CPS PSW-2M-EU / CPS PSW-2.4M-EU

PCS Skid ESS User Manual

Shanghai Chint Power Systems Co., Ltd

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Contents

Preface

Dear user, thank you very much for choosing the CPS PSW series PCS Skid ESS (hereinafter referred to as "PCS Skid ESS" in this manual) products developed and produced by Shanghai Chint Power Systems Co., Ltd. CHINT PV grid-connected PCS Skid ESS is a highly reliable product, which is widely used in high-standard PV grid-connected systems.

IMPORTANT!

The product description, installation, safe operation, troubleshooting and other important information are contained in this manual. Please read this Manual carefully and make sure that you fully understand all contents before performing any operation.

This manual contains the following main contents:

- **Safety Instructions**

The introduction for the safety precautions that need to be paid attention to when operating and maintaining the PCS Skid ESS.

- **System Introduction**

The introduction for the system structure and electrical principle of the PCS Skid ESS.

- **Installation**

The detailed introduction for the installation, wiring steps and precautions of the PCS Skid ESS.

- **Power-on and Power-off**

The detailed illustration for the power-on and power-off steps of the PCS Skid ESS.

- **Maintenance and Troubleshooting**

The introduction for the maintenance and troubleshooting of the PCS Skid ESS.

- **Technical Data**

The introduction for technical data of the PCS Skid ESS.

- **Quality Assurance**

The introduction for quality assurance clauses of the company.

- **Routine Maintenance**

The introduction for the routine maintenance of the PCS Skid ESS.

In case of any problem arising in using, installation or operation, please refer to this manual first, and contact your local dealer or representative. The instructions in this manual may help you solve most of the use, installation and operation problems.

Applicable Personnel

This manual is applicable to authorized and qualified engineers or operators authorized by the owner, and these people can perform wiring, operation, maintenance, and daily management of the PCS Skid ESS.

Manual Management

Please read this manual carefully before using the product. Please keep this Manual and other documents of the product together and ensure these are accessible for relevant personnel.

Copyright Restriction

Version Upgrade

Due to the update and improvement of products, the contents of the Manual will be updated, adjusted and revised accordingly, and the products purchased by users shall be subject to the physical objects. You can get the latest version of the Manual through the corresponding sales channels, or you can download the latest version of the Product User Manual from our official website http://www.chintpower.com.

1 Safety Instructions

Please read the safety instructions in this chapter carefully before installing and using the PCS Skid ESS. We will not be liable and provide quality assurance if personal injury or equipment damage is caused as a result of failing to follow the safety instructions in this manual!

1.1 Definition of symbols in this manual

	**Danger:** There is a high-level potential danger that, if not avoided, may result in death or serious injury to personnel.
	**Warnings:** There is a moderate potential danger that, if not avoided, may result in death or serious injury to personnel.
	**Caution:** There is a low-level potential hazard that, if not avoided, may result in moderate or mild injury to personnel.
	**Note:** There is a potential risk that, if not avoided, may result in the equipment not functioning properly or causing property damage.
	**Remarks:** Additional information in the manual that highlights and supplements the content and may also provide tips or tricks to optimize the use of the product, which helps solve problems or save time.

1.2 Interpretation of product markings

	**Electric Shock Hazard:** This marking indicates that there is high voltage inside the machine body, and touching it may cause electric shock.
	**Energy danger:** Pay attention to the danger of electric shock, and please operate the machine 5 minutes after the discharge is completed.
	**High Temperature:** This product complies with international safety standards, but it generates heat during operation. Therefore, never touch the cooling fin or the metal surface of the PCS Skid ESS during operation.
	**Noise prevention:** This marking indicates that the equipment noise has a risk of hearing damage and hearing protection devices is required.
	**Protective Earthing:** This marking is located at the protective earth (PE) terminal and shall be firmly earthed to ensure operator safety.
	**CE Certification:** The PCS Skid ESS meets the requirements of CE certification.

1.3 Precautions for product safety

DANGER:

It is necessary to manually shut down through the screen before the PCS Skid ESS is repaired. The DC switch on the PV side should be disconnected and the discharge procedure is executed, and then the AC switch on the grid side should be disconnected, confirm that the PCS Skid ESS has no power and the PCS Skid ESS can be examined and repaired!

WARNING:

All operations and connections shall be completed by professional engineering and technical personnel!

To prevent the risk of electric shock during equipment maintenance or installation, please ensure that all DC and AC power has been disconnected from the equipment, and ensure that the equipment is reliably earthed.

WARNING:

The connected PV panel will generate DC voltage and charge the DC bus capacitor of the PCS Skid ESS when it is exposed to sunlight. The charge is still stored in the capacitor when the PV input to the PCS Skid ESS is cut off. Therefore, please ensure that the electric energy inside the PCS Skid ESS has been completely discharged before maintenance of the equipment. It is necessary to measure the voltage and confirm safety before operation.

CAUTION:

As the equipment is heavy and large in shape, it is recommended that users use forklifts for handling as much as possible. Please pay attention to the center of gravity position of the PCS Skid ESS during handling to prevent toppling.

CAUTION:

High temperature will be generated by the PCS Skid ESS during working. Please do not touch the cooling fin and metal surface of the PCS Skid ESS!

NOTE:

The PCS Skid ESS is specially designed to generated ac power and connect to the public grid. Do not directly connect the ac output terminal of the equipment to private ac electrical equipment.

NOTE:

It is forbidden to directly close the DC switch if the DC switch trips due to a fault. The system must be reset first, and then the DC switch should be closed manually according to prompt of the touch screen.

NOTE:

The PCS Skid ESS should not be exposed to direct sunlight, so as to avoid reducing energy conversion efficiency due to excessive internal temperature of the PCS Skid ESS .

NOTE:

AC and DC switches should be disconnected and external power supply should be used if it is necessary to update the program.

NOTE:

When the PCS Skid ESS is in a charging state, the discharge command is invalid and can only be executed after the charging process is completed.

IMPORTANT:

Before choosing the grid code, contact your local power supply company. If the PCS Skid ESS is working under a wrong grid code, the power supply company may cancel the operating license for the equipment.

Before operating the PCS Skid ESS, ensure that the whole system complies with national standards and applicable safety regulations.

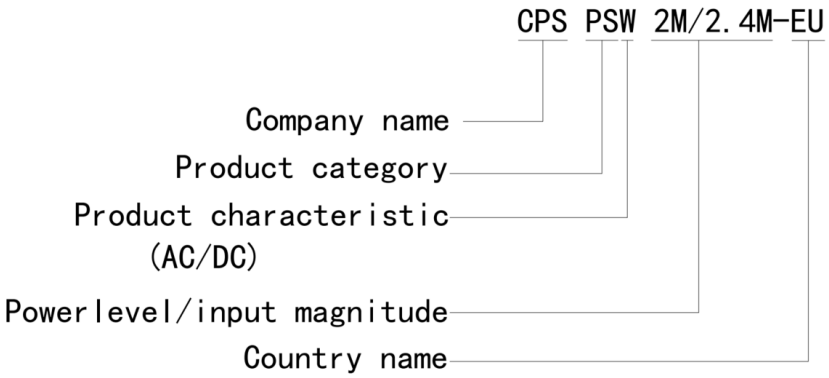
2 System Introduction

2.1 PCS Skid ESS

CPS PSW series PCS Skid ESS integrates PCS, step-up transformer, AC/DC power distribution, etc. featuring high efficiency, reliability and environmental sustainability. Key functional characteristics of the Skid ESS include:

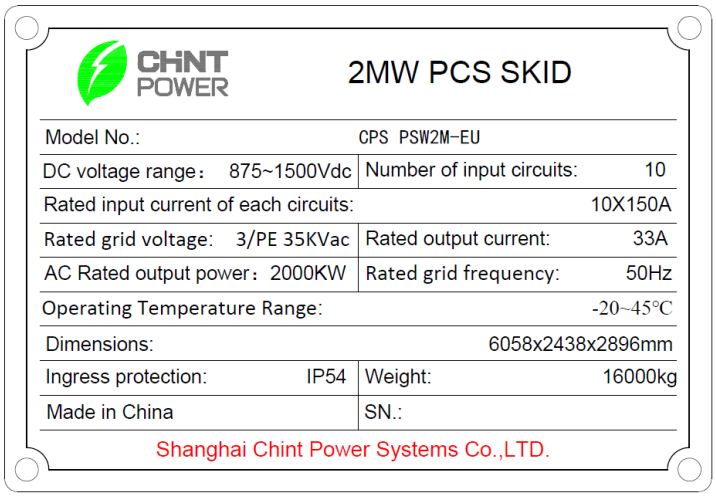
- Reasonable and efficient layout, improved space utilization rate, integrated design of "transformation" and "boost", implementation of lean intelligence for integrated product delivery
- Secondary circuit integration, unified measurement, protection and communication
- Unified external communication interface, quick commissioning, integrated data acquisition and optical fiber ring network, intelligent operation management
- Support for high/low voltage ride-through, frequency ride-through and dispatching, efficient and stable power grid adaptation
- Voltage levels of 35kV and below are covered in step-up application types
- 110% overload and 45°C without derating are supported, and the system has high stability and flexible configuration
- Support for functions such as multi-machine parallel connection, PQ control (i.e. active and reactive power control function) and VF control (i.e. PCS maintains the output voltage and frequency unchanged, output active power and reactive power are determined by load), etc.
- 1500V wide DC voltage range of the system, flexible DC terminal configuration
- Multiple applications such as peak-load shifting, peak shaving and frequency regulation and new energy grid connection auxiliary, etc.

2.2 Introduction of series and model



The AC rated output power of PCS Skid ESS is 2000/2400kW. The maximum DC input voltage of the PCS Skid ESS is 1500V, and the rated AC output voltage is 35KV. The specific voltage and frequency can be set according to the actual grid connection requirements, which can adapt to power grid applications in different countries.

2.3 Nameplate of energy storage system

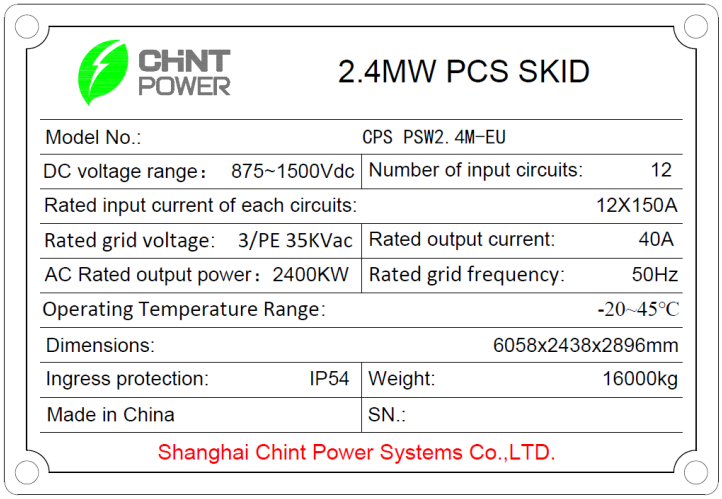


CHINT POWER

2MW PCS SKID

Model No.:		CPS PSW2M-EU	
DC voltage range:	875~1500Vdc	Number of input circuits:	10
Rated input current of each circuits:			10X150A
Rated grid voltage:	3/PE 35KVac	Rated output current:	33A
AC Rated output power: 2000KW		Rated grid frequency:	50Hz
Operating Temperature Range:			-20~45°C
Dimensions:			6058x2438x2896mm
Ingress protection:	IP54	Weight:	16000kg
Made in China		SN.:	

Shanghai Chint Power Systems Co.,LTD.



CHINT POWER

2.4MW PCS SKID

Model No.:		CPS PSW2.4M-EU	
DC voltage range:	875~1500Vdc	Number of input circuits:	12
Rated input current of each circuits:			12X150A
Rated grid voltage:	3/PE 35KVac	Rated output current:	40A
AC Rated output power: 2400KW		Rated grid frequency:	50Hz
Operating Temperature Range:			-20~45°C
Dimensions:			6058x2438x2896mm
Ingress protection:	IP54	Weight:	16000kg
Made in China		SN.:	

Shanghai Chint Power Systems Co.,LTD.

2.4 Circuit structure of PCS Skid ESS

The basic principle of the PCS Skid ESS is shown in the following figure. The DC voltage output from the battery container is connected to the DC input terminal, and then converted into three-phase AC voltage (3*800VAC) through PCS, and then connected to the power grid after step-up.

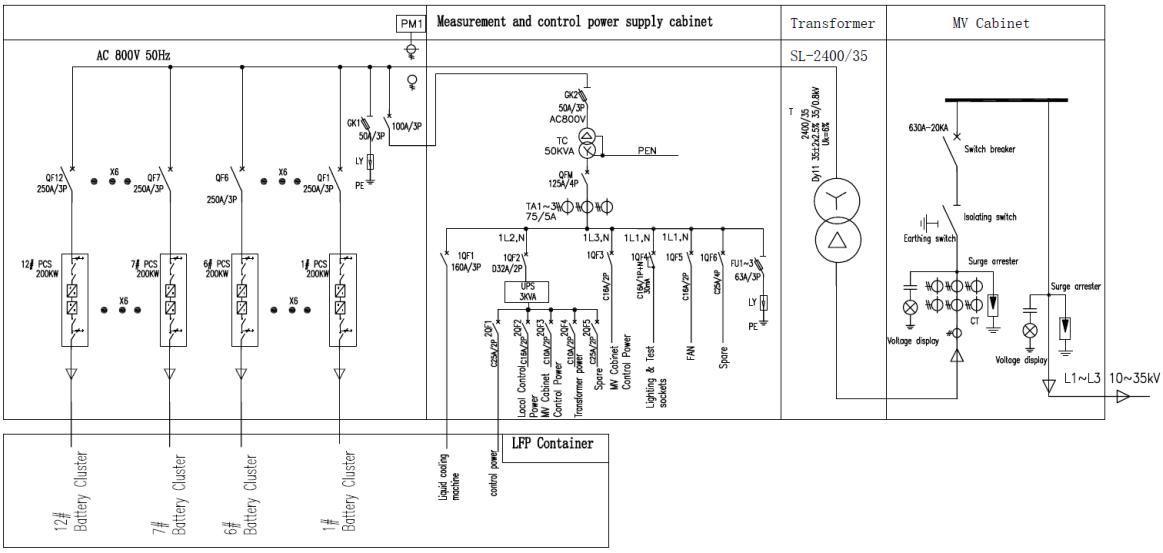


Figure 2- 1 Basic schematic diagram of PCS Skid ESS

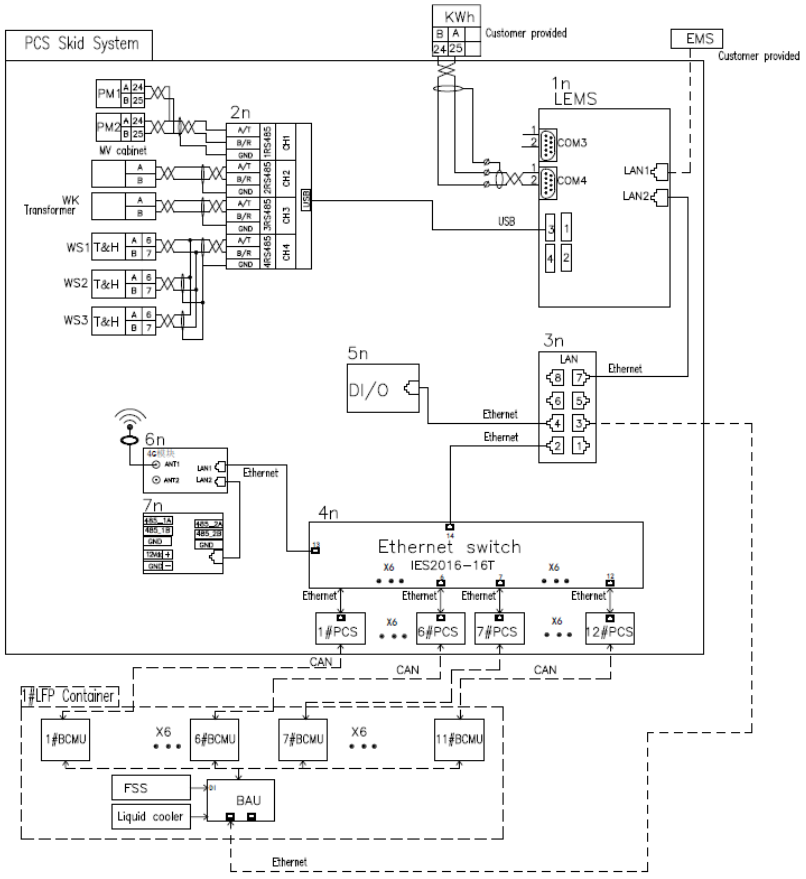


Figure 2- 2 Communication diagram （0.5C system)

2.5 Dimension and appearance

Refer to the following figure for the dimension (Unit:mm) and appearance of PCS Skid ESS:

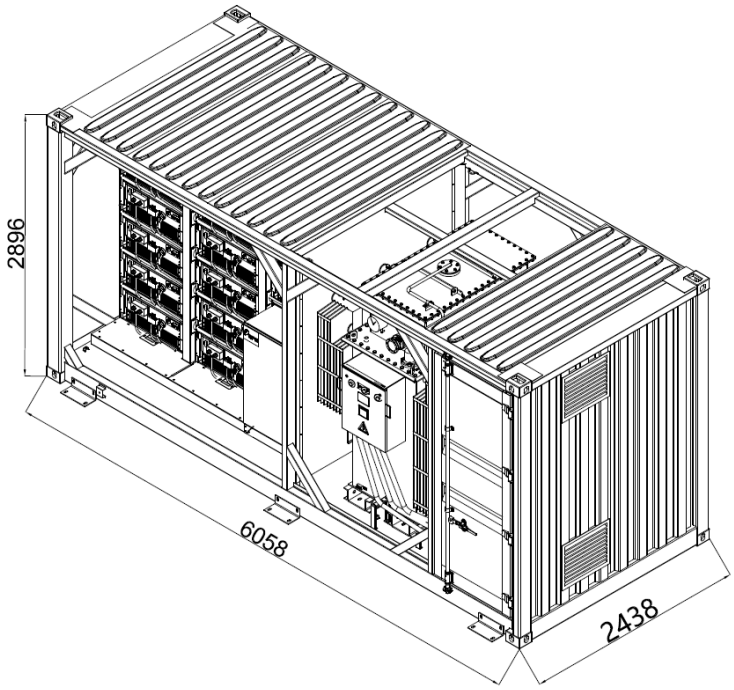


Figure 2- 3 Overall Dimensions

2.6 Main components of PCS Skid ESS

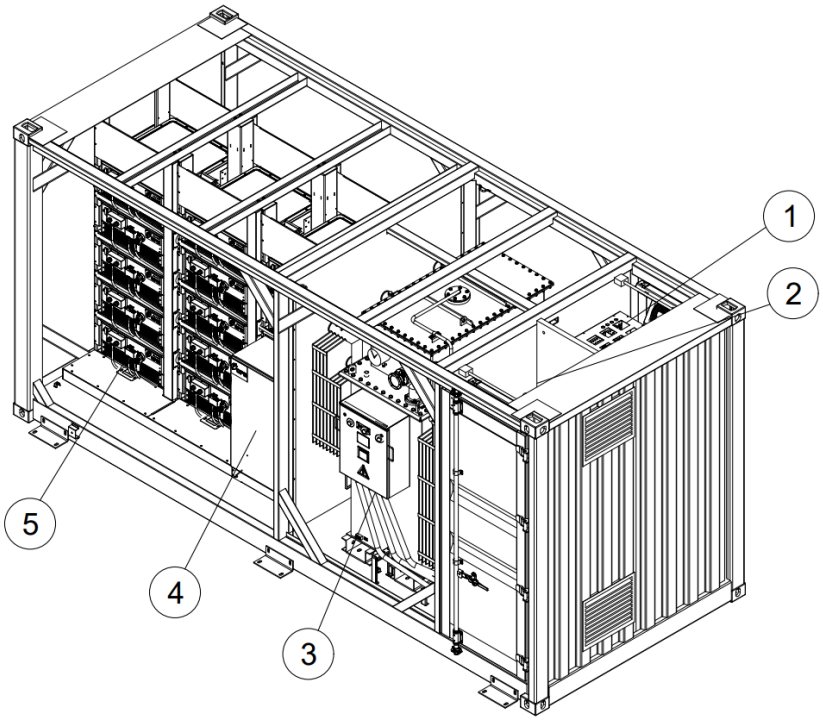


Figure 2- 4 Diagram of main components

Table 2- 1 Name of main components

No.	Name
1	LV (Low-voltage) Cabinet
2	MV (Medium-voltage) Cabinet
3	Transformer Cabinet
4	AC/DC Wiring Cabinet
5	PCS Cabinet

2.6.1 LV Cabinet

The LV (Low-voltage) cabinet contains a measurement and control power supply cabinet, fans, lighting fixtures, and emergency lighting systems. The measurement and control power supply cabinet contains switches, communication modules, network switches, auxiliary transformers, EMS, and UPS.

