sungrow will void any or all warranty rights.
- Transport the PCS by strictly following the description in this chapter.

**WARNING**
- Always keep in mind the non-central center of gravity of the PCS and gravity mark on the PCS.
- Please take the heavy weight of the PCS into consideration during shipping and moving.

**WARNING**
- Always keep the PCS upright!
- Inclination angle <5°. If the inclination angle is more than 5°, PCS may tip over. Since the device is heavy and big, there may be personal injury or device damage.
- Avoid sudden force when moving or transporting the device.

**WARNING**
- Do not transport the PCS in raining or other harsh environments.
- Take proper protection methods if the PCS must be transported in harsh days.

**WARNING**
- Only qualified personnel with professional authorization can transport and move the PCS.

**NOTICE**
- Please take necessary auxiliary methods to transport the PCS to the final installation place safely.

6.1.2 Moving the Packed PCS

Please transport the PCS with package for better protection. Pay attention to the symbols, marks and data on the package.
The moving of the packed PCS must be carried out with the aid of specific equipment, such as forklift, pallet truck or crane. Always keep in mind the heavy weight and the uneven distribution of the weight of the PCS during moving.

- Forklift

The standard way to transport the PCS is using a forklift. The central of gravity of the crate should be placed between the two prongs. A trial transport is recommended. The length of prongs should be at least 0.8m, see item A in the following figure.

The transport, move and put down of the PCS must be slow and stable. Place the PCS only where is solid and smooth.
**Fig. 6-1 Move the Packed PCS via a Forklift**

Safety Operation Rules of Forklift should be observed at all times. The big size of the PCS may block the driver’s view, please transport the device with the help of other persons.

- Pallet Truck

**Fig. 6-2 Move the Packed PCS via a Pallet Truck**

If the transportation route is stable on site, a pallet truck can be used. The central of gravity of the crate should be placed between the two prongs. A trial transport is recommended.

The transport, move and put down of the PCS must be slow and stable. Place the PCS only where is solid and smooth.

Safety Operation Rules of Pallet Truck should be observed at all times. The big size of the PCS may block the driver’s view, please transport the device with the help of other persons.

- Crane

The crane can be used to move the PCS. Tie two flexible straps to the external crate through the crane marks. The lifting hook should be vertical to the central of gravity of the device. Tilting transport is strictly forbidden.

The transport, move and put down of the PCS must be slow and stable. Place the PCS only where is solid and smooth.

Safety Operation Rules of Crane should be observed at all times. Avoid moving PCS with crane in raining, heavy fog, or strong wind conditions.
6.1.3 Moving the Unpacked PCS

Lay the DC and AC cables before moving the PCS to the final installation place. Since those cables are thick, once the PCS is installed, those cables are hard to operate and easily broken.

Unpack the PCS only just before it is to be installed. Forklift, rail steels or crane can be employed to move the PCS after unpacking.

- Forklift

Safety Operation Rules of Forklift should be observed at all times.

The transport, move and put down of the PCS must be slow and stable. Place the PCS only where is solid and smooth.

- If the unpacked PCS is far from the final position, it can be moved together with the wooden baseboard by a forklift. Place the gravity of the PCS between the two prongs of the forklift.
Fig. 6-4 Move the PCS with the Wooden Baseboard by forklift

- If the wooden baseboard is removed, move the PCS with forklift directly. You need to remove the front and rear base covers of the PCS and place the central of gravity between the two prongs and then move the device.

Fig. 6-5 Move the PCS by forklift

- **Pallet Truck**
  Pallet truck can be used to move the unpacked PCS. A trial transport is recommended. The central of gravity of the crate should be placed between the two prongs.
  
The transport, move and put down of the PCS must be slow and stable. Place the PCS only where is solid and smooth.
  
  Safety Operation Rules of Pallet Truck should be observed at all times.

- **Crane**
  PCS is designed with lifting beams for easy crane transport.
  
  During moving, the center of the hook should be vertically through the PCS center. A trial lifting is necessary.
  
  Safety Operation Rules of Pallet Truck should be observed at all times.
The transport, move and put down of the PCS must be slow and stable. Place the PCS only where is solid and smooth.

Fig. 6-6 Transport the PCS by crane

- Rail Steels
If the door of the electrical control room is too narrow to use forklift or crane, the rail steels can then be used to move the PCS to its final installation place. Crowbar and jack need also be used.