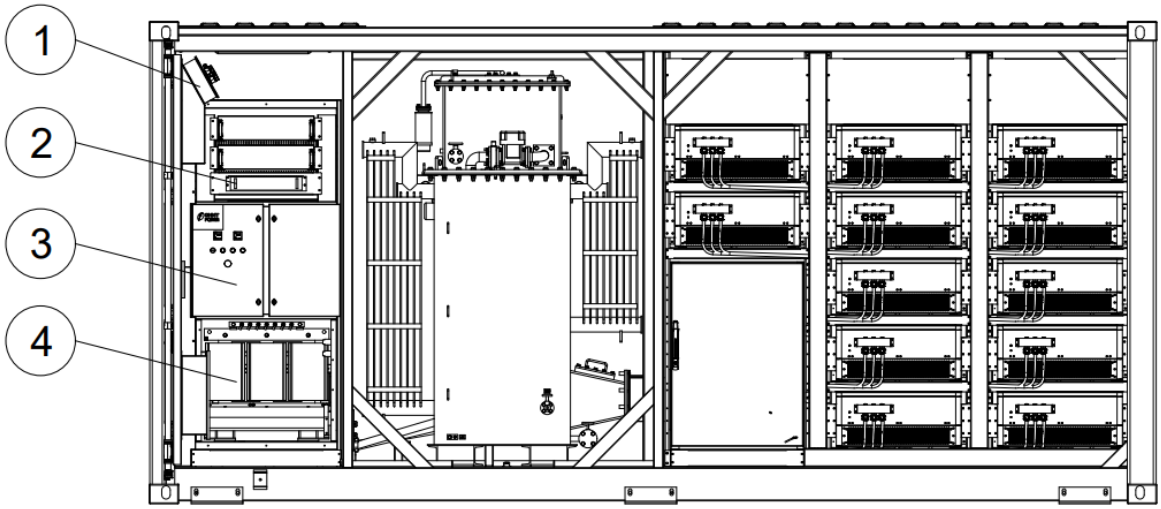


Figure 2- 5 LV Cabinet

Table 2- 2 LV Cabinet Details

No.	Name	Effect
1	Fan	/
2	UPS	UPS 6KVA / Rack type + supporting: Mountain special battery 26Ah / 12V, a total of 16 pieces / 192VDC
3	Mesurement and control power supply cabinet	Including circuit breakers, communication module, ethernet switch, and EMS
4	Auxiliary transformer	SGL-90/0.8, 90KVA / Dyn11 / 50 / 60 HZ / AC800 V/AC380V

2.6.2 MV Cabinet

The MV (Medium-voltage) cabinet is located on the back and contains a medium voltage ring network cabinet inside.

The ring network cabinet consists of a circuit breaker cabinet and a directly connected cable cabinet. Cabinet names vary with cabinet manufacturers, as shown in the following table.

Table 2- 3 Cabinet names

Cabinet names	Abbreviation	Manufacturer
Circuit breaker cabinet	V	Chint
Directly connected cable cabinet	D	Chint

The NG7-12 combination cabinet of Chint brand is as follows:

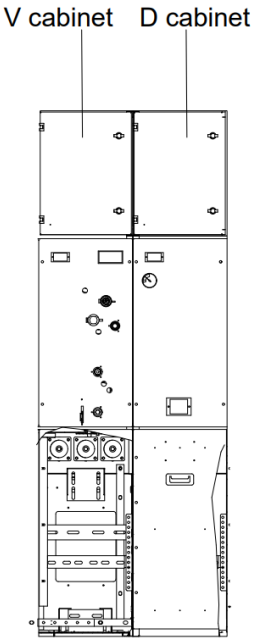


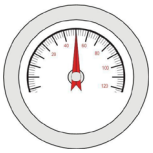
Figure 2- 6 Medium-voltage cabinet

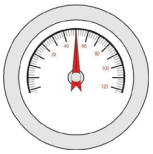
2.6.3 Transformer Cabinet

The transformer cabinet contains a medium voltage transformer. A medium voltage transformer can convert the low voltage output by the inverter to a grid compatible high voltage.

The transformer integrates accessories such as pressure relief valve, step switch, oil level gauge, pressure gauge, oil temperature gauge, oil filling valve and oil drain valve. The functions of each accessory are shown below.

Table 2- 4 Transformer Cabinet Component

Photo	Name	Description
	Oil filling valve	When the oil level in the transformer tank is low, open the oil filling valve.
	Pressure relief valve	When the oil pressure in the tank reaches 55kPa, the valve will automatically release.
	Pressure gauge	The pressure gauge is used to read the pressure value inside the oil tank.
	Oil level gauge	If the oil level value falls below the lowest mark on the oil level gauge or below the oil level mark required for safe operation of the transformer, the transformer will stop running. When the oil level is too high, open the oil drain valve to lower the oil level. When the oil level is too low, disconnect the transformer and check the oil tank for oil leakage.
	Oil temperature gauge	The oil temperature alarm temperature is 100℃. When the oil temperature reaches this value, the alarm signal will be sent to the intelligent measurement and control cabinet or communication device (provided by customer). The oil temperature trip temperature is 105℃. When the oil temperature reaches this value, the trip signal will be sent to the intelligent distribution cabinet or client communication device. At the same time, the transformer will be disconnected from upstream and downstream equipment.

	Winding Thermometer	The oil temperature alarm temperature is 100℃. When the oil temperature reaches this value, the alarm signal will be sent to the intelligent power distribution cabinet or client communication device. The oil temperature trip temperature is 105℃. When the oil temperature reaches this value, the trip signal will be sent to the intelligent measurement and control cabinet or communication device (provided by customer). At the same time, the transformer will be disconnected from upstream and downstream equipment.
	Oil drain valve	When the oil level is too high or maintenance is required, the oil drain valve needs to be opened.
	Step switch	The step switch has five positions: 1, 2, 3, 4, and 5.

2.6.4 PCS

The PCS Skid ESS contains 10/12 PCS units, with the following layout:

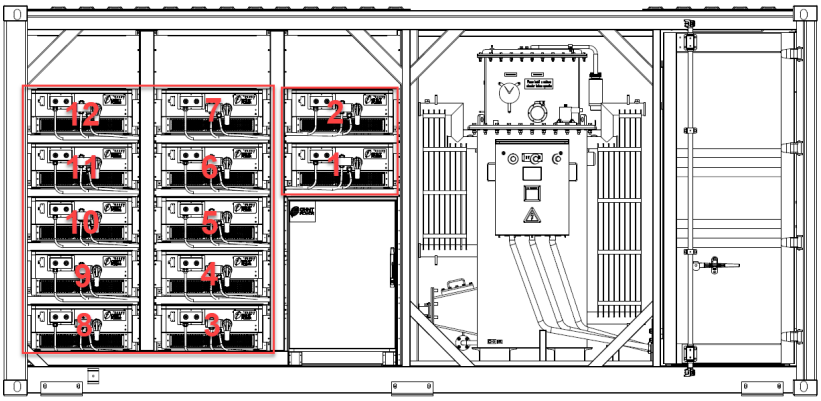


Figure 2- 7 PCS layout

Figure 2- 8 PCS

The key features of PCS are as follows:

- Integrated DC disconnect switch
- Protection functions for enhanced reliability and safety
- Full power capacity up to 45°C
- IP66 outdoor rated
- Integrated DC-DC bi-directional converter
- Wide DC voltage range, suitable for different batteries
- Modular design, easy for maintenance

Refer to the following figure for the circuit diagram of PCS:

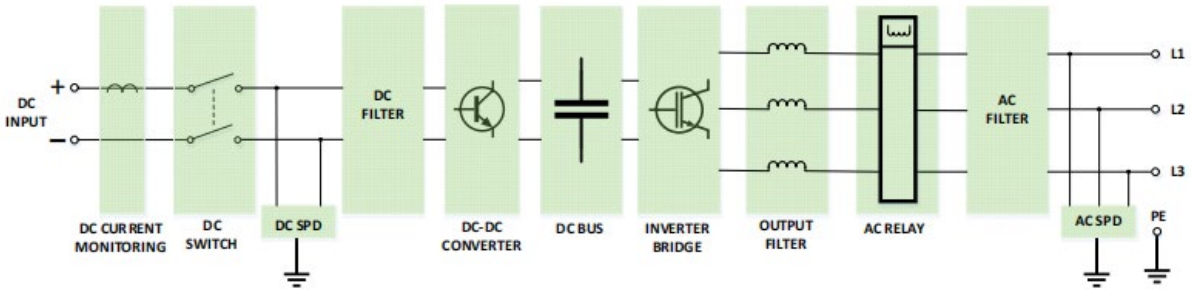


Figure 2- 9 Circuit diagram of PCS

2.6.5 AC/DC wiring cabinet

There is a confluence junction copper bar in the DC wiring cabinet. The positive and negative power cables of the two groups of battery cabinets are connected to a group of confluence copper bars, and then connected to PCS through the copper bar.

The layout is shown below:

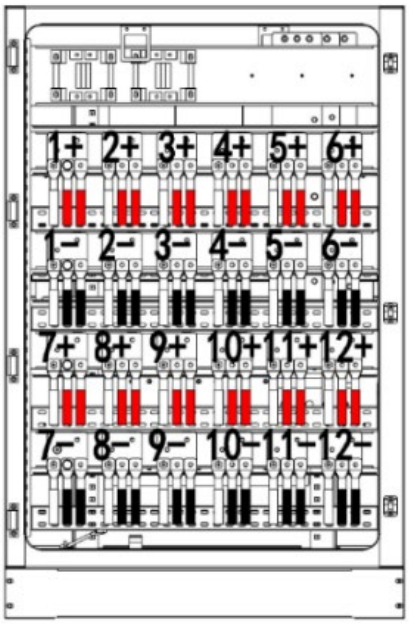


Figure 2- 10 DC distribution diagram

There is a plastic shell circuit breaker in the AC wiring cabinet, the lower end is connected to the PCS intersection side by cable, and the upper break is connected to the low voltage side of the main transformer by copper row. At the same time, the cabinet is equipped with a temperature controller and a cooling fan. As shown in the figure below:

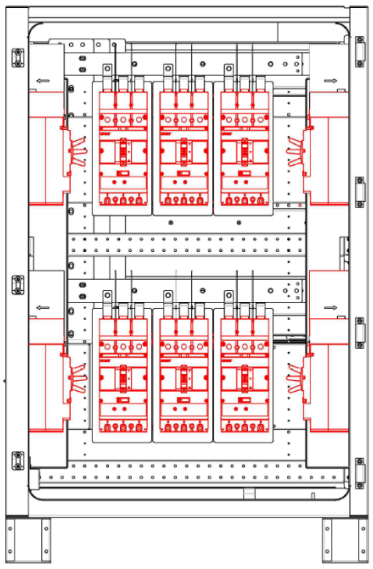


Figure 2- 11 Distribution diagram of AC circuit breakers

2.7 Optional product configuration

The following optional configurations are supported by the PCS Skid ESS:

Table 2- 5 Optional Configuration

No.	Configuration	Function
1	Metering instrument	Measurement of control load

IMPORTANT:

You need to confirm what optional functions are required for the PCS Skid ESS before ordering, ensure that the delivered PCS Skid ESS meets the use requirements.

3 Installation

3.1 Basic requirements

Check before installation:

- Whether the environmental parameters (including protection grade, working temperature range, humidity, altitude, etc.) of the installed product are within the range specified in the technical parameter table;
- Ensure that the grid voltage is within the normal range;
- The grid connection permit has been obtained from the local electricity services department;
- The installation personnel must be professional electricians or have received professional training;
- Sufficient air convection space;
- Keep away from flammables and explosives;
- Keep away from electromagnetic interference sources.

3.2 Scope of supply

CPS PSW2M-EU / PSW2.4M-EU is delivered in a complete machine package, and the delivered goods are shown in the following table.

Table 3- 1 Scope of Supply

No.	Description	Qty.
1	CPS PSW2M-EU / PSW2.4M-EU	1
2	Instructions	1
3	Warranty Card	1
4	Shipping orders	1
5	Certificate of Conformity	1

3.3 List of installation tools

Please refer to the following table for the list of tools required for installing this product.

Table 3- 2 Preparation of Installation Tools

No.	Description	Specification	Purpose description
1	Open-end wrench	14 mm	M8 hexagon head screw
2	Open-end wrench	17 mm	M10 hexagon head screw
3	Open-end wrench	19 mm	M12 hexagon head screw
4	Straight screwdriver	3 mm	Dry contact wiring
5	Sleeve	7 mm	M4 nut
6	Sleeve	10 mm	M6 nut
7	Torque wrench	25 N.m (221.3 in-lb)	M10 hexagon head screw
8	Torque wrench	50 N.m (442.5 in-lb)	M12 hexagon head screw

3.4 Mechanical installation

3.4.1 Installation requirements for PCS Skid ESS

1. The PCS Skid ESS shall be installed on the structure supported by cement foundation or channel steel, with surface made of flame-resistant materials. It is necessary to make sure that the foundation is smooth, solid, safe and reliable, and has sufficient bearing capacity. The foundation surface shall not be sunk or inclined.
2. Cable trenches should be preset according to the overall design of the power station and the incoming and outgoing mode of cables at the bottom of the PCS Skid ESS when foundation is built. The AC side of the PCS Skid ESS does not support bottom wiring, but only supports side outlet copper bars. The DC side is equipped with waterproof connectors for wiring. The specific wiring position of the PCS Skid ESS is shown in the following figure, and it is the top view of the PCS Skid ESS.

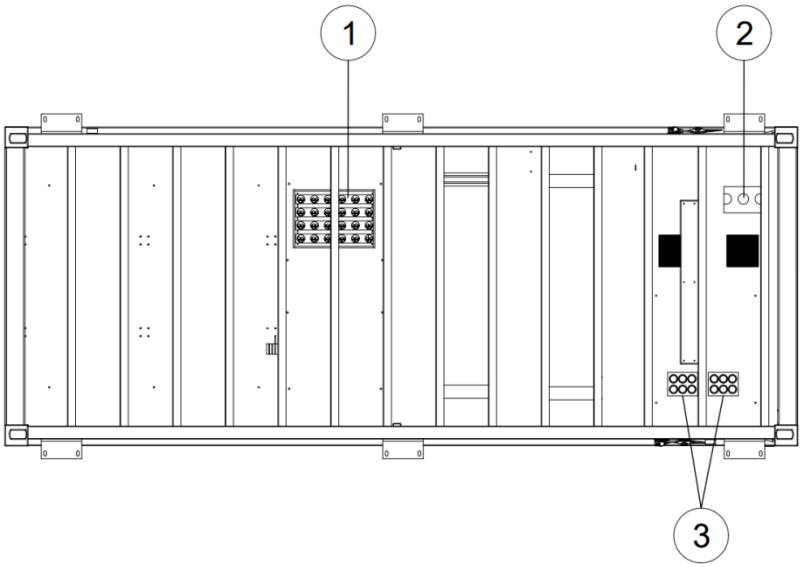


Figure 3- 1 Location of incoming and outgoing line holes

Table 3- 3 Description of incoming and outgoing line holes

No.	Description
1.	DC wiring hole
2.	Medium-voltage wiring hole
3.	Communication/distribution wiring holes

3. The installation foundation of the PCS Skid ESS must be designed and constructed in advance according to certain standards to meet the requirements of mechanical support, cable wiring, ventilation and heat dissipation. Foundation should be constructed to at least meet the following requirements:
   - The climatic environment, geological conditions and other characteristics of the PCS Skid ESS installation site should be fully considered;
   - The surrounding environment shall be dry, well ventilated and away from flammable and explosive areas;
   - Foundation should be constructed in relatively high elevation areas in the power station area;
   - The soil on the installation site needs to have a certain compactness, and certain measures need to be taken to ensure the stability of the foundation if the soil is loose. The bottom of the foundation pit for foundation construction must be tamped and filled;
   - The foundation should be sufficient to provide effective load-bearing support for the PCS Skid ESS and raise the PCS Skid ESS to prevent rainwater from eroding the base and interior of the PCS Skid ESS;
   - The cement foundation should be constructed with adequate cross-sectional area and height. Recommended cross-sectional area is (length × width) 6700mm×3100mm. The foundation height should be determined by the construction party according to the site geology;

- Cable wiring should be considered in the construction of foundations. The cable trench can be constructed at the bottom of the PCS Skid ESS according to the overall design planning of the power station, namely a preset cable trench in the foundation. The cable trench can also be constructed outside the rear door side of the PCS Skid ESS and be paralleled to the housing.

4. Low cement piers with sufficient supporting capacity shall be set up on the foundation to ensure the firm installation of the PCS Skid ESS and meet the requirements of cable wiring, and incoming and outgoing positions for cables should be reserved at the same time. The recommended scheme is shown in the following figure (Unit: mm):

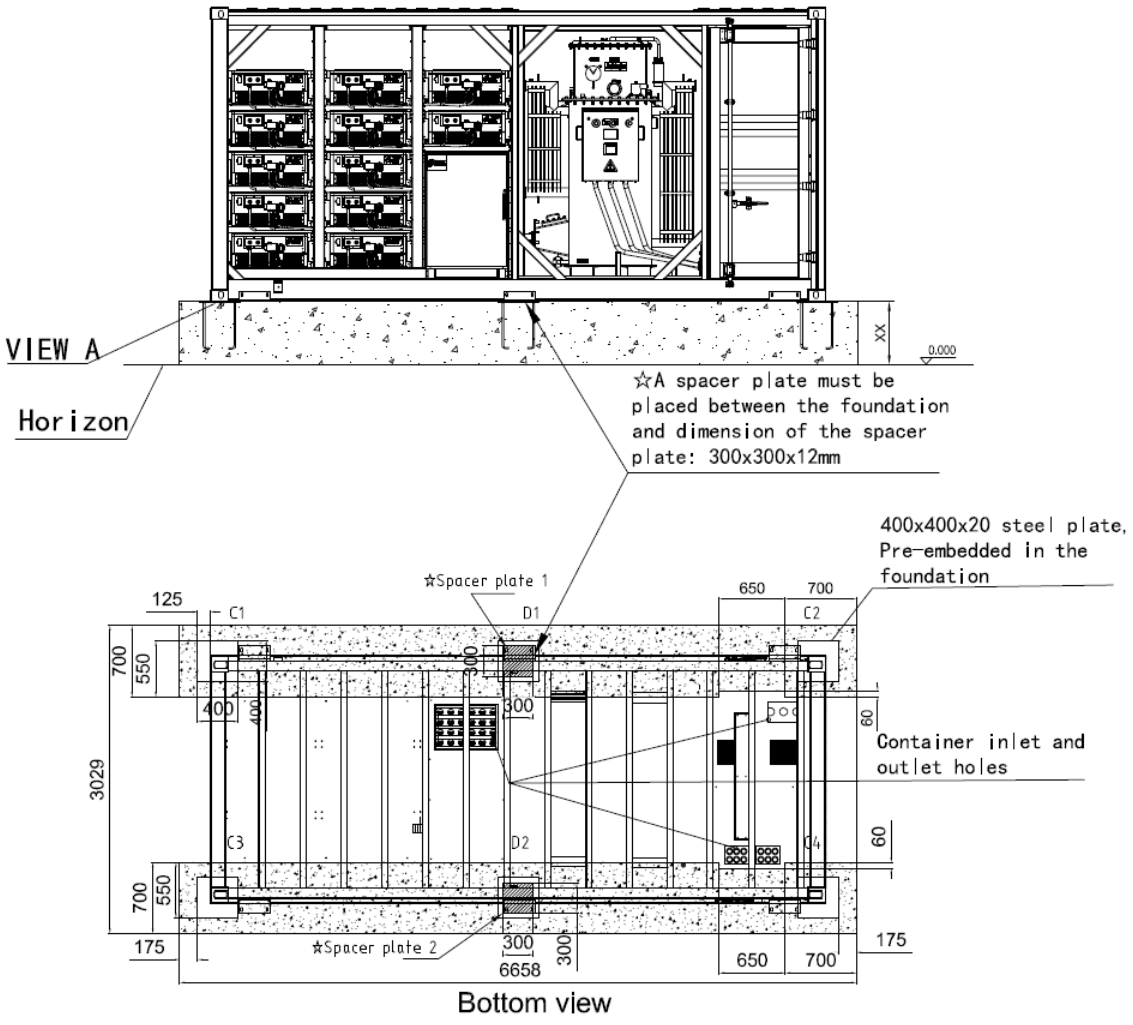


Figure 3- 2 Reference diagram of installation foundation

5. Appropriate distance must be reserved between the PCS Skid ESS and walls and other equipment to meet the requirements of minimum maintenance access, escape routes and ventilation, as shown in the following figure and table.

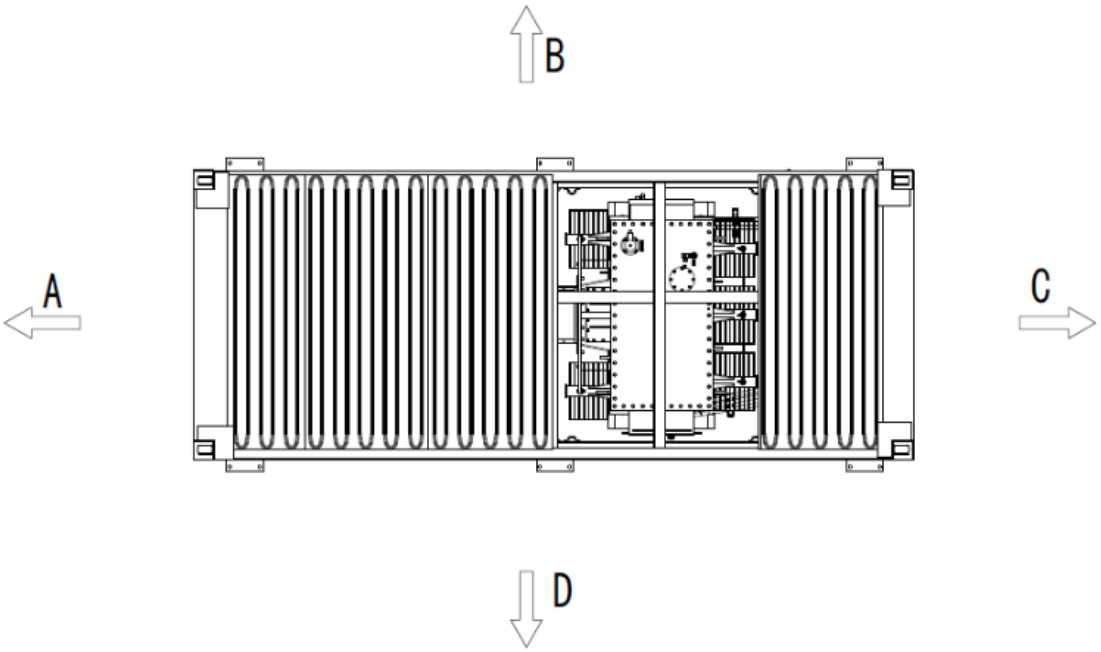


Figure 3- 3 Diagram of installation space distance

Table 3- 4 Installation Distance

No.	Recommended minimum distance	Remarks
A	2000 mm	Meet the requirements of normal door opening and closing, user operation, wiring construction, etc.
B	2500 mm	Meet the requirements of normal door opening and closing, user operation, wiring construction, etc.
C	2000 mm	Meet the requirements of normal door opening and closing, user operation, wiring construction, etc.
D	2500 mm	Meet the requirements of normal door opening and closing, user operation, wiring construction, etc.

3.4.2 On-site handling of PCS Skid ESS installation

3.4.2.1 Lifting Precautions

DANGER:

- During the whole process of lifting the PCS Skid ESS, the safety operation regulations of the crane must be strictly followed.
- It is forbidden to stand within 10m of the operation area. In particular, it is forbidden to stand under the lifting arm and the lifted or moved machine to avoid casualties.
- In case of bad weather conditions, such as heavy rain, fog and strong wind, the lifting operation should be stopped.

When lifting the PCS Skid ESS, the following requirements should be met at least:

- Site safety must be ensured during lifting.
- During the lifting and installation operations, there should be professionals on site to command the whole process.
- The lifting cable used has a bearing capacity of more than 10 tons and a length of more than 6.5 meters. 4 lifting cables are used for lifting at 4 corners. Angle between the lifting cable and the equipment should not be less than 60° (Figure 3- 4), and the total bearing capacity should not be less than 40 tons.
- The crane shall have sufficient arm length and radius of rotation, please refer to the dimensions of the PCS Skid ESS (Figure 2- 2).
- Please use the four lifting corner fittings of the PCS Skid ESS to lift it.
- Ensure that all sling joints are safe and reliable, and all slings connected with lifting rings are of equal length.
- The length of the sling can be properly adjusted according to the actual requirements of the site.
- During the whole lifting process, the PCS Skid ESS must be stable and not skewed.
- The PCS Skid ESS shall be lifted vertically, and no dragging on the ground is allowed during lifting. It shall not be dragged or pushed on any surface.
- After the PCS Skid ESS is lifted 300mm away from the supporting surface, suspend to lift and check the connection between the sling and the PCS Skid ESS. Only after confirming that the connection is firm can continue to lift the machine.
- After the PCS Skid ESS is in place, it shall be placed gently and landed stably. It is strictly prohibited to place the PCS Skid ESS outside the vertical landing by swinging the lifting appliance.
- The PCS Skid ESS shall be placed on a solid and flat ground with good drainage and no obstacles or protrusions, and the PCS Skid ESS shall be supported by the base only.
- Take all necessary auxiliary measures to ensure the safe and smooth lifting of the PCS Skid ESS.

3.4.2.2 Handling with Crane

Install the sling into the four lifting angle fittings around the PCS Skid ESS for lifting, and use a crane to move the PCS Skid ESS to an appropriate position for installation, as shown in the following figure.

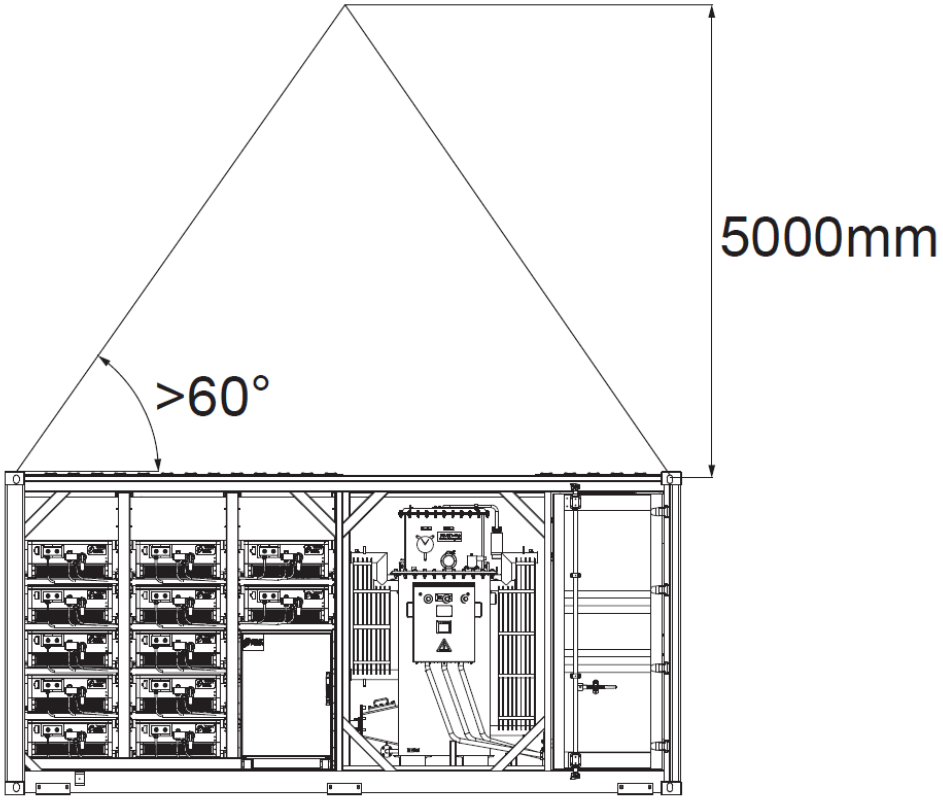


Figure 3- 4 Schematic Diagram of Crane Handling

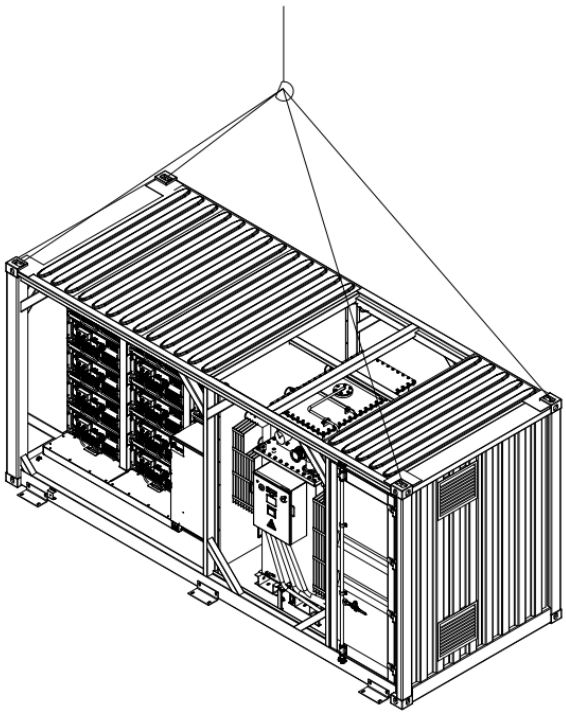


Figure 3- 5 PCS Skid ESS Lifting

3.4.3 Fix PCS Skid ESS on the foundation

Lift the PCS Skid ESS to the installation area, use six L-shaped angle steel to fix the PCS Skid ESS on the foundation.

1. There are L-shaped angle steel mounting holes reserved at the bottom of the PCS Skid ESS.

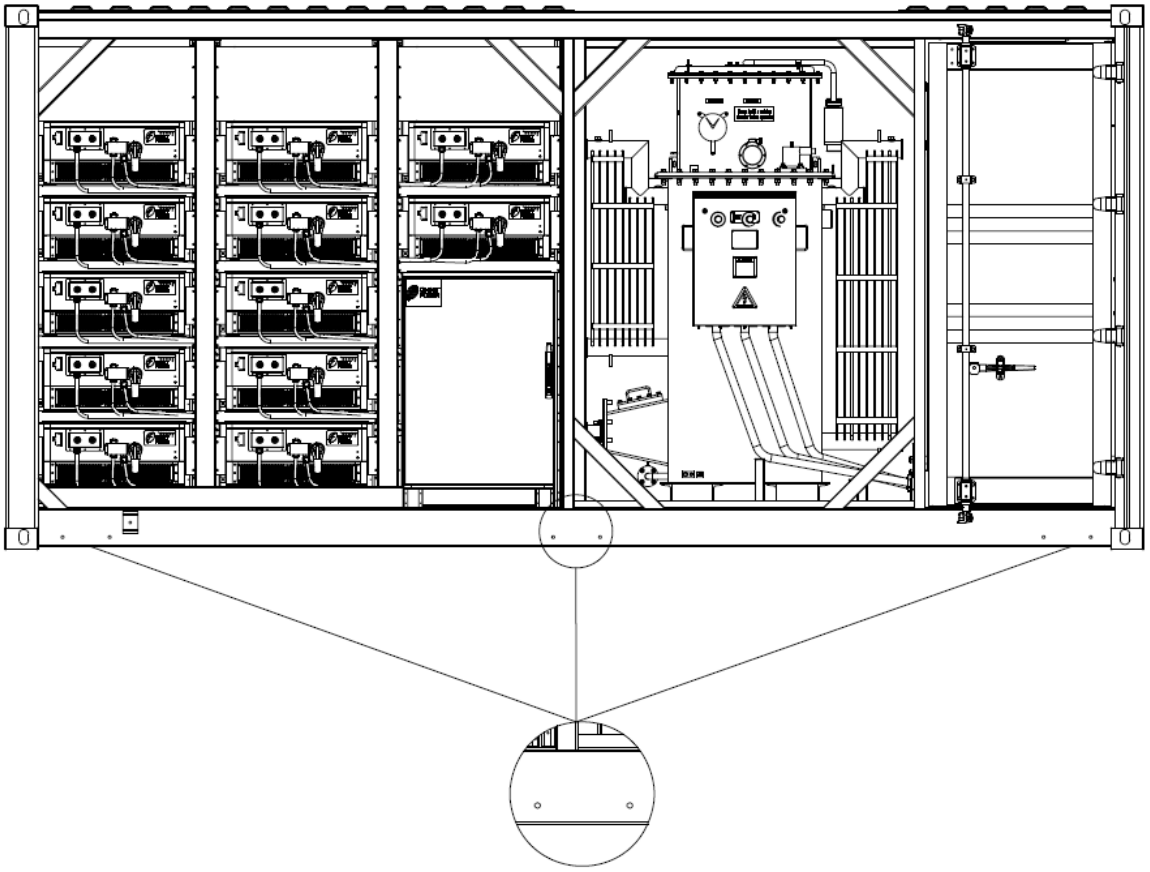


Figure 3- 6 Positions of fixing point

2. Mark the drill location with the L-shaped angle steel.

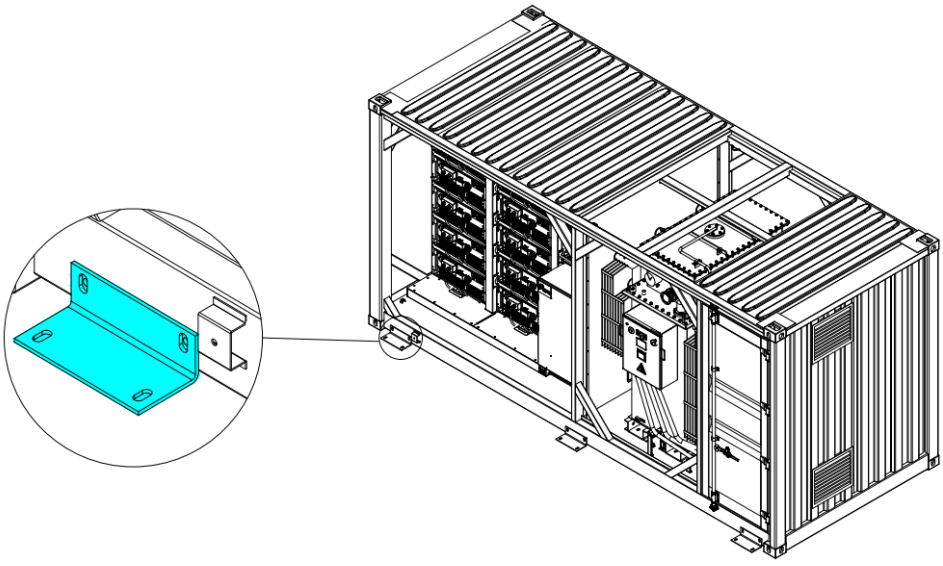


Figure 3- 7 Mark the drill locations.