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Take the dimensions of the PCS and other devices into account when designing the door of the control room for convenient transport of the PCS.</td>
</tr>
</tbody>
</table>

| Lubricant can be used on the surface of the rail steels. |

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>No matter which transport method is adopted, please make sure:</td>
</tr>
<tr>
<td>• Keep the center of gravity in mind at all time;</td>
</tr>
<tr>
<td>• Keep the heavy weight of PCS in mind at all time;</td>
</tr>
<tr>
<td>• Take proper auxiliary methods to ensure the safety of transport personnel;</td>
</tr>
</tbody>
</table>

6.2 Field Installation

6.2.1 Unpacking the PCS

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Since the PCS package panels are heavy, please make sure at least two persons are operating together during PCS unpacking</td>
</tr>
</tbody>
</table>

Proceed as follows to unpack the PCS from the shipping crate:

**Step 1** Remove the crate’s wooden top panel.
Step 2 Remove the crate's wooden sidepanel.
Step 3 Remove the barrier bag material from the crate.
Step 4 Remove the PCSs anchor hardware that bolts the PCS to the pallet.

PCS is removed from the wooden baseboard.

---

**WARNING**

Once the PCS is removed from the wooden baseboard, do not transport the PCS by the baseboard. Meanwhile, take possible measures to prevent the PCS from rolling over.

---

Pack the PCS as the reversed procedures shown above. Keep the barrier materials and desiccant bags inside. Store the packed PCS with the descriptions in this manual.

---

6.2.2 Checking before Fixing

It is advisable to fix the PCS to the steel channel. Before fixing the PCS, please make sure:

- The built of cable trench meets the requirements of the PCS installation;
- The installation and holes of the steel channel meets the requirements of the PCS installation.

PCScan also be fixed to the ground by foot screws. Drill holes on the ground and make sure the dimensions of the holes exactly match the holes of the PCS.

6.3 Fixing the PCS

Place the AC side of the PCS near to the downstream devices to shorten the cable length from PCS AC side to the downstream 3-phase.

Proceed as follows to fix the PCS:

Step 1 Move the PCS to its final installation place using proper tools;
Step 2 Fix the PCS to the steel channel or ground by M12 bolts;
Step 3 Install the front and rear panel of PCS base to finish the PCS fixing.
Connection sequence between PCS base and channel steels is described below.

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Nut</td>
</tr>
<tr>
<td>B</td>
<td>Spring washer</td>
</tr>
<tr>
<td>C</td>
<td>Square washer</td>
</tr>
<tr>
<td>D</td>
<td>PCS base</td>
</tr>
<tr>
<td>E</td>
<td>Channel steels</td>
</tr>
<tr>
<td>F</td>
<td>bolt</td>
</tr>
</tbody>
</table>
7 Electrical Connection

7.1 Safety Instructions

The safety instructions in this chapter and country/regional-specific safety instructions must be respected for safe electrical connection.

⚠️ DANGER

High voltage! Electrical hazards!
• Do not touch the live components of the device.
• Make sure the AC and DC sides are voltage-free before installation.
• Never put flammable or explosive materials in the vicinity of the PCS.

⚠️ WARNING

• Observe all the country/regional-specific standards and regulations for electrical connection.
• Connect the PCS to public grid only after receiving authorization from the local network operator and only by professional technicians.

⚠️ WARNING

• Only professional electricians can perform the operations described in this chapter
• Strictly follow all the device internal cable connection instructions.

Five Safety Rules

Throughout electrical connections and other work on the PCS, observe the following Five Safety Rules:

• Disconnect all the external connections and disconnect the PCS internal power supply.
• Avoid any accidental re-connections of the PCS.
• Verify that no voltage or current is present inside the PCS with appropriate testing devices.
• Ground and short-circuit whenever necessary.
• Cover possible live parts with insulation materials to avoid accidental contact.

7.2 Installation Tools

Prepare the following tools before installation:

• Torque wrench
• Screwdrivers
• Wire stripper
7.3 Parts for Cabling

**WARNING**

- Incorrect connection of power cables will cause fires. Follow the sequence when connecting the power cables.
- Ensure the fastness of the connection parts. Poor contact or oxidation of the contact surface may cause fire.
- The National Electrical Code, ANSI/NFPA 70 wiring methods are to be used.

Clean the connection terminals before wire connection. Do not touch the terminal after cleaning.

Spare parts required for power cables connection like the screws are within the scope of delivery. Please follow strictly the description in this chapter.