3. Use a percussion drill (Φ16 mm bit) to drill a hole of 70 mm depth. Use the rubber hammer to knock in the four expansion tubes.

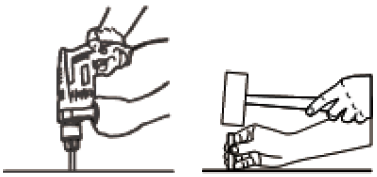


Figure 3- 8 Drill and install expansion tube

4. Screw off the nuts from the expansion tubes. Put the L-shaped steel on the ground and make sure expansion tubes pass through holes of the L-shaped steel.

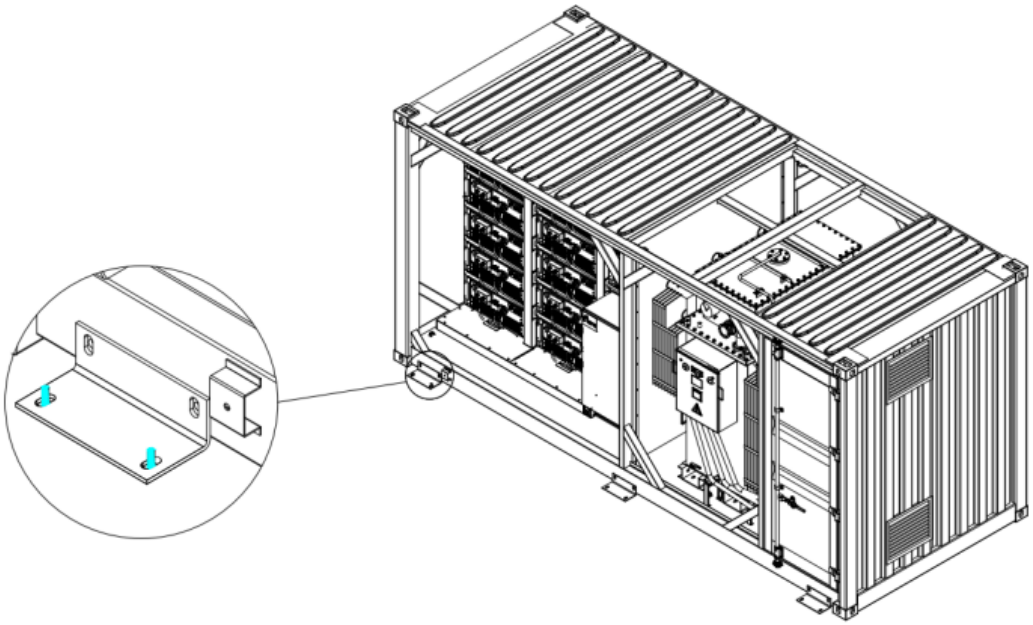


Figure 3- 9 Install the L-shaped steel

5. Tighten the nuts and M16x50 combined screws. Torque:140±5 N.m (1283 ~ 1391 in-lb)

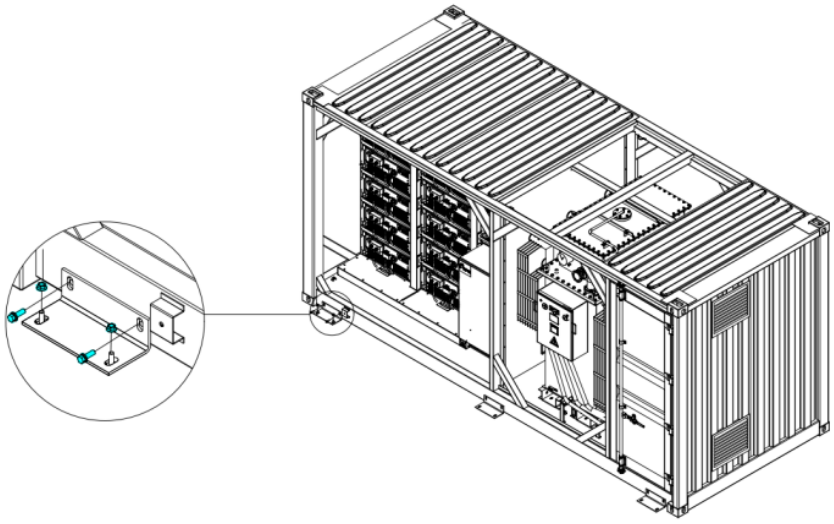


Figure 3- 10 Fix the container

6. Install the other L-shaped steels in the same way.

3.5 Electrical connection

Before delivery, the electrical connection in the equipment has been completed. On site, the electrical connection includes grounding, high voltage side wiring, DC side wiring and communication wiring.

WARNING:

- The configuration of the grid level, frequency, and other technical parameters must meet the technical parameter requirements of PCS Skid ESS.
- The PCS Skid ESS can be connected to the power grid only after being approved by the local power supply company and installed by professional technicians.
- All electrical connections must comply with local electrical installation standards.

3.5.1 Grounding

Grounding includes equipotential connection inside the PCS Skid ESS and grounding of external grounding points.

Internal grounding

Before leaving the factory, the equipotential connection between all the equipment in the PCS Skid ESS has been completed, and they are uniformly summarized to the grounding copper bar.

External grounding

In order to facilitate grounding, there are two grounding points outside the PCS Skid ESS.

Grounding point is as shown below:

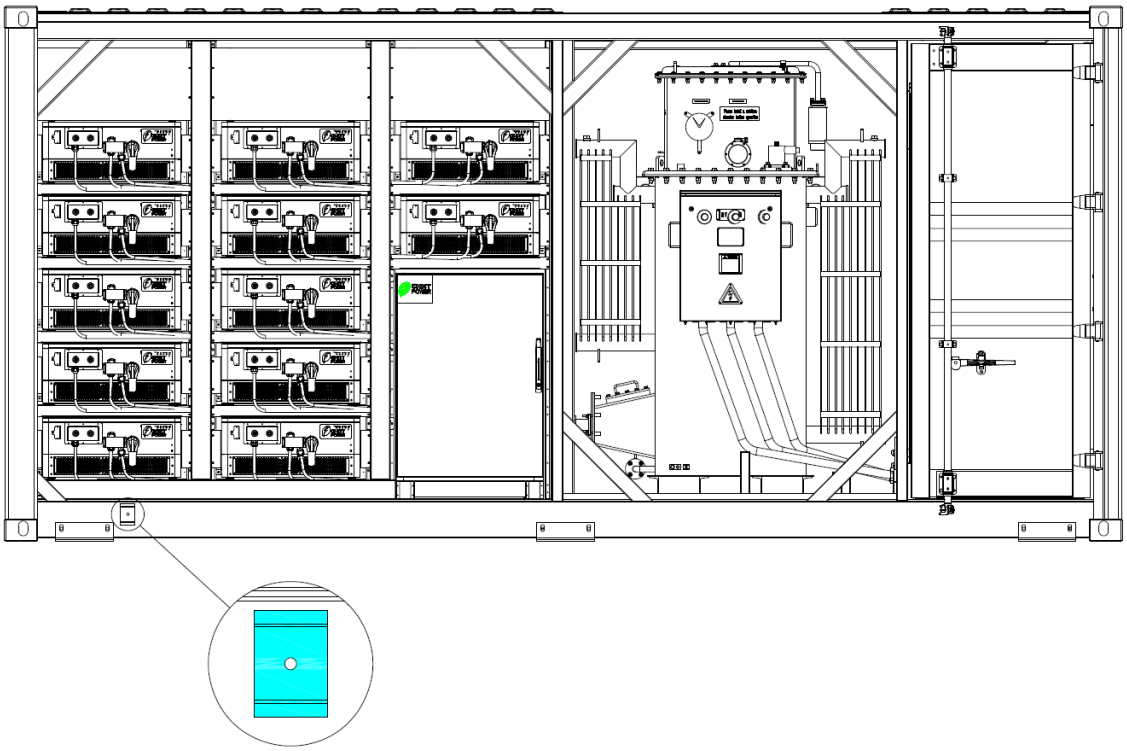


Figure 3- 11 Grounding

Measure the conductivity between the equipment grounding terminal and the total equipotential bonding copper bar to ensure the effectiveness of the internal grounding connection. External contacts of PCS Skid ESS shall be reliably grounded by the following method:

Use 70mm^2 ~ 95mm^2 grounding cables to reliably connect the external grounding point of the PCS Skid ESS to the grounding point of the photovoltaic system. After completion, use M12 bolts to tighten and the torque is 50±5 N.m (398 ~ 487 in-lb).

3.5.2 Medium-voltage cabinet wiring

The connection terminals of the PCS Skid ESS and external medium-voltage equipment are located inside the ring network cabinet. On site, refer to the specific manual of the ring network cabinet for wiring. The wiring position is shown below:

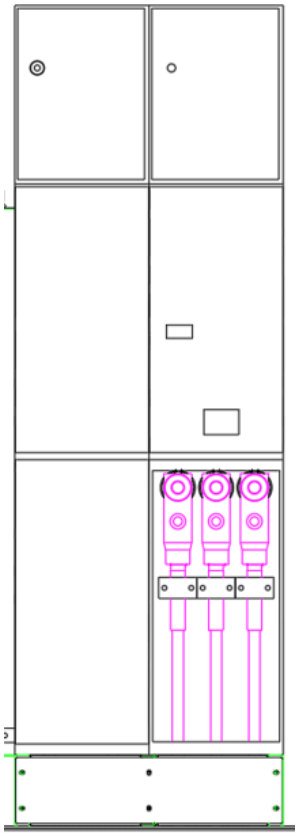


Figure 3- 12 Wiring position

3.5.2.1 Installation of Cable Sealing Kit

Select the proper cable sealing assembly and install according to the manufacturer's installation instruction. Make sure the copper shield exposed is 175mm.

3.5.2.2 Installation of Deadbreak Tee Connector

1. Peel off the Cable
   1) Remove copper shield against the end of cold/heat shrink tube. Remove semi-conductive layer and insulation according to the dimensions given in Figure 3- 13.

2) Bevel the semi-conductive laver cut for 3mm to make smooth transition to insulation. Bevel the edge of insulation for 2mmx45°.

3) Wrap the phase marking strip to the cold/heat shrink tube according to original phases.

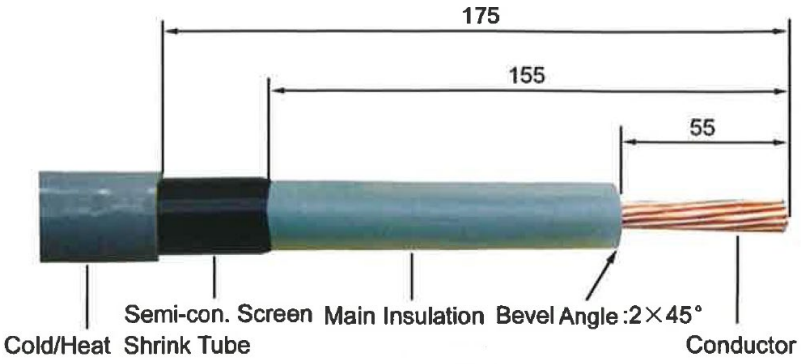


Figure 3- 13 Peel off the Cable

Note: When beveling the semi-conductive layer cut, ensure that the knife edge faces the semi-conductive layer so as not to damage insulation. There should be no scratching, cutting trace or conductive particles on the insulation.

2. Wrap Semi-conductive Tape

Stretch semi-conductive tape to 150% of its original length, wrap around 5mm of the semi-conductive screen and 10mm of cold/heat shrink tube (few loops on semi-conductive screen first to level with cold/heat shrink tube), forming a cylinder stage of 10-15mm wide, 4~5mm thick.

Note: First wrap-around semi-conductive screen until it is level with the surface of cold/heat shrink tube. The semi-conductive tape must be wrapped into a cylinder: Other shapes will cause location problems. Keep the semi-conductive tape clean and stretched to 150% of its original length.

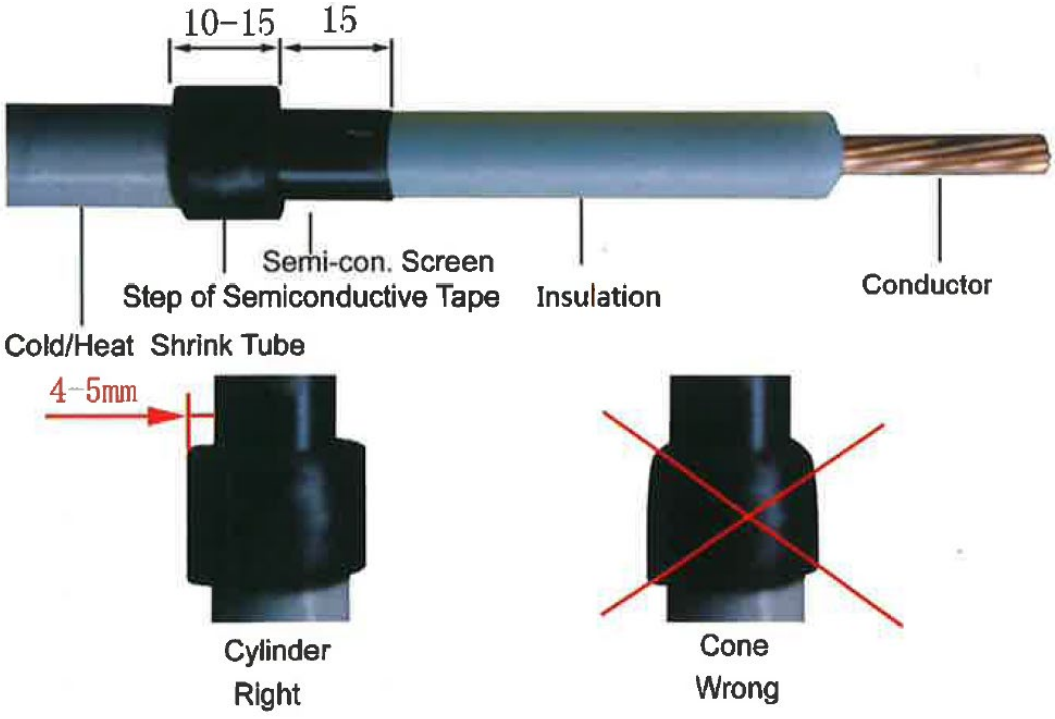


Figure 3- 14 Wrap Semi-conductive Tape

3. Clean the Insulation

Clean the surface of insulation and semi-conductive layer with cleaning tissue, check the insulation. If there is any scratching, cutting trace or conductive particle, abrade and clean the insulation once again.

Note: When cleaning the insulation, always start from insulation towards semi-conductive layer. Never move back and forth.

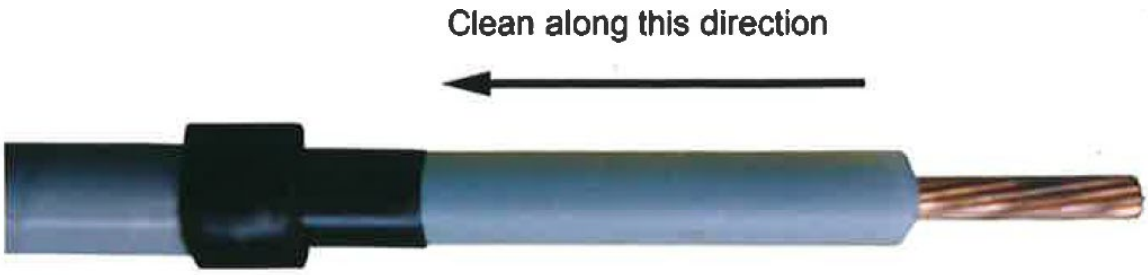


Figure 3- 15 Clean the Insulation

4. Installation of Cable Adapter

1) Cover the end of the conductor with PVC tape or vinyl tape.

2) Lubricate the insulation and the inner surface of the cable adapter with lubricating grease. Apply more lubricating grease over the insulation cut for an easier installation.

3) Push the cable adapter over the insulation up to the cylinder stage till the conductor is entirely exposed. The insulation protruding out of the adapter should be less than 7mm.

4) Remove the PVC tape or vinyl tape and wipe of excess lubricating grease.

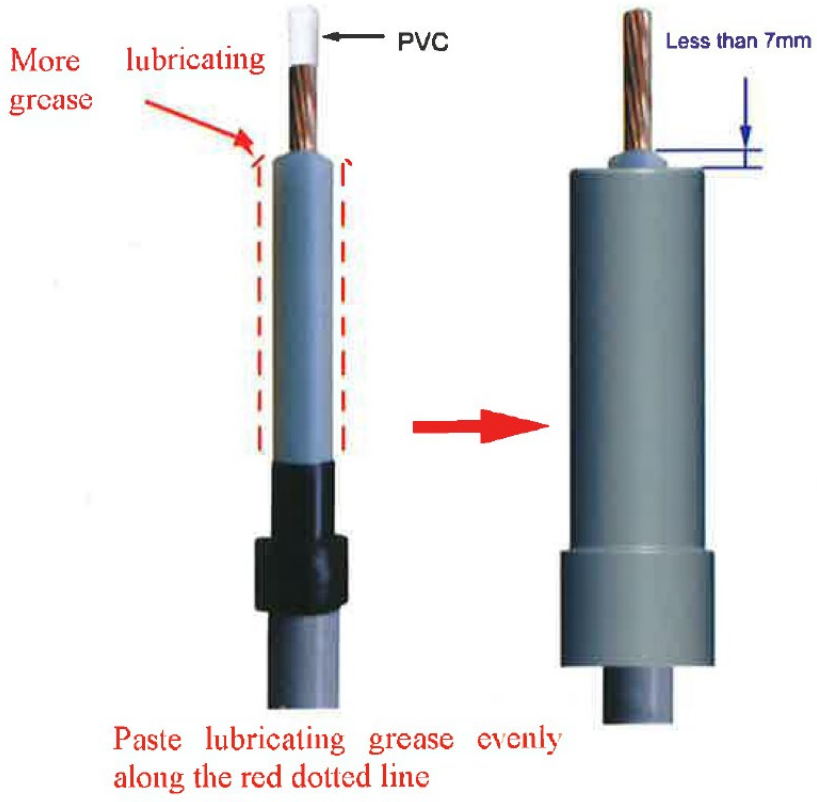


Figure 3- 16 Installation of Cable Adapter

5. Crimp the Lug

   Insert the conductor into lug and compress it with standard dies, ensure that the flat surface of the lug faces the bushing. Remove any burrs from the lug with abrasive tape. Wipe excess residues from lug and cable adapter surface.

   Note: Don't overlap crimps.

6. Installation of Tee Connector

   1) Lubricate the surface of the adapter and the inner surface of the Tee Connector with lubricating grease.

   2) Check if the angle of Tee Connector is correct. Push Tee Connector onto the cable until the hole of the lug is centered in 630A interface. The gap between the end of Tee Connector and step of cable adapter should be less than 3mm as shown in Figure 3- 17.

   3) Tighten M16/M12 two-headed screw into the bushing with a torque force of 10 N.m (88.5in-lb). Clean and lubricate a thin film of lubricating grease on the interfaces of bushing and Tee Connector.

   4) Push Tee Connector onto the bushing ensuring that the two-headed screw of the bushing passes through the hole of the lug.

   Note: The crimping lug must be in the correct position. Take care not to scratch the screw when pushing the Tee Connector onto the bushing.

7. Successively assemble flat washer, spring, washer and hex nut onto the Tee Connector. Tighten the hex nut into thread of two-headed screw with supplied socket wrench with a torque force of 40 N.m (354.0 in-lb). Clean and lubricate the mating interfaces of Tee Connector and insulated plug. Screw the insulated plugin place. Put on the end cap.

   Note: The mating interfaces must be clean and lubricated with lubricating grease.

8. Repeat steps 1-7 for the other two-phase cables, ensuring a minimum spacing of 5mm between phase connectors.

9. Fix the cable

   Fix the trifurcation part of the cable and ground the cable earth wire per relevant system earthing requirements. Make sure the earthing wires of the separable connectors are effectively grounded all the time.

   Evenly apply a layer of grease on the surface of the stress body and the surface of the inner hole of the plug; Make sure that the direction of the inner hole of the plug is the same as the direction of the terminal hole. Push the cable into the lower hole of the plug to ensure that the terminal is in place and the terminal hole is centered. Note: The corresponding contact parts of the product must be cleaned; The cable must be pushed in place, and the distance between the plug body exposed outside the large step surface of the stress body is less than 3mm, which is the correct position (as shown in the following figure).

   (Tee Connector installation completed.)

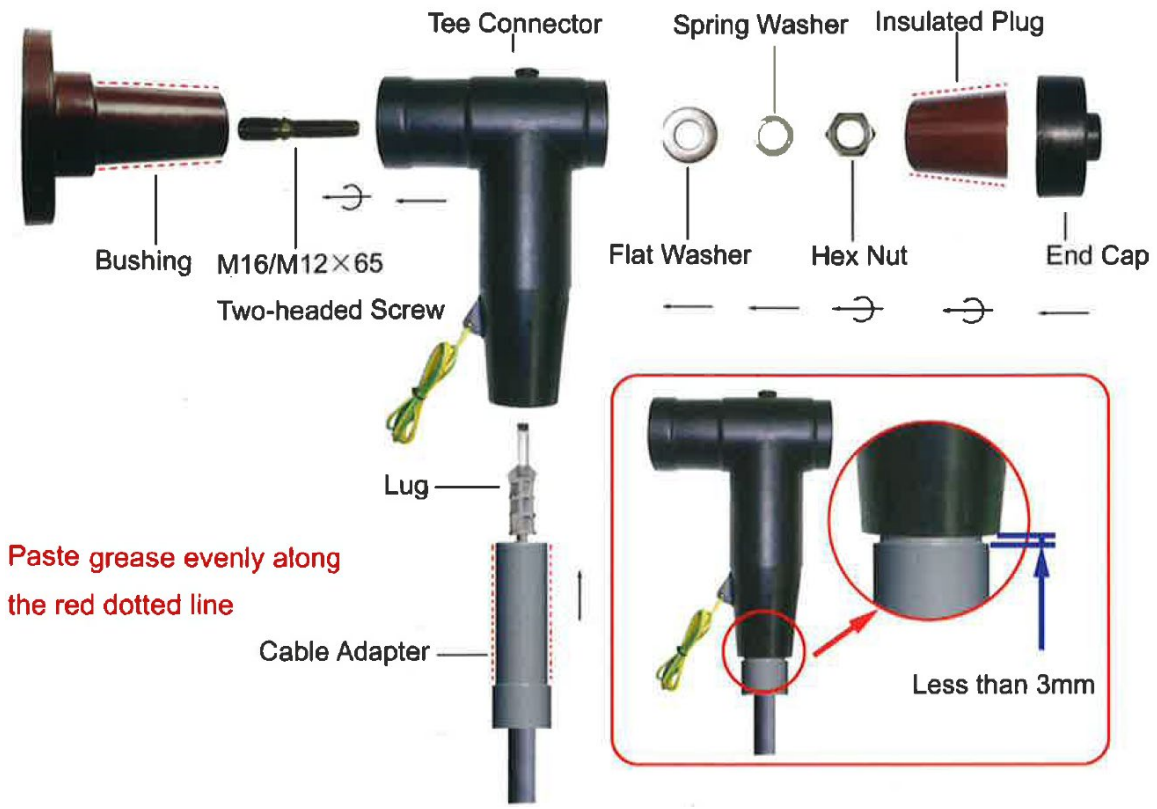


Figure 3- 17 Tee Connector Installation

10. Make sure that the lugs match the standard die, insert the lugs onto each phase conductor, and perform a three-step crimping process using a crimping tool to secure the lug onto the cable conductor. (Note: Ensure the lug face is parallel to the bushing seat end face.)

Figure 3- 18 Insert lugs onto each phase conductor

11. Tighten the M16/M12 two-headed screw on the bushing, with the M16 end (thicker side) forward, clean the mounting hole of Tee connector, surface of cable adapter and surface of bushing. After drying, uniformly apply grease to the cleaned mounting hole of Tee connector, surface of cable adapter and surface of bushing.

Figure 3- 19 Clean and apply grease

12. Push the cable into the lower hole of the Tee connector to ensure that the lug is in place and the lug hole is centered without deviation. (Note: The cable must be pushed in place, and the distance between the the cable adapter and the Tee connector is less than 3mm.)

Figure 3- 20 Push cable into Tee connector

13. Push the Tee connector and the cable adapter into the bushing together, and the lugs are set on the stud. (Note: The lug shall not be moved down to prevent the friction between the lug and the stud. The friction may leave the conductive copper debris in the mounting hole of Tee connector and compromise insulation.)

Figure 3- 21 Push Tee connector and cable adapter into bushing

14. Pass the steel branch through the bushing, and place the hex nut, the spring washer, and the flat washer in turn. Hold the steel branch against the stud, install the nut and washer, and tighten the nut with a torque of no less than 40 N.m (354 in-lb).

Figure 3- 22 Install the nut and washer

15. Clean the rear hole of Tee connector and sealing cap, evenly apply grease after drying, tighten the cap and wipe off excess grease, and install the end cap.

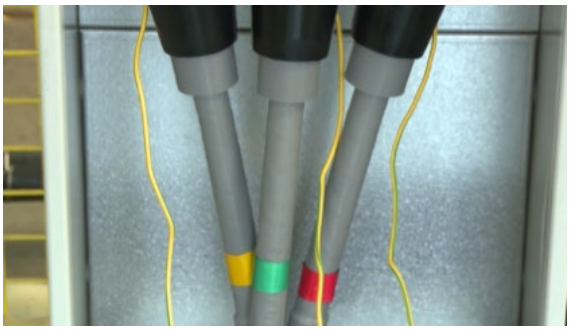


Figure 3- 23 Install end cap

3.5.3 DC Connection

1. To get the best performance from your PCS Skid ESS, follow these guidelines:
   - First, ensure that the maximum output voltage of the battery cluster is lower than 1500V.
   - Ensure that the polarity on the DC input side is correct, i.e. the positive pole of the battery cluster is connected to the positive DC input of the PCS Skid ESS, and the negative pole of the battery cluster is connected to the negative input of the PCS Skid ESS.
   - The 2400KW PCS skid supports up to 12 inputs, and the maximum current of each DC input is 218A.
   - For DC input, it is recommended that each input copper bar be connected with up to two cables. The size of the DC wiring copper bar is shown in the following figure, and the cable diameter recommendations are shown in the following table.

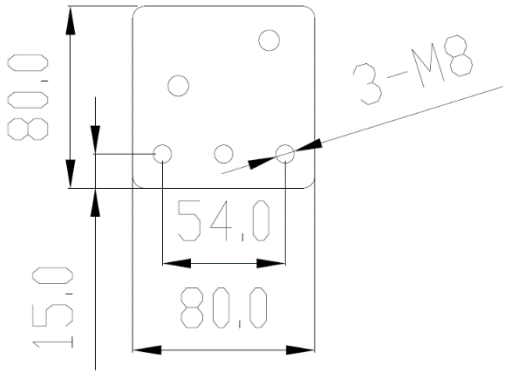


Figure 3- 24 Diameter of Copper Bar for DC Wiring (mm)

Table 3- 5 Cable Parameters

Parameter	**Value**	
Machine type	CPS PSW2M-EU	CPS PSW2.4M-EU
Number of DC input channels	10	12
Recommended cable diameter	120mm² AL/50mm² AL/	
Bolt	M10	
Torque	25 N.m (221 in-lb)	

2. Connect the DC positive (1+, 2+, 3+…) and negative cables (1-, 2-, 3-…) to the positive and negative copper bars of PCS accordingly. The positions of the DC input positive and negative wiring copper bars are shown in the following figure:

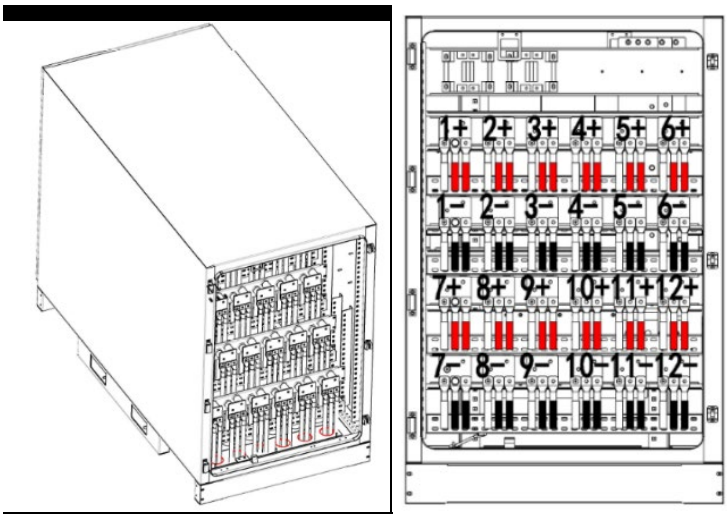
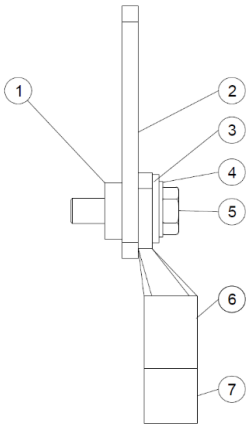


Figure 3- 25 DC Input Wiring Position

NOTE:

There are six groups of DC inputs on one side below the DC distribution isolating switch, with DC "+" wiring copper bar located above and DC "-" wiring copper bar below.

3. The following principles are recommended for DC input wiring:
   - It is recommended to use standard copper terminals or copper-aluminum composite terminals.
   - Copper or aluminum-core cables with an operating temperature of 90°C or above are recommended.
   - Hexagonal cross section is recommended for the crimping of wiring terminals and cables with 2-3 times.
   - Please confirm the number of DC input channels, select an appropriate cable diameter, then fix the wiring terminal on the copper bar according to the connection method shown in the following figure, and lock it with a torque wrench. Torque: 25 N.m (221.3 in-lb).



1. Nut
2. Copper bar
3. Flat washer
4. Spring washer
5. Bolt
6. Terminal
7. Cable

Figure 3- 26 Connection of DC Input Cable

3.5.4 Low voltage cabinet wiring

The power supply of the liquid-cooling battery container is connected to the low-voltage cabinet of the PCS Skid ESS through cables. The location map is as follows:

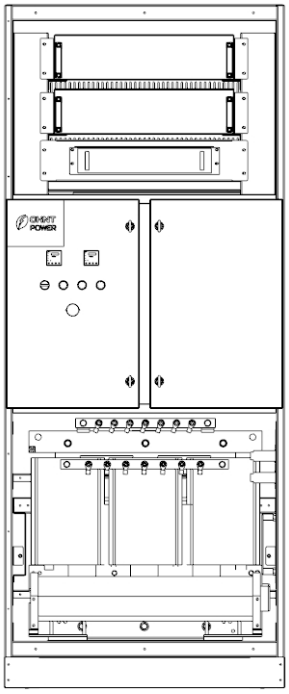


Figure 3- 27 Low-voltage cabinet wiring

Number	Cable label	Origin (Low voltage cabinet of PCS Skid ESS)	Terminal point (Battery container)	Cable
1	1#1DY1-1	1QF1	XT	YJV-4*25mm^2
2	1#1DY1-2	2QF1	1XT	YJV-2*2.5mm^2
3		◦ ◦ ◦		

See the wiring table in the cable catalogue for details.

3.5.5 Communication connection

1. Communication connection with battery container BMS:

   The PCS Skid ESS is directly connected to the BMS of battery container through Ethernet and CAN interfaces.

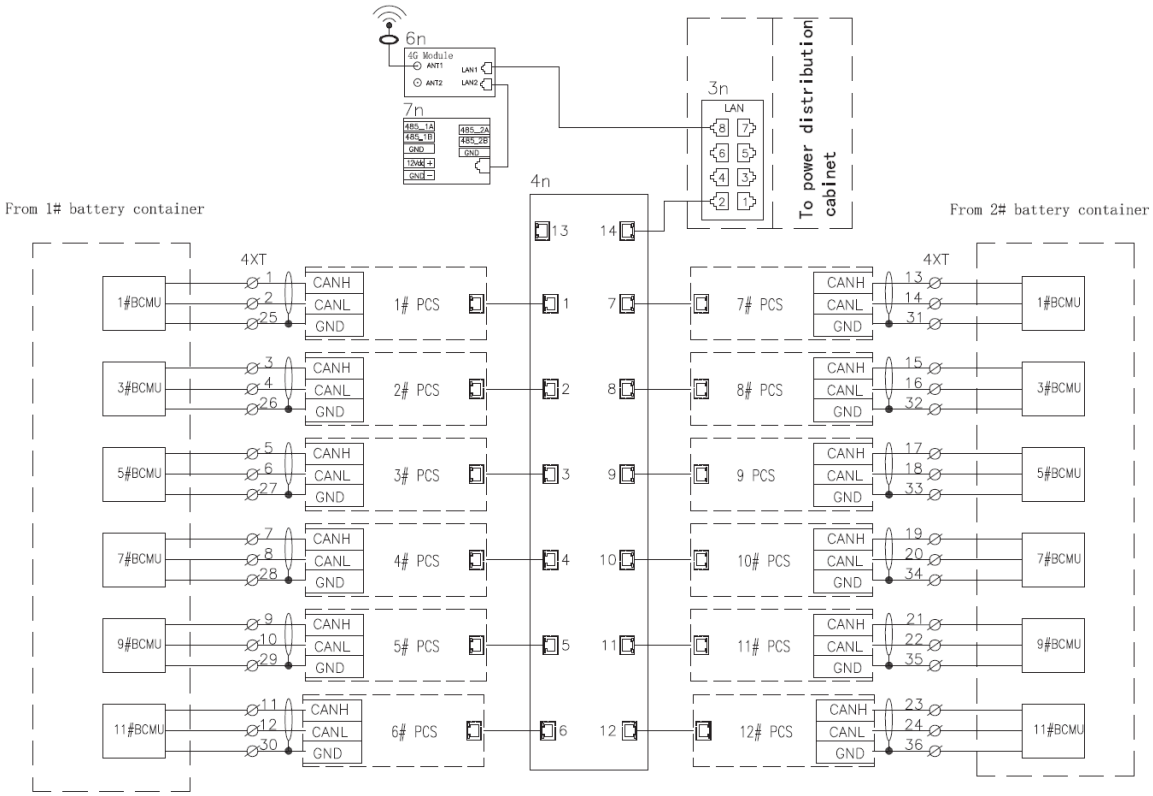


Figure 3- 28 Communication Interface

2. Communication with background upper computer

   - Each PCS Skid ESS is reserved with 3 Ethernet signal interfaces and 2 optical fiber interfaces for communication with the background. The communication cable shall be a shielded network cable, and both ends of the crystal plug with a straight-through twisted pair shall comply with the 568B standard. Each group of twisted pairs shall correspond to each other at both ends one by one, and the same color shall be kept consistent in the corresponding slots of the crystal plugs at both ends.
   - For remote monitoring of multiple PCS Skid ESS, the Ethernet interface or optical fiber interface on the PCS Skid ESS is connected in parallel with the corresponding interface of another PCS Skid ESS and connected to the monitoring background through the bus.