### 7.3.1 Copper Wire Connection

If copper wires are used, connect the spare parts as described below:

![Copper Wire Connection Diagram](image)

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper Bar</td>
<td>Copper terminal</td>
<td>Bolt</td>
<td>Spring washer</td>
<td>Flat washer</td>
<td>Nut</td>
</tr>
</tbody>
</table>

### 7.3.2 Aluminum Wire Connection

When the aluminum wire is selected, an albronze filter is needed as shown below:
### Fig. 7-2 Aluminum wire connection sequence

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper Bar</td>
<td>Aluminum terminal</td>
<td>Bolt</td>
<td>Spring washer</td>
<td>Flat washer</td>
<td>Nut</td>
<td>Albronze filter</td>
</tr>
</tbody>
</table>

Beware the direction of the albronze filter, i.e. the copper side must be closely attached to the copperbar and the aluminum side must be closely attached to the aluminum connection terminal.

### Fig. 7-3 Albronze filter connection direction

When the busbar has several connection terminals, an intact albronze filter is required as shown in the following figure.

### Fig. 7-4 Albronze filter connection sequence

#### 7.4 Preparation before Electrical Connections

**Step 1** Close the AC main switch.

**Step 2** Open the front door.

Open the front door as follows before any cable connection.
1. Open the door lock as shown below:

```
Move the keyhole cover up to reveal the keyhole
Insert the key and turn it clockwise
Turn the handle to the following position
```

![Fig. 7-5 Open the door lock](image)

2. Open the front door by pulling the handle

**Step 3** Remove the protection cover.

The PCS is equipped with transparent protection grid inside to maintain safe operation and reduce noise level. Remove the grid prior before electrical connections.

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All external cables connect to the connection terminal through the cable entries on the bottom of the PCS.</strong></td>
</tr>
</tbody>
</table>

1. Open the cabinet door and find the transparent protection grid.
2. Unscrew the bolts on the bottom of the transparent protection grid and remove the protection grid.

**Step 4** Open the cable entries.

Cable entries are reserved on the bottom of the PCS. Lead the external cables to the PCS through the bottom of the PCS. Proceed as follows to open the cable entries:

1. Turn the two nuts on the back of the cover plate counterclockwise until the cover plate can move forward and backward.
2. Turn the cover plate backward to open the cable entry.

Pull the cover plate back to the front door and screw the nut clockwise to fasten it after cable connection. Seal the gaps with polyurethane foams to prevent rodents from coming inside.

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Protective sponges are used to prevent the cover plate and baseplate from scratches. Do not remove them.</strong></td>
</tr>
</tbody>
</table>

**Checking the Cables**

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Check to ensure the intactness and insulation of all cables before electrical connection. Poor insulation or damages of cables may cause potential hazards. Replace them immediately.</strong></td>
</tr>
</tbody>
</table>
During Connection

**WARNING**

- Make sure the DC cables and AC cables are correctly routed before connection.
- Do not pull the cables hard during connection.
- Make sure there is enough wire bending space for all cables.
- Take proper methods to reduce the stress of cables.
- Check carefully to ensure the correctness and fastness of the connections.

7.5 Cable Requirements

Choose cables according to the requirements below:

- All cables must have sufficient ampacity. The ampacity of the conductor can at least be influenced by environmental conditions, conductor insulation materials, laying, wire materials and cross-sectional areas and etc.
- All the cables must be chosen according to the maximum current of the PCS.
- Cables for one side should be of the same type and specification.
- Flame retardant and fire resistant cables are recommended.

Recommended cable specifications are listed below.

<table>
<thead>
<tr>
<th>Cable</th>
<th>Min. Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC+</td>
<td>At least 3 with each 250Kcmil (120 mm²), copper, 90°C</td>
</tr>
<tr>
<td>DC-</td>
<td>At least 3 with each 250Kcmil (120 mm²), copper, 90°C</td>
</tr>
<tr>
<td>Grid phase L1</td>
<td>2 for each phase, with each phase 250Kcmil (120 mm²), copper, 90°C</td>
</tr>
<tr>
<td>Grid phase L2</td>
<td></td>
</tr>
<tr>
<td>Grid phase L3</td>
<td></td>
</tr>
<tr>
<td>Off-Grid neutral</td>
<td></td>
</tr>
<tr>
<td>Ground cable</td>
<td>1/0 AWG (53.5 mm²), copper, 90°C</td>
</tr>
<tr>
<td>Communication</td>
<td>2x18AWG or 2x17AWG (2x0.75 mm²), shielded cables are recommended</td>
</tr>
<tr>
<td>cable</td>
<td></td>
</tr>
</tbody>
</table>

**WARNING**

Overloading operation of cables is strictly forbidden.