3.5.6 Checks after wiring

Inspection items	Acceptance criteria
Equipment appearance	The appearance of the equipment is completed without damage, rust and paint peeling. If there is paint peeling, please carry out touch-up operation. Equipment labels are clearly visible. Damaged labels should be replaced promptly.
Cable appearance	The protective cable wrapping is intact and there is no obvious damage. The threading cable and hose are in good condition.
Cable connection	The cable connection location is the same as the design. The terminals are made in accordance with the specifications, and the connection is firm and reliable. The labels at both ends of each cable are clear, and the labels are oriented in the same direction. The wiring meets the principle of strong and weak electricity separation.
Cable arrangement	The cables are neat and beautiful. The wire buckle joints are cut neatly, and no spikes are exposed. Allowance shall be reserved at the turning as required and shall not be tightened. The cables are straight and smooth, and the cables in the cabinet do not cross.
Cabinet cleaning	The interior of the cabinet is clean and tidy, free of excess cables, wire ends, terminals and tools. There are no obvious sundries outside the equipment.

4 Power-on and Power-off Operations

After the wiring is completed, perform the following steps to power on and power off the PCS Skid ESS.

4.1 Power-on operation process

After completing all pre-power-on inspection items, the system can be powered on. The steps are as follows:

1. In the measurement and control cabinet of the low-voltage cabinet, press the key of UPS for 3 seconds, the UPS power indicator light is ON, the red indicator light of UPS power on the panel of LV cabinet is on, and the power supply of the control loop is normal.

Figure 4- 1 Power on UPS

2. Close 2QF1-2QF5 micro circuit breaker to supply power to the measurement and control cabinet, battery container and medium voltage cabinet control power supply;

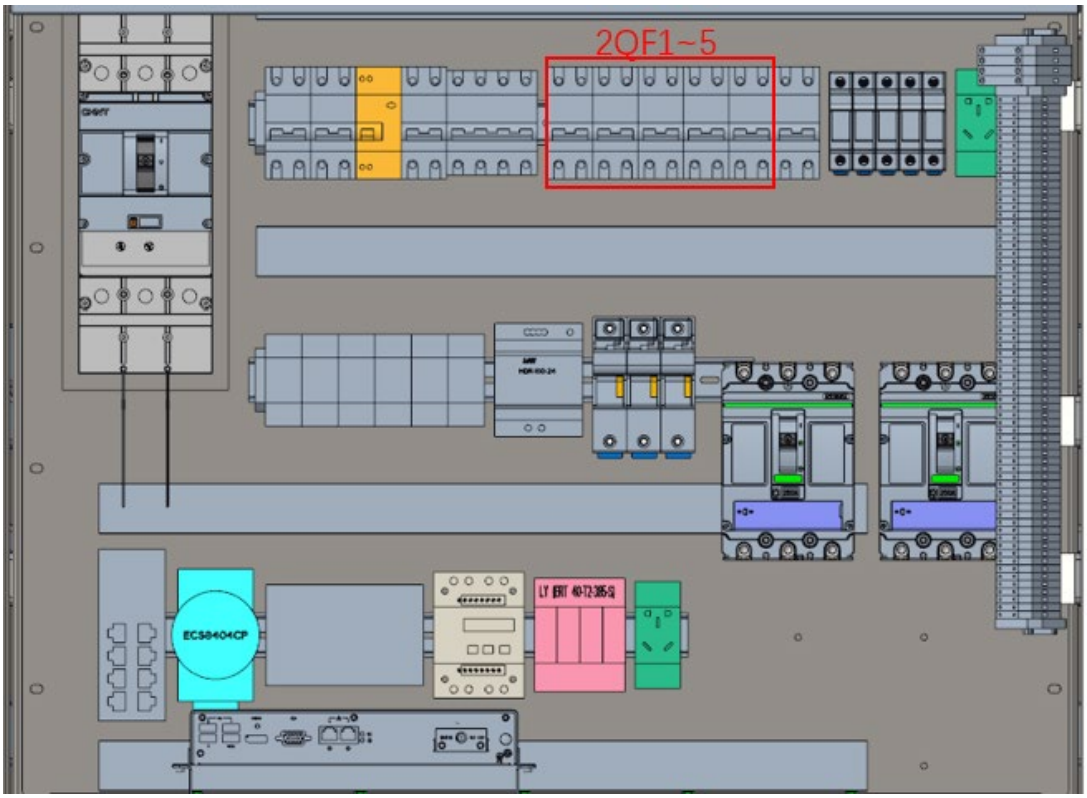


Figure 4- 2 Close 2QF1-2QF5 micro circuit breaker

3. Move to the corresponding battery container, close the QFM2, 1QF1-1QF4 micro circuit breaker to turn on the white indicator light of utility power supply and supply power to the control loop of battery container, fire power supply, so that it does not send a trip signal; Close the plastic case circuit breaker QFM1, miniature circuit breaker QF1-QF5;

Figure 4- 3 Circuit breaker of battery container

4. Move to the confluence box of PCS Skid ESS, and successively close the plastic case circuit breakers QF1-QF13 ;

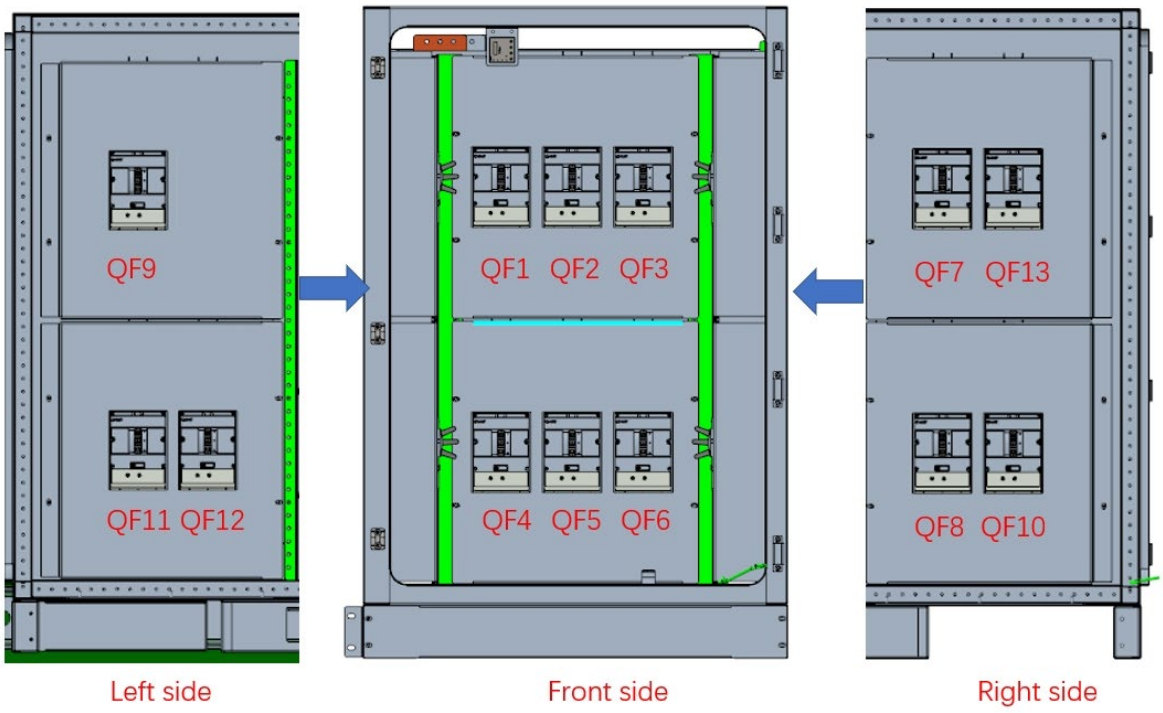


Figure 4- 4 Plastic case circuit breakers QF1-QF13

5. The operator wears high voltage operation protective clothing and then move to the medium-voltage cabinet of PCS Skid ESS, close the mini circuit breakers 1QF and 2QF (1) of circuit breaker cabinet (V cabinet) and directly connected cable cabinet (D cabinet);

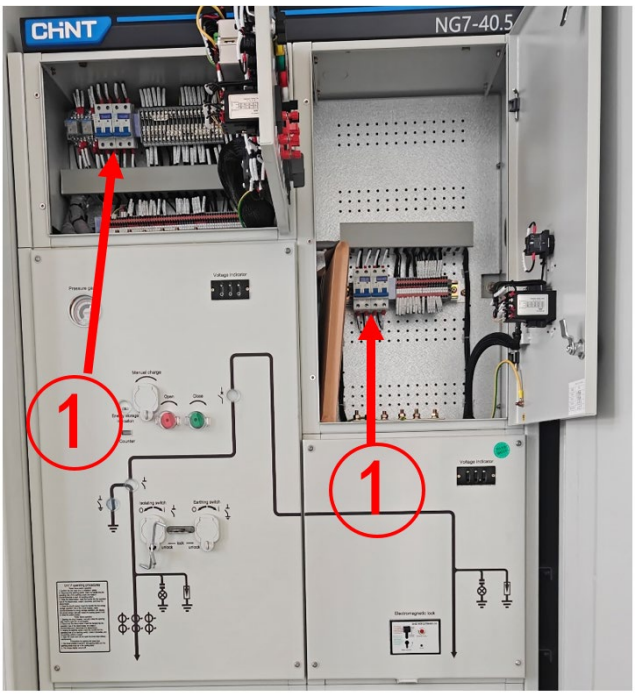


Figure 4- 5 V cabinet and D cabinet

6. Using the pneumatic cabinet operating lever to rotate the grounding switch (2) of the pneumatic cabinet circuit breaker cabinet to the dividing position, then rotate the isolating switch (3) to the closing position, and then manually rotate the circuit breaker closing knob (5) or press the closing button (4), so that the circuit breaker is closed and the live display DXN (7) light is on;

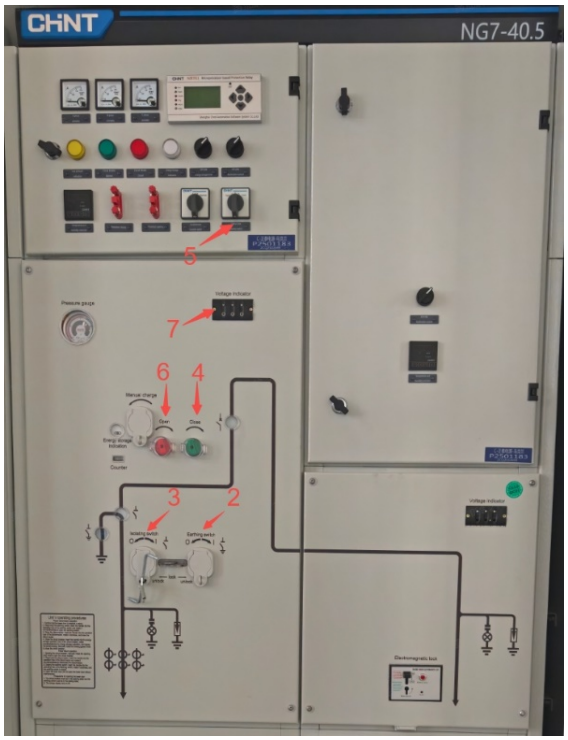


Figure 4- 6 Inflatable cabinet panel

7. During the first power-on, three no-load closing operations shall be performed on the transformer at the rated voltage;

8. Move to the low-voltage cabinet, successively close the QFM in the distribution unit, the plastic shell circuit breaker 1QF1, the miniature circuit breaker 1QF2-1QF6. Verify that the white indicator light of

utility power supply is on, the grid circuit power supply is normal, and the UPS interface shows the grid mode;

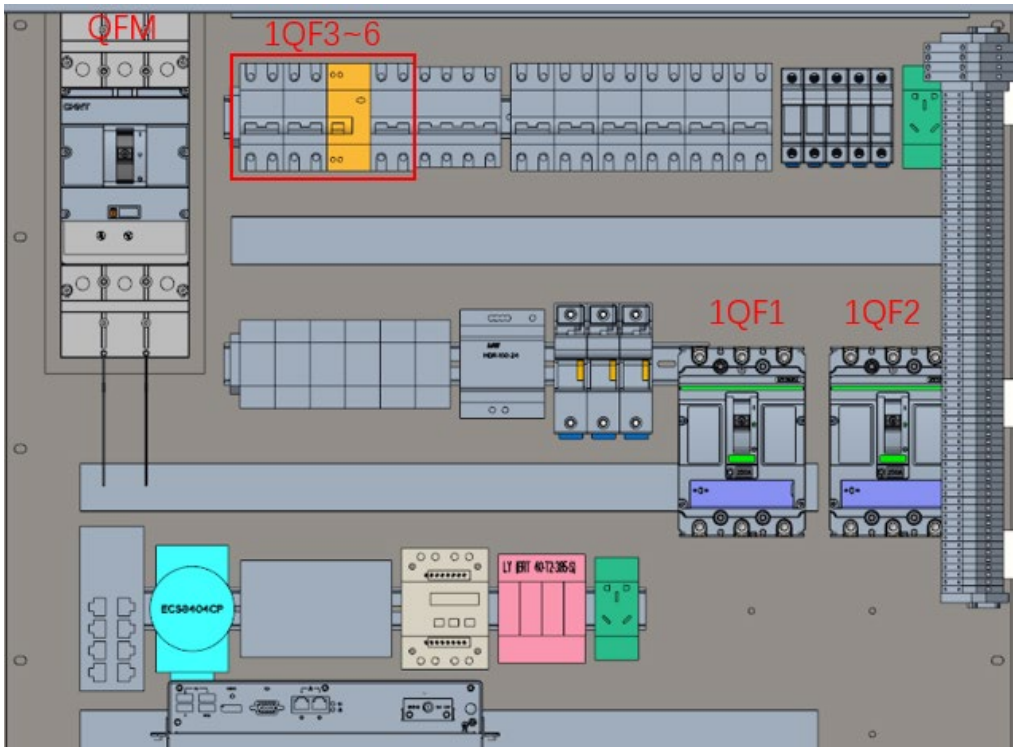


Figure 4- 7 Low-voltage cabinet

9. Check whether there is a fault signal in the battery cell parameter data set on the BMS screen of the battery container, and conduct the next operation after the fault is resolved;
10. Move to the PCS Skid ESS, and rotate the DC isolation switch of 12 PCS units counterclockwise to the ON position;

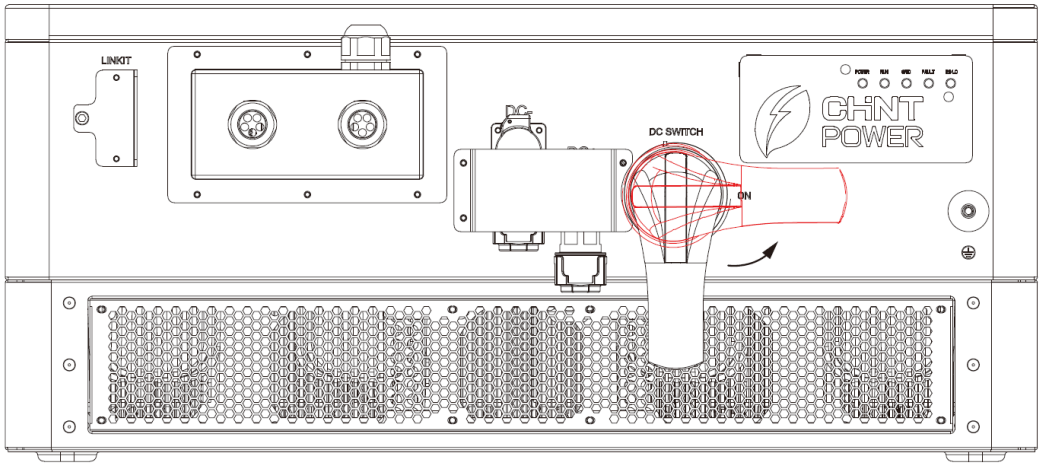


Figure 4- 8 Schematic diagram of PCS

11. Check the EMS screen on the measurement and control cabinet to check the current fault, and carry out the next operation after the fault is resolved;
12. The DC side battery is powered on, and PCS startup instructions are sent through the EMS system and charge and discharge strategies are carried out.

4.2 Power-off operation process

1. The EMS system in the measurement and control cabinet will issue the shutdown instruction. Under normal circumstances, the energy storage converter will be shut down;

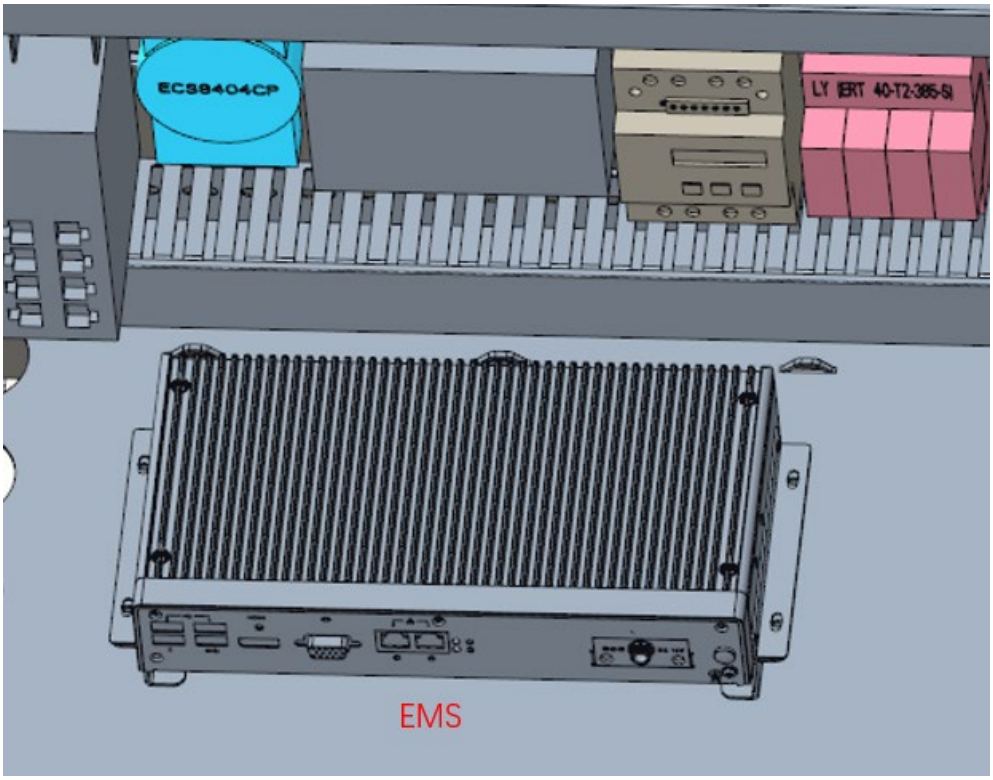


Figure 4- 9 Position of EMS

2. Then successively disconnect the plastic shell circuit breaker QFM, 1QF1, micro circuit breaker 1QF2-1QF6 in the measurement and control cabinet;

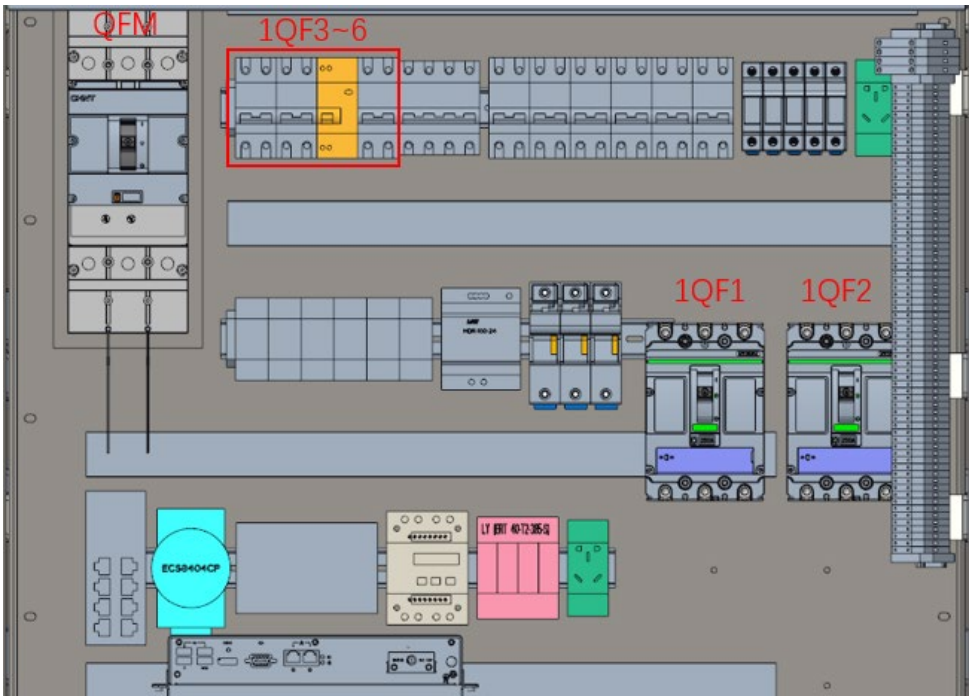


Figure 4- 10 Measurement and control cabinet

3. The operator wears high voltage operation protective clothing and then move to the medium-voltage cabinet, and manually rotate the brake knob of the circuit breaker of the inflatable cabinet, so that the circuit breaker is opened and the DXN light of the live display is off, and then use the operating rod of the inflatable cabinet to rotate the isolation switch to the point. See Figure 4- 6.
4. Disconnect the micro circuit breaker 2QF1-2QF5 under the UPS of the measurement and control power cabinet. See Figure 4- 2.
5. Long press the UPS OFF button for 3 seconds to shut down the UPS. See Figure 4- 1.
6. Rotate the DC isolation switch of 12 PCS units clockwise to the OFF position; (If the power outage is for a short time, this operation may not be performed).
7. Successively disconnect the plastic case circuit breaker QF1-QF13 in the confluence box; (If the power outage is for a short time, this operation may not be performed). See Figure 4- 4.
8. Move to the corresponding battery container, successively disconnect the plastic case circuit breaker QFM1, mini circuit breaker QF1-QF4,QFM2, 1QF1-1QF5. See Figure 4- 3.

5 Operation

The LEMS (local controller) can be used to control the startup and shutdown of the PCS Skid ESS and set the power.

Refer to the user manual of LEMS.

6 Maintenance and Troubleshooting

6.1 Maintenance

6.1.1 Regular maintenance

Table 6- 1 Regular maintenance

Item	Method	Maintenance intervals
System clean	1. Check the temperature and dust of the PCS. Clean enclosure if necessary. 2. Check if the air inlet and outlet as well as air vent filter are normal. Clean the air inlet and outlet as well as air vent filter, with soft brush or vacuum cleaner, if necessary.	6 months to 1 year (depending on the installation environment)
Cable entry	Check whether the cable entry is insufficiently sealed or the gap is excessively large, and reseal the entry when necessary.	Once a year
Electrical connection	1. Check whether all cables are firmly in place. If loose, please tighten all the cables referring to 3.5 Electrical connection. 2. Check for cable damage, especially whether the cable surface is scratched or smooth. Repair or replace the cables if necessary.	6 months to 1 year

6.2 Service and Replace

6.2.1 Replace the PCS

DANGER:

Please disconnect the electrical connection in strict accordance with the following steps. Otherwise, the PCS may be damaged, and the personal and life safety of service personnel may be endangered.

Dismount and replace the PCS according to the following steps when the service time is due or when it is needed:

1. Turn off all switches according to the power-off operation process in 4.2 Power-off operation process;
2. Turn off the operation and switch of DC side equipment (such as battery container equipment);
3. Turn the DC SWITCH (1) on PCS to OFF position;

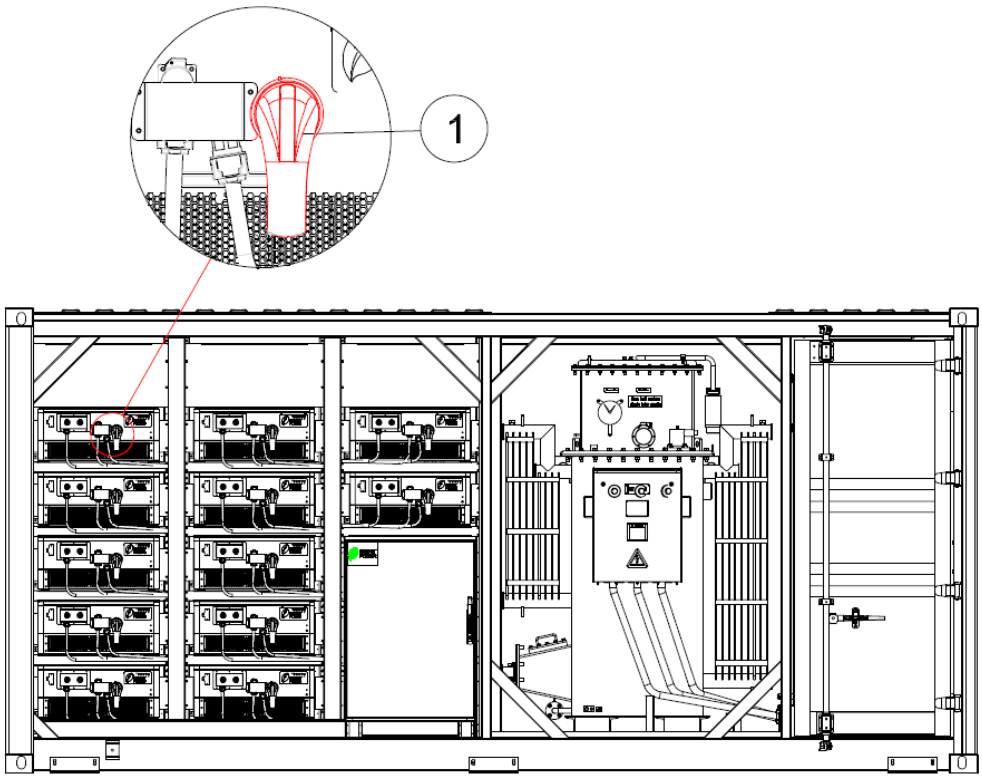


Figure 6- 1 DC switch

4. Connect and hang the maintenance grounding cable at the cable connection between the DC incoming copper bar of the confluence box and the medium-voltage cabinet of the transformer;

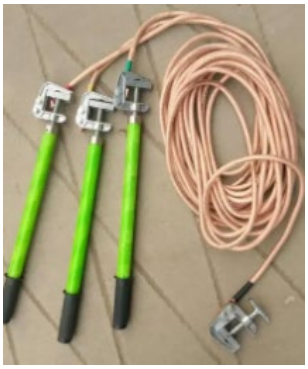


Figure 6- 2 Grounding Cable

5. Remove the DC cable and AC cable (1), and PCS grounding cable (2) of PCS incoming and outgoing lines;

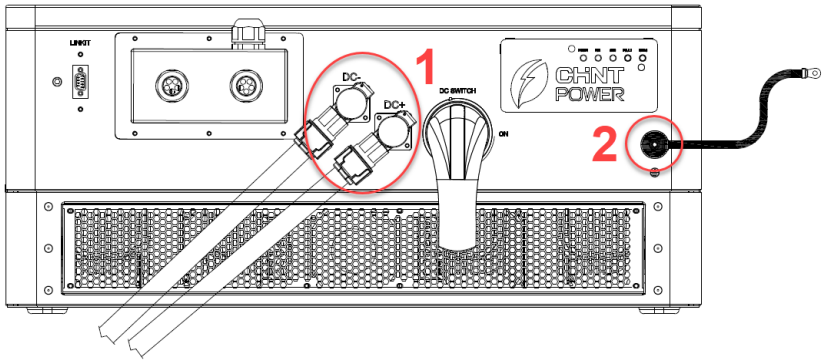


Figure 6- 3 Schematic Diagram of Cables

6. Remove the ten combination screws (1) of the PCS to remove it;

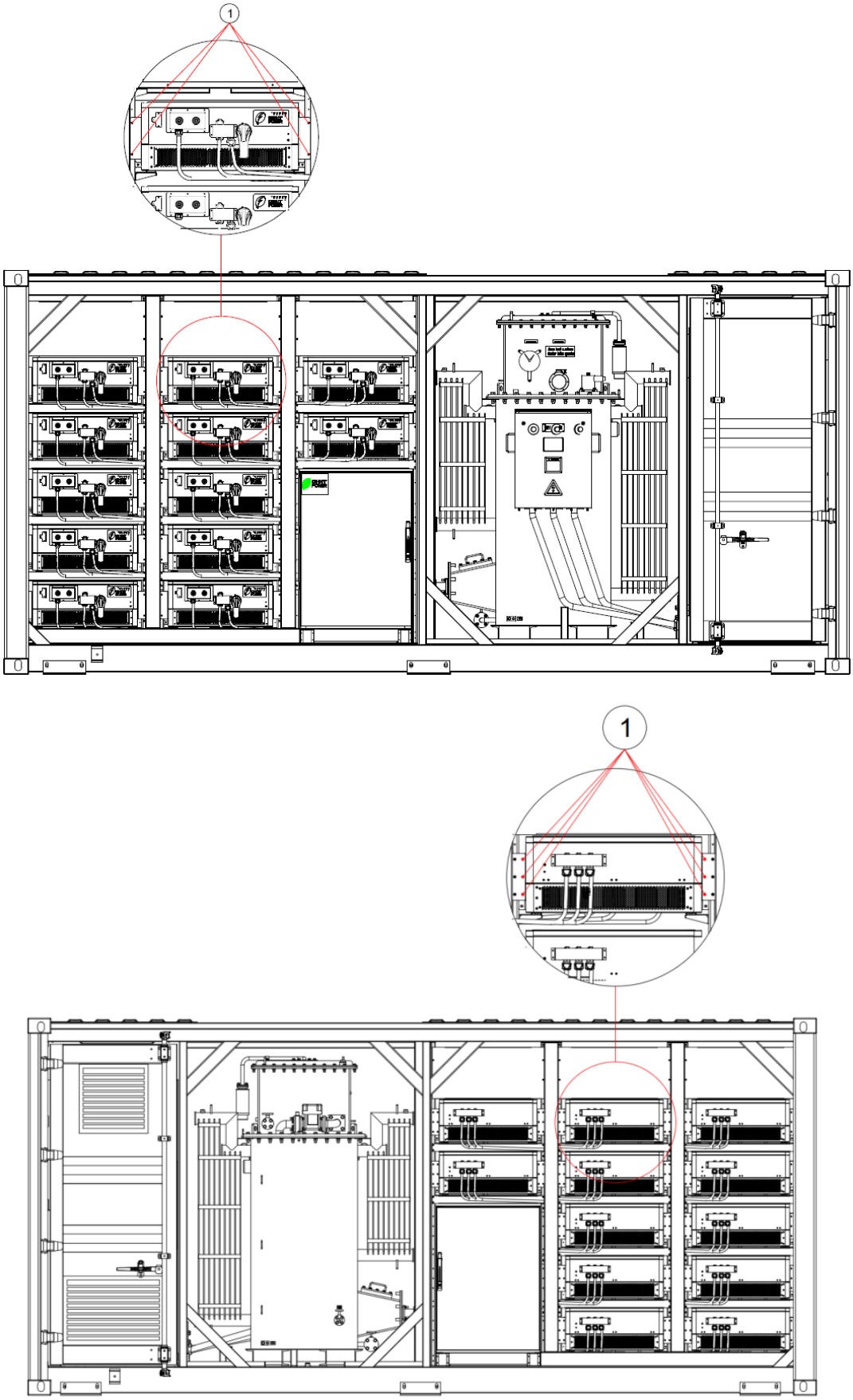


Figure 6- 4 Remove the PCS Combination Screw

7. Install a new PCS on the mounting bracket and tighten the ten combination screws; Torque: 12.5 N.m (110.6 in-lb);

NOTE:

The Weight of one PCS is about 120 kg (≈265 pounds).

It is recommended to have four people in total to move the PCS.

WARNING:

Watch out for falling of device when replacing the PCS.

Support the PCS carefully when the external part is approaching to the warning line.

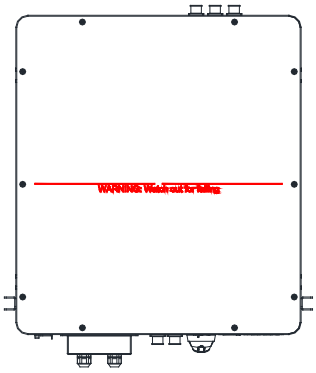


Figure 6- 5 Watch out for the Dropping Safety Line

8. Connect the incoming and outgoing DC cables, AC cables, and PCS grounding cables in the reverse order of cable removal;

9. Turn the DC Switch (1) on PCS to “On” position;

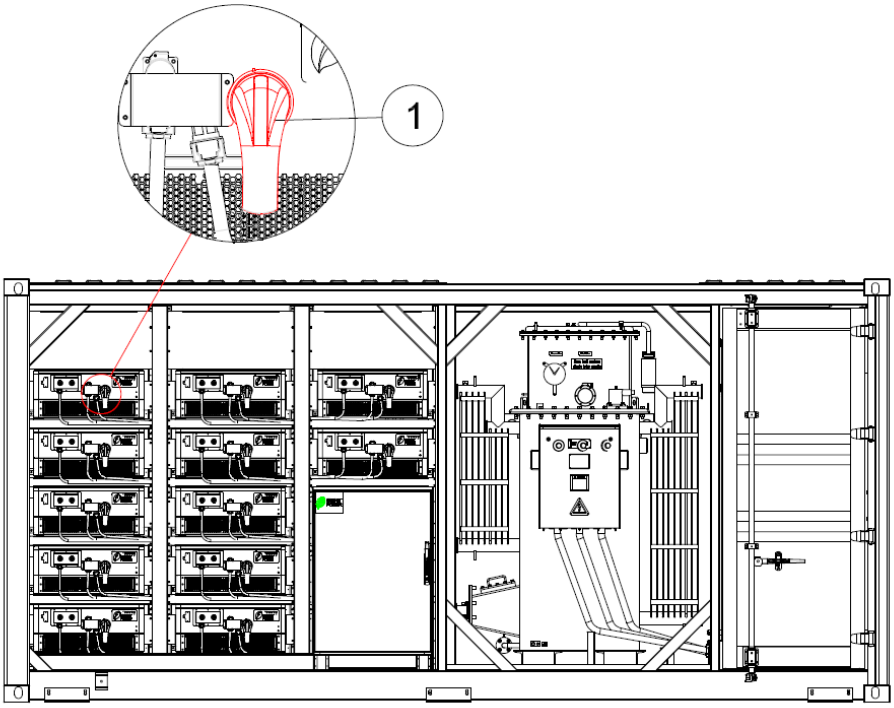


Figure 6- 6 DC SWITCH

10. Run the equipment and check whether the newly replaced PCS operates normally;

6.2.2 Replace cooling fans

If the internal temperature of the PCS is higher than normal operating temperature or abnormal noise is heard assuming the air vent is not blocked and is clean, it may be necessary to replace the external fans. Please refer to the following steps for replacing the cooling fans.