- Cable sizes in the above table are only for copper cables. If aluminum cables are used on site, please choose cable with appropriate cross sectional areas.
- Cable specifications and inputs in the above table are for standard configuration PCS. Should you have any specific requirements, please inform us. Please refer to the actual product you received for the detailed specification.

7.6 DC Connection

Storage battery can connect to the DC side of the PCS. There are connection holes reserved in
the positive and negative polarities of the PCS as shown in Fig. 7-6.

Fig. 7-6 Electrical connection terminal

**NOTICE**

Check the material of the external connection points. If the copper material and aluminum material are connected, a special albronze connector is required. Do not connect them directly. (Albronze connector can be ordered from Sungrow or other place.)

To meet the current requirement of maximum DC current input and leave sufficient margin, connect at least 3 input cables with specification of 120mm² for each of the positive (+) and negative polarity (-). Proceed as follows to connect the DC cable:

**Step 1** Disconnect the switch upstream of the PCS to make sure the DC side is voltage-free;

**Step 2** Measure by multimeter the open-circuit voltage of the storage battery does not exceed the DC maximum DC voltage.

**Step 3** Measure the positive and negative polarity by multimeter.

**Step 4** Strip off the insulation cover of the cable end with a stripped length of 5mm longer than the depth of the cable lug; connect 3 input cables with specification of 95mm² for each of the positive and negative polarity of the PCS DC input.

**Step 5** Crimp the DT-cable lug.
1. Put the stripped cable inside the cable lug;
2. Tighten the cable lug with relevant tools. The crimping number should be more than two.

**Step 6** Insert the heat-shrinkable tubing:
1. A tubing with length of 5cm is recommended;
2. Insert the heat-shrinkable tubing into the cable lug;
3. Shrink the tubing with hot air blower.

**Step 7** Connect DC+ cable to the positive pole of the battery.
1. Select bolt M10 to connect the cable lug to the copper bar.
2. Tighten the screws with screwdriver or wrench.

**Step 8** Connect the DC- of the PCS to the negative polarity of the storage battery by the same method of step 7.

**Step 9** Make sure the cable connections are secure.

### 7.7 AC Connection

PCS AC side output can be increased to 480Vac after internal transform and then connect to load or 3-phase grid.

When the device is operated in grid system, do not connect the N cable and the PCS only connects the L1 (A) / L2 (B) / L3 (C) and PE cable.

The PCS is not intended for connection to a grounded WYE configured transformer.

When the device is operated in off-grid system, short-circuit the N cable and PE cable inside the PCS by a 1/0AWG cable and then connect the N / L1 (A) / L2 (B) / L3 (C) and PE cable according to the requirement.
Proceed as follows to connect the PCS AC side to the grid or load.

Connect to Grid

**WARNING**

Disconnect the upper AC side circuit breaker to make sure the contact terminals are voltage-free when connecting to AC grid.

Connection to the grid must be done only after receiving approval from utility grid and following all related safety instructions.

The AC output is not bonded to ground inside of the equipment.

The DC and AC circuits are isolated from the enclosure and that system grounding, if required by Section 250 of the National Electrical Code, ANSI/NFPA 70, is the responsibility of the installer.

The PCS could only work under on-grid mode or off-grid mode, and could not be switched between these two modes in the field.

**Step 1** Disconnect the upper AC circuit breaker and measure by multimeter to make sure terminals are voltage-free.

**Step 2** Make sure AC cable connection sequence is correct.

**Step 3** Strip off the insulation cover of the cable end with a stripped length of 5mm longer than the depth of the cable lug; connect 2 input cables with specification of 120mm² for each phase of the of the PCS AC output.

**Step 4** Crimp the DT-cable lug.

1. Put the stripped cable inside the cable lug;
2. Tighten the cable lug with relevant tools. The crimping number should be more than two.

**Step 5** Insert the heat-shrinkable tubing:

1. A tubing with length of 5cm is recommended;
2. Insert the heat-shrinkable tubing into the cable lug;
3. Shrink the tubing with hot air blower.

**Step 6** Connect cable L1 to the grid L1, phase A(U).
1. Select bolt M10 to connect the cable lug to the copper bar.
2. Tighten the screws with screwdriver or wrench.

**Notice**
* Long bolts may affect the insulation and may even cause short circuit of the device. Bolt M10*20 is recommended.
* Remove the heat-shrinkable tubing between the cable lug and the copper bar if any. Poor contact or over-heating may follow if otherwise.

**Step 7** Connect cable L2 to grid L2, i.e. phase B(V) and cable L3 to grid L3, i.e. phase C(W) following the procedure in step 6.

AC output 3-phase cable L1, L2 and L3 should be distinguished from each other by brown, black and gray (IEC standard) or yellow, green and red heat-shrinkable tubing.

**Step 8** Check to ensure the connection is secure.

**Connect to Load**

**Step 1** Connect the N cable inside the PCS to the PE copper bar by a 1/0AWG cable.

**Step 2** Refer to the description above to connect the L1, L2 and L3 inside the PCS to the L1(A), L2(B), and L3(C) of the load.

**Step 3** Connect AC output N to Load phase N.

### 7.8 Ground Connection

Ground all PCSs via ground cables to ensure safety.

The PE copper bar has been firmly connected to the enclosure of PCS inside the cabinet before delivery. Connect the PE copperbar to the equipotential bonding equipment in the installation field or electrical control room using ground cable with cable cross-sectional area of 35mm². The ground resistance must not exceed 4Ω. Ground terminal is shown in Fig. 7-6.

If several PCSs are connected in parallel and if different cabinets do not connected by bolts, fix the yellow-green cable of at least 35mm² to the PCS enclosure (use cable lug plate and bolt) to ensure they are equipotential. This can avoid current appearing (caused by the unbalance the device potential) in the shielded layer of the communication cable.

**Warning**

* Ground cable should be grounded properly! Otherwise:
  * When a fault occurs, operators may have electric shock.
  * Device may be damaged by lightening shock!
  * Device may not be able to operate normally!
NOTICE

Notice the followings during ground connection:

• Ground connection must meet the notional/local standards and specifications.
• Ground connection and connection with device and grounding electrode should be secure.
• Measure the ground resistance after ground connection to make sure the resistance should not exceed 4Ω.

⚠️ WARNING

Strictly follow all the device internal cable connection instructions.

7.9 Communication Connection

⚠️ WARNING

Strictly follow all the device internal cable connection instructions.

7.9.1 Communication Terminals

When PC is used to monitor a single PCS, PCS can adopt RS485 bus. Connect the communication port A and B of the RS485 to the PC via a RS485/RS232 convertor. Internet communication can also be adopted. Fig. 7-7 shows the communication port.
7.9.2 Communication Solution

**RS485 communication solution**

The communication solution of PCS is shown in Fig. 7-10: connect the communication port A1 and B1 of the RS485 to a RS485/RS232 convertor and then connect to the monitor PC.

**Connection step**

**Step 1** Strip off the insulation layer of the two cables that connected to one connection terminal.

**Step 2** Insert the bare copper cable to the cold-pressed terminal and connect them tightly with crimping pliers.

**Step 3** Connect the cold-pressed terminal to the communication terminal.
**Step 4** Twist the shielded layer of the two cables into one and then cover it with thermal shrinkable sleeve.

![Terminal connection](image)

**Fig. 7-9** Terminal connection

---

**NOTICE**

The RS232 communication distance should be within 15 meters and the RS485 communication distance should be within 1200 meters. If the distance is exceeded, the LAN communication method should be used. The electric/optical adapter and the optical fiber part should be designed separately according to the actual situations. Sungrow can provide professional technical solutions.

- RS485 cable should be shielded twisted-pair for good communication (RVVSP-2*1.0 shielded twisted-pair cable is recommended).
- Shielding layer of shielded cable should be single-point grounded in the site of monitoring terminal.

---

**Ethernet Communication Solution**

Connect the Ethernet port of the PCS to the PC by network cable for single PCSs Ethernet communication solution.

For several PCSs’ Ethernet communication, Ethernet switch is needed. The following monitoring solution can be adopted.

![Ethernet communication](image)

**Fig. 7-10** Ethernet communication for several PCSs
## 7.10 Installation Checklist

Check the mechanical and electrical installation of the PCS before commissioning. Go through the checklist below with the aid of another person.

Make record during checking. Make improvement once any unconformity is found.

### Mechanical Installation

- PCS is intact without distortion or damage
- PCS bottom is reliably fixed and supported
- The clearance spaces around the PCS are sufficient
- The PCS ambient temperature, humidity and ventilation meet the requirements
- Cooling air circulates smoothly
- Cabinets are integrated and reliably sealed

### Electrical Installation

- PCS is grounded properly and reliably
- The grid voltage matches the nominal output voltage of the PCS unit
- Grid side connection sequence is correct and the torque meets requirements
- Polarities of the DC input connection are correct and the torque meets requirement
- Communication cables are connected correctly and far away from other cables
- Marks on the cables are correct, clear and distinguishable
- Insulation protection cover is reliable and intact; warning labels are clear and distinguishable

### Others

- Insulation belts tighten all unused cables
- No tools, spare parts, dusts or other foreign objects falls inside the PCS
- No condensation or ice inside the cabinet
8 Commissioning

8.1 Commissioning Requirements

Before starting PCS for the first time, all installation performed on the device should be checked thoroughly.

- Make sure all cables are connected correctly and all bolts are screwed securely.
- Make sure DC side voltage meets PCS requirement and the polarities are correct.
- Make sure AC side voltage meets the PCS requirement.
- Make sure all system connections meet the requirements of related standards and regulations.
- Make sure system is properly grounded. Ground resistance decides the safety of the whole system. Make sure the ground resistance meets the requirement (ground resistance should be no more than 4Ω) before commissioning.

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>All operation during commissioning must be performed by qualified personnel only. Unauthorized persons are not permitted to operate.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disconnect all external AC and DC switches before commissioning.</td>
</tr>
</tbody>
</table>

8.2 Checking before Commissioning

8.2.1 Checking Cable Connection

- Check cable connection for any possible damages or cracks;
- Check again to make sure all cables are connected correctly according to the system circuit diagram. Adjust the cable connection if necessary.
- Make sure all cables are connected securely. Fasten corresponding installation screws if necessary.
- Check the PE equipotential connection. Ensure the PCS AC side PE ground copper bar has connected to the equipotential connection point in the electrical room and properly grounded. The ground resistance should be no more than 4Ω.

8.2.2 Checking the PCS

Check the PCS before PCS power on:

- Ensure the AC and DC switches are disconnected.
- Ensure the emergency stop button is released and work normally.
• Check and ensure the PCS and switches and buttons upstream and downstream operate flexibly and meet the requirement.

### 8.2.3 Checking Batteries

#### WARNING

**Make sure the measuring devices are connected and used correctly. There will be electric arc if otherwise.**

#### WARNING

**DC side voltage should not exceed the PCS maximum allowable DC input voltage.**

**Too high DC voltage may damage the PCS even cause safety incident.**

Check the storage battery before start to make sure the open-circuit voltage of the battery meet therequirement.

• Record the field measured data accurately;
• Make sure the positive and negative polarities are correct. Incorrect polarity may seriously damage the module.
• Measure the resistance of cables (between the terminal box and the PCS) by ohmmeter. Accurately record all measured data.

### 8.2.4 Checking Grid Voltage

Measure accurately the grid side 3-phase line voltage: L1-L2, L1-L3, and L2-L3. The measured data should not exceed PCS AC side permissible voltage and the three phases are balance.

#### TIP

**Adjust the transfer ratio of the transformer by qualified personnel if the grid voltage deviation is serious.**

• Measure accurately the AC grid side frequency. The measured data should not exceed the grid permissible frequency range of the PCS.
• Measure the voltage THD of each phase if necessary. PCS may not operate if the THD is serious.
• Record accurately all measured data.

### 8.3 Preparation before Starting

Prepare for starting the PCS when the abovementioned items are checked and meet requirements:

• Place the disassembled protection grids to their original places and make sure the connection is secure.
• Close and lock the cabinet front door. Store the key by appointed person.
• Clean the device site. Make sure the field is clean without any flammable or explosive materials.
• Make sure the ventilation of the device installation place is normal.
• Check again and ensure the PCS and switches and buttons upstream and downstream operate flexibly and meet the requirement.

8.4 Starting the PCS

If all tests and measurements have been performed, and all measured data lie within the permissible range, the device can be switched on for the first time. Proceed as follows to start the PCS:

Step 1 Connect the DC storage battery and grid correctly.

Step 2 Turn the circuit breaker handle of the PCS AC side to the ON position.

Step 3 It takes approximately 5-10 minute for the automatic initialization of the power inversion circuit and LCD control panel. The POWER LED of the PCS will be on.

Step 4 Work state displayed on the LCD is Stop when the AC voltage meets the requirement.

Step 5 PCS will turn to Run state according to directions if all requirements are met. The OPERATION LED is on and PCS begins normal operation.

8.5 LCD Parameter Setting

When the LCD is on, set the LCD display language, data and time, communication parameters, and active power limitation etc. according to the Operation Manual. You can also view the PCS running information and perform pertinent operation through LCD display.

8.6 Completing Commissioning

Perform the following tests when the PCS is successfully connected to the grid:

• Check whether there are anomalies of the PCS: abnormal noise, overheating, smoking or unusual odor.

• Measure the PCS's grid-connected voltage, current and THD for unstableness.

• Check if the PCS enclosure is correctly grounded.

• Check if the LCD display is operated normally and correctly.

If several PCSs are commissioning at the same time, operate them as the same principle of the single PCS operation. During commissioning, record accurately the running data of each PCS.

PCS can operate normally after completing.

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCS needs no manual control in daily operation. Open the cabinet door only for maintenance or troubleshooting and by qualified personnel only.</td>
</tr>
<tr>
<td>Keep the door closed and locked and store the keys of the door by appointed personnel during normal operation.</td>
</tr>
</tbody>
</table>

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9 Appendix

9.1 Technical Data

9.1.1 Electrical Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC side parameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nominal DC power</td>
<td>250kW</td>
<td></td>
</tr>
<tr>
<td>Max. DC voltage</td>
<td>870V</td>
<td></td>
</tr>
<tr>
<td>Working voltage range</td>
<td>500V - 850V</td>
<td>-</td>
</tr>
<tr>
<td>Min. DC voltage</td>
<td>480V</td>
<td></td>
</tr>
<tr>
<td>AC side parameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working mode</td>
<td>Continuous</td>
<td></td>
</tr>
<tr>
<td>Nominal Output Power</td>
<td>250 kVA</td>
<td></td>
</tr>
<tr>
<td>Output overload capacity</td>
<td>275 kVA</td>
<td></td>
</tr>
<tr>
<td>Max. AC current</td>
<td>300A</td>
<td></td>
</tr>
<tr>
<td>Max. THD</td>
<td>&lt;3% at nominal power</td>
<td></td>
</tr>
<tr>
<td>Nominal grid voltage</td>
<td>480V</td>
<td></td>
</tr>
<tr>
<td>Grid voltage range</td>
<td>480V±10%</td>
<td></td>
</tr>
<tr>
<td>Nominal grid frequency</td>
<td>60Hz</td>
<td></td>
</tr>
<tr>
<td>Grid frequency range</td>
<td>55 - 65Hz</td>
<td></td>
</tr>
<tr>
<td>Power factor at nominal power</td>
<td>&gt;0.99</td>
<td></td>
</tr>
<tr>
<td>Isolation transformer</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>DC current injection</td>
<td>&lt;0.5% at nominal output current</td>
<td></td>
</tr>
<tr>
<td>Grid-connected power factor range</td>
<td>1 (leading) - 1 (lagging)</td>
<td></td>
</tr>
<tr>
<td>Independent inverter voltage range</td>
<td>480V±10%</td>
<td></td>
</tr>
<tr>
<td>Independent inverter output voltage THD</td>
<td>&lt;3% (linear load)</td>
<td></td>
</tr>
<tr>
<td>Independent inverter unbalance load capacity</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Independent inverter voltage transition range</td>
<td>Within 10% (resistance load 0% - 100%)</td>
<td></td>
</tr>
<tr>
<td>Utility interconnection voltage trip limits - Overvoltage/Fast</td>
<td>576-624 V</td>
<td>Default setting: 576</td>
</tr>
<tr>
<td>Utility interconnection voltage trip limits - Overvoltage/Slow</td>
<td>528-576 V</td>
<td>Default setting: 552</td>
</tr>
<tr>
<td>Utility interconnection voltage trip limits - Undervoltage/Slow</td>
<td>240-430 V</td>
<td>Default setting: 422</td>
</tr>
<tr>
<td>Utility interconnection voltage trip limits - Undervoltage/Fast</td>
<td>192-240 V</td>
<td>Default setting: 240</td>
</tr>
<tr>
<td>Utility interconnection voltage trip times - Fast</td>
<td>0.12-10.0 s</td>
<td>Default setting: 0.2</td>
</tr>
<tr>
<td>Utility interconnection voltage trip times - Slow</td>
<td>0.12-10.0 s</td>
<td>Default setting: 2.0</td>
</tr>
<tr>
<td>Utility interconnection frequency trip limits - Overfrequency</td>
<td>60.2-65.0 Hz</td>
<td>Default setting: 61.0</td>
</tr>
</tbody>
</table>
### 9.1.2 Mechanical Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions(W×H×D)</td>
<td>1006mm(39.6inch) x 2034(80inch)mm x 850mm(33.5inch)</td>
</tr>
<tr>
<td>Weight</td>
<td>1600kg (3520lbs)</td>
</tr>
</tbody>
</table>

### 9.1.3 System Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. efficiency</td>
<td>97.3%</td>
</tr>
<tr>
<td>Protection Degree</td>
<td>IP21 (indoor), Type 1</td>
</tr>
<tr>
<td>Power Consumption at startup</td>
<td>&lt;80W</td>
</tr>
<tr>
<td>Noise level</td>
<td>&lt;70dB</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-30°C<del>45°C (-22°F</del>113°F)</td>
</tr>
<tr>
<td>Cooling Concept</td>
<td>temperature-controlled forced air cooling</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>0~95% (Non-condensing)</td>
</tr>
<tr>
<td>Max. Working Altitude</td>
<td>6000m (operation with derating above 4000m)</td>
</tr>
</tbody>
</table>

### 9.1.4 Display and Communication

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display</td>
<td>Touchscreen</td>
</tr>
<tr>
<td>Standard communication</td>
<td>RS48S, Ethernet</td>
</tr>
<tr>
<td>Communication with BMS</td>
<td>CAN, RS48S</td>
</tr>
<tr>
<td>Communication protocol</td>
<td>Modbus/ IEC104</td>
</tr>
</tbody>
</table>

### 9.1.5 Other Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC side disconnection device</td>
<td>Contactor</td>
</tr>
<tr>
<td>AC side disconnection device</td>
<td>Circuit breaker</td>
</tr>
<tr>
<td>DC over-voltage protection</td>
<td>Yes</td>
</tr>
<tr>
<td>AC over-voltage protection</td>
<td>Yes</td>
</tr>
</tbody>
</table>
### 9.2 Exclusion of Liability

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- Install or operate the product in unintended environment
- Install or operate the product without observing relevant safety regulations in the deployment location
- Ignore the safety warnings or instructions contained in all documents relevant to the product
- Install or operate the product under incorrect safety or protection conditions
- Alter the product or supplied software without authority
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- Unforeseen calamity or force majeure

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### 9.3 Contact Information

Should you have any questions or queries about this product, please contact us through the following information. We will be more than happy to assist you!

**Headquarters**

<table>
<thead>
<tr>
<th>Company</th>
<th>Sungrow Power Supply Co., Ltd.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Website</td>
<td><a href="http://www.sungrowpower.com">www.sungrowpower.com</a></td>
</tr>
<tr>
<td>Email</td>
<td><a href="mailto:info@sungrow.cn">info@sungrow.cn</a></td>
</tr>
<tr>
<td>Address</td>
<td>No.1699 Xiyyou Rd., New High Technology Industrial Development Zone, Hefei, P. R. China.</td>
</tr>
<tr>
<td>Zip</td>
<td>230088</td>
</tr>
<tr>
<td>Telephone</td>
<td>+86 551 6532 7834, +86 551 6532 7845</td>
</tr>
</tbody>
</table>
Fax: +86 551 6532 7856

**North America**

- **Sungrow Canada**

<table>
<thead>
<tr>
<th>Add</th>
<th>6535 Millcreek Dr, Unit 63-64, Mississauga, ON, Canada L5N 2M2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tel</td>
<td>+1 905 286 9266</td>
</tr>
<tr>
<td>Fax</td>
<td>+1 905 286 9668</td>
</tr>
<tr>
<td>Sales</td>
<td><a href="mailto:sales@sungrow.ca">sales@sungrow.ca</a></td>
</tr>
<tr>
<td>After-Sales</td>
<td><a href="mailto:service@sungrow.ca">service@sungrow.ca</a></td>
</tr>
</tbody>
</table>

- **Sungrow USA Corporation**

<table>
<thead>
<tr>
<th>Add</th>
<th>47751 Fremont Blvd., Fremont, CA 94538</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tel</td>
<td>+1 510 656 1259</td>
</tr>
<tr>
<td>Sales</td>
<td><a href="mailto:sales@sungrow.ca">sales@sungrow.ca</a></td>
</tr>
<tr>
<td>After-Sales</td>
<td><a href="mailto:service@sungrow.ca">service@sungrow.ca</a></td>
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