1. Remove the ten combined bolts (1) of PCS and remove the PCS from the bracket.

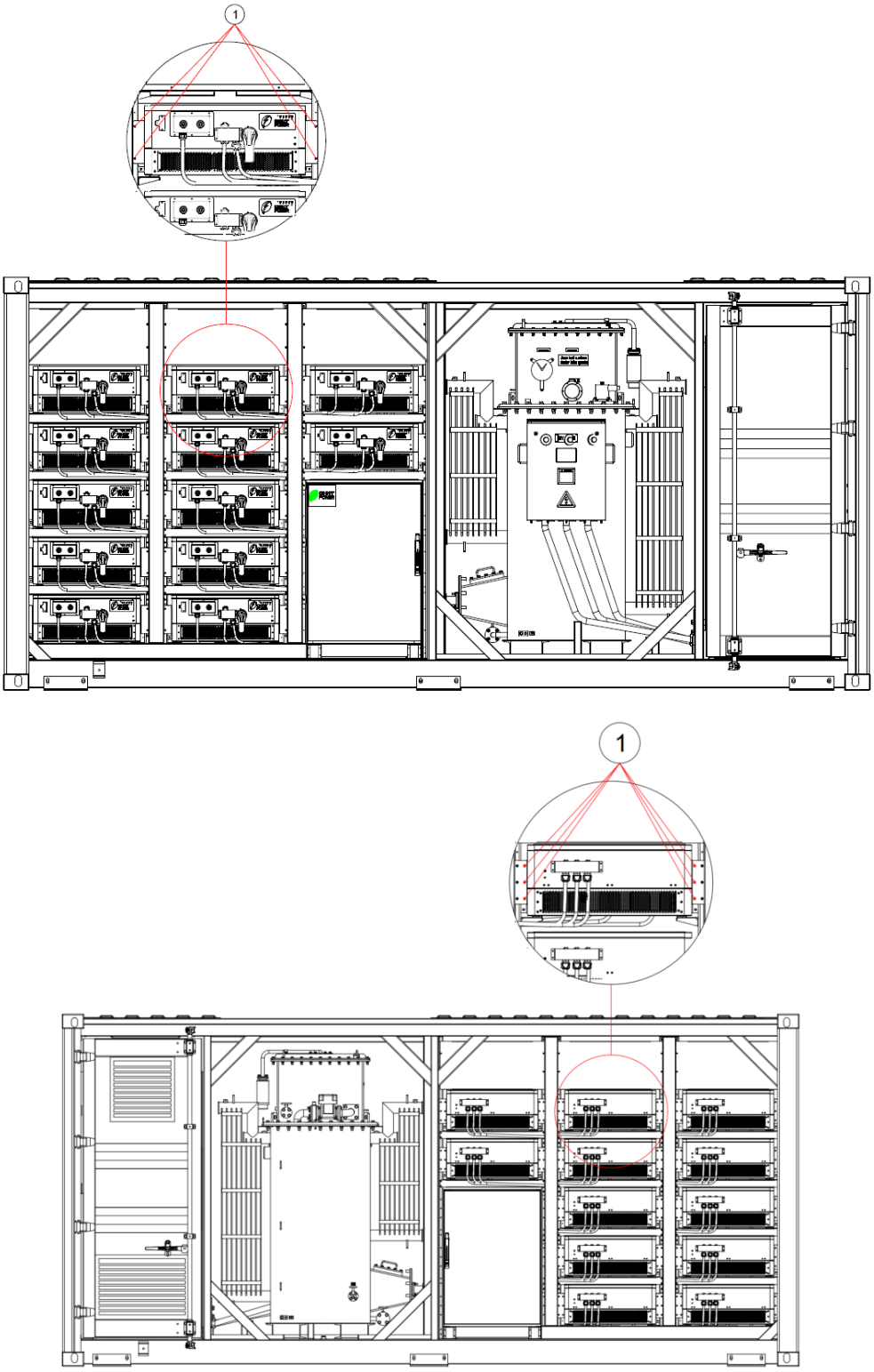


Figure 6- 7 Remove the PCS Combination Screw

NOTE:

The weight of one PCS is about 120kg (≈265 pounds).

It is recommended to have four people in total to move the PCS.

WARNING:

Watch out for falling of device when replacing the PCS.

Support the PCS carefully when the external part is approaching to the warning line.

2. Put the PCS on flat ground and use a No.2 Phillips head screwdriver to unscrew the eight screws on the front plate and take off the fan tray.

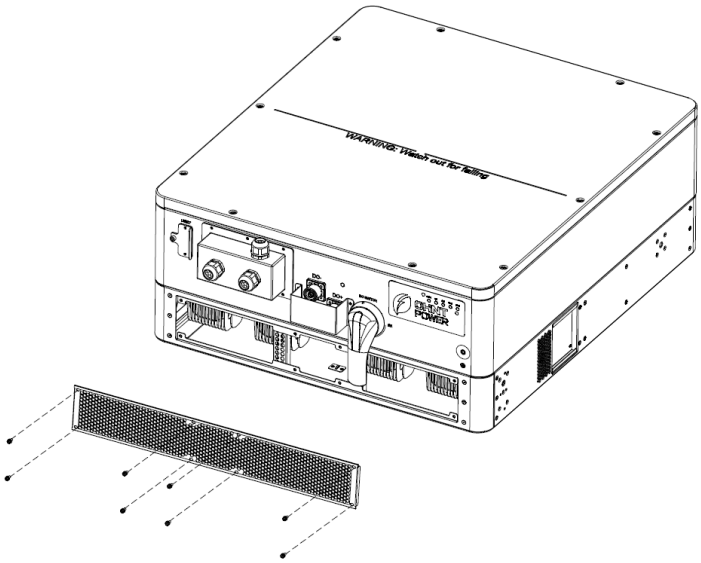


Figure 6- 8 Remove screws

3. Disconnect the cable connector from the cooling fan and cut the cable ties (1).

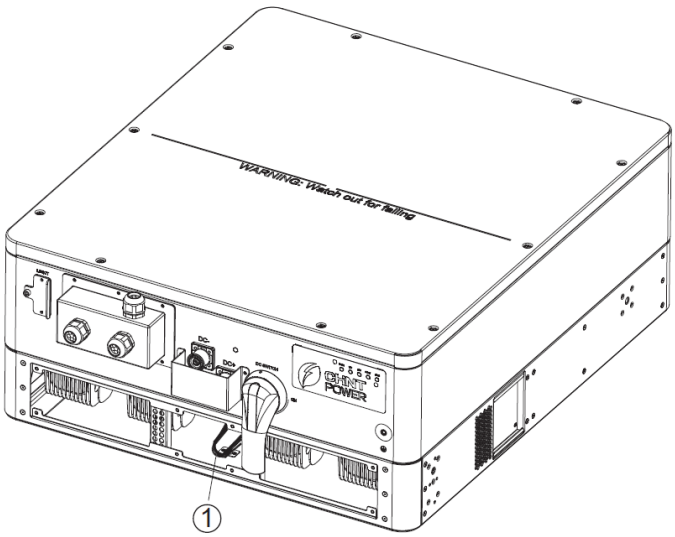


Figure 6- 9 Cut the cable ties

4. Use a No.2 Phillips head screwdriver to take off the four M4 screws (2) on the left or right clamp plate and remove the clamp plate (3).

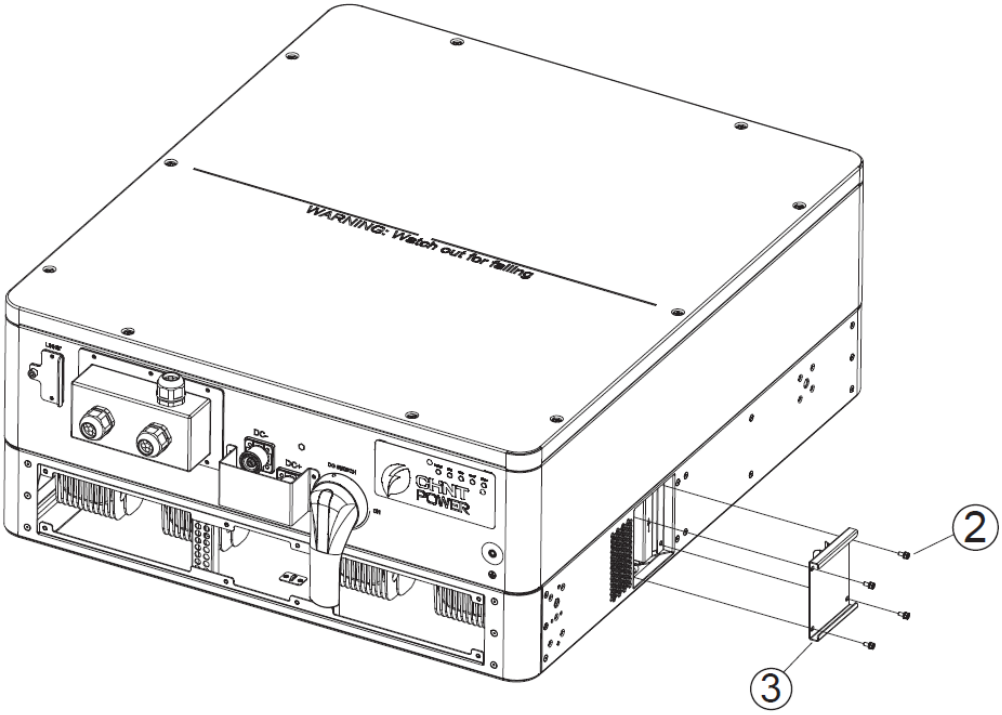


Figure 6- 10 Remove the clamp plate out

5. After removing the clamp plate, pull out the fan tray with the aid of the exposed handle (1) of the fan tray.

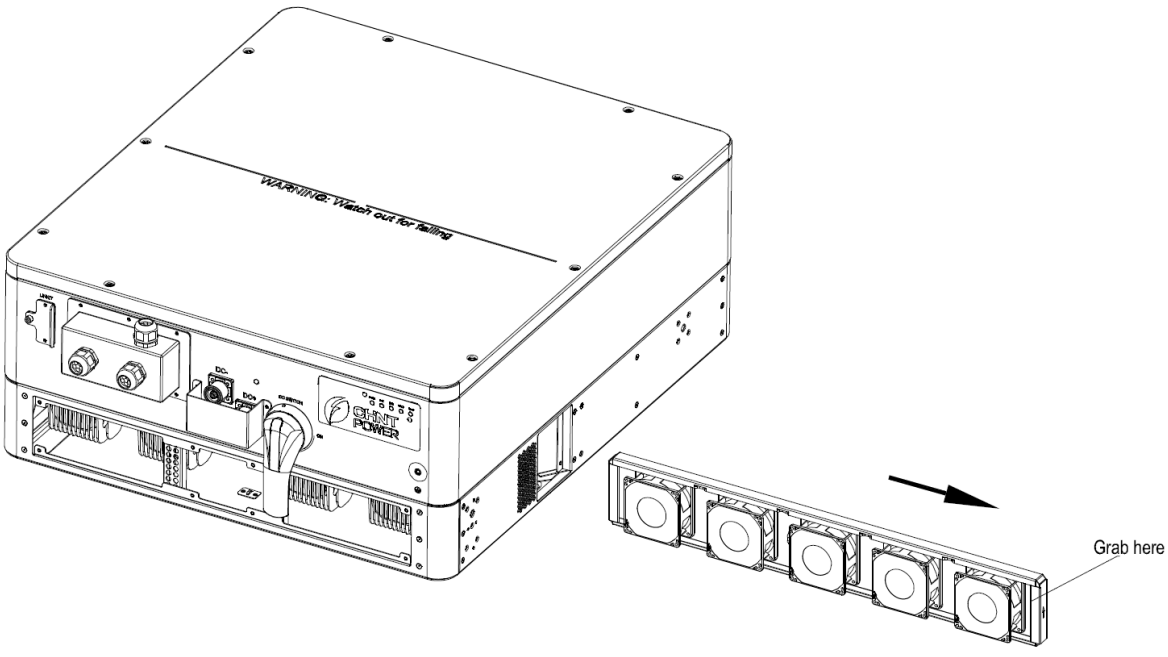


Figure 6- 11 Pull out the fan tray

NOTE:

Do not pull it too hard to protect the fan cables from being damaged.

6. Cut off the cable ties between fan cable and fan tray, remove the damaged fans and replace them. Tighten the tapping screws with a torque value of 0.8-1 N.m (7.1-8.9 in-lb).

NOTICE:

A rubber pad shall be placed between the fan and fan tray to reduce noise caused by vibration.

7. Fix the new cooling fan on the fan tray and fasten the cable on the fan tray with cable ties in ways shown as below.

   Torque value: 0.8-1N.m (7.1-8.9 in-lb)

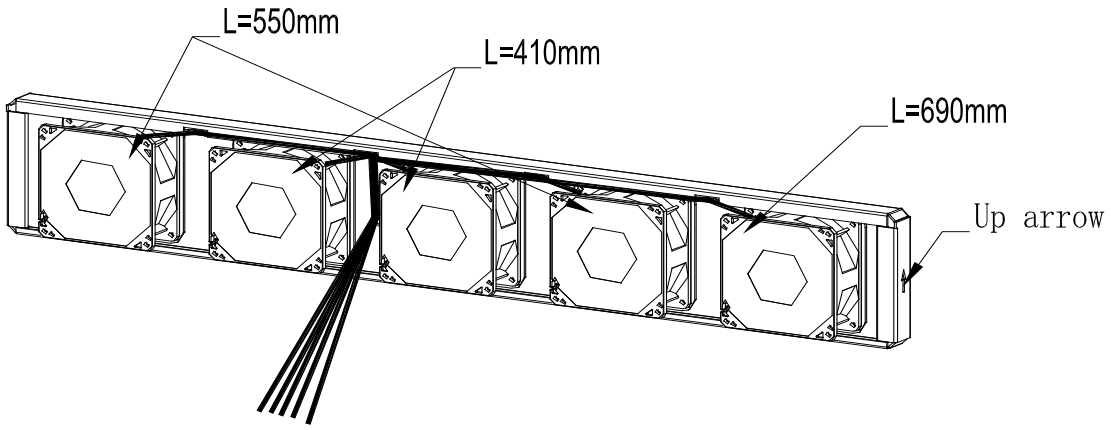


Figure 6- 12 Fasten the cable on the fan tray with cable ties

NOTICE:

Fan cables shall be placed in the groove of the fan tray.

8. Install the fan trays, clamp plates and front plate to the PCS, and tighten the screws.

   Torque value: 1.2 N.m (10.6 in-lb).

9. Install the PCS and tighten the combined screws.

   Torque: 25 N.m (221.3 in-lb)

6.3 Fault analysis and troubleshooting

Please refer to the definition of LED lights as shown in the following figure and table and troubleshooting as shown in Table 6- 3:

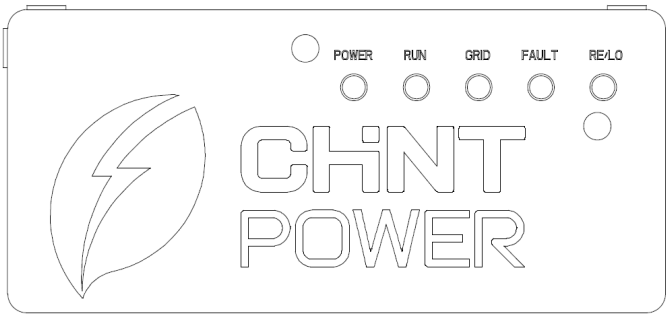


Figure 6- 13 LED lights

Table 6- 2 LED lights and indication

LED lights	Name	Status	Indication
POWER	Working power indicator	Light on	Energized (control panel starts to work)
		Light off	Power supply not working
		Slow flash	The system is not powered on or the communication between MCU and DSP is abnormal
RUN	Grid-tied operation indicator	Light on	In grid-tied power generation state
		Slow flash	Derated running status (light on 0.5s, light off 2.0s)
		Light off	In other operation status or power supply not working
GRID	Grid status indicator	Light on	Grid on
		Light off	Power supply not working
		Flash	Grid fault (light on 0.5s, light off 2.0 s)
FAULT	Fault status indicator	Light on	Indicates a Fault
		Slow flash	Indicates Alarm (light up 0.5s, light off 2s)
		Fast flash	Protective action (light up 0.5s, light off 0.5s)
RE/LO	Remote/local status	Light on	Remote control mode is enabled
		Light off	Remote control mode is disabled

Table 6- 3 Fault Information

Fault name	Fault explanation	Fault cause	Fault handling
TempSensor Err	Prompt detection of abnormal temperature	1.Temperature Sensor socket connector has poor contact; 2.Temperature Sensor is damaged;	1.Observe temperature display; 2.Switch off 3-phase working power supply and then reboot the system; 3.Contact service personnel
CommErr	Communication inside PCS fails	Terminal block connecters of internal communication wires have poor contact	1.Observe for 5 minutes and see whether the alarm will be eliminated automatically; 2.Switch off 3-phase power supply and then reboot the system; 3.Contact service personnel
ExtFanErr	Cooling fan failure by visual check	1.Fan is blocked; 2.Fan service life has expired; 3. Fan socket connecter has poor contact.	1.Observe for 5 minutes and see whether the alarm will be eliminated automatically; 2.Check for foreign objects on fan blades; 3.Switch off 3-phase power supply and then reboot the system; 4.Contact service personnel
EepromErr	Internal alarm	Internal memory has a problem	1.Observe for 5 minutes and see whether the alarm will be eliminated automatically; 2.Contact service personnel
TempOver	Ambient or internal temperature is too high	1.Ambient temperature outside the PCS is too high; 2.Fan is blocked; 3.Convection airflow is insufficient due to improper installation.	1.Confirm that external ambient temperature is within the specified range of operating temperature; 2.Check whether air inlet is blocked; 3.Check whether fan is blocked; 4.Check whether the location of installation is appropriate or not; 5.Observe for 30 minutes and see whether the alarm will be eliminated automatically; 6.Contact service personnel

Fault name	Fault explanation	Fault cause	Fault handling
GridV.OutLim	Grid voltage exceeds the specified range	1.Grid voltage is abnormal; Power grid breaks down 2.Cable connection between the PCS and the grid is poor;	1.Observe for 10 minutes and see whether the alarm will be eliminated automatically; 2.Check whether the grid voltage is within the specified range; 3.Check whether the cable between the PCS and power grid is disconnected or has any fault; 4.Contact service personnel
GridF.OutLim	Grid frequency is abnormal, or power grid is not detected	1.Grid frequency is abnormal; 2.Cable connection between the PCS and the grid is poor;	1.Observe for 10 minutes and see whether the alarm will be eliminated automatically; 2.Check whether the grid frequency is within the specified range; 3.Check whether the cable between the PCS and power grid is disconnected or has any fault; 4.Contact service personnel
Battery VoltOver*	Battery voltage exceeds the specified value	Battery overvoltage	1.Observe for 30 minutes and see whether the alarm will be eliminated automatically; 2.Check whether battery voltage exceeds the specified range; 3.Turn off the battery input switch, wait for 5 minutes, and then turn on the switch again; 4.Contact service personnel
GFCI.Err	System leakage current is too high	1.Excessive parasitic capacitance on battery module due to environmental factor; 2.Grounding is abnormal; 3.Internal PCS fault	1.Observe for 10 minutes and see whether the alarm will be eliminated automatically; 2.Detect whether the electrical connection is abnormal 3.Contact service personnel
IntProtect 0010~0620	Internal protection of the PCS	Protection procedure occurs inside the PCS	1.Observe for 10 minutes and see whether the alarm will be eliminated automatically; 2.Contact service personnel

Fault name	Fault explanation	Fault cause	Fault handling
IntFault 0010~0150	Internal fault of the PCS	Fault occurs inside the PCS	1.The PCS can be forced to restart once if it is required by operation and if it is confirmed that there is no other problem; 2.Contact service personnel

7 Technical Data

Model Name	CPS PSW2M-EU / PSW2.4M-EU
DC Input	
Max. DC Input Voltage	1500V
Min. DC Voltage	875V
DC Voltage range for nominal power	950-1500V
Number of CPS ECB200KTL PCS Units	12
Number of DC inputs	12
AC output	
Rated power	2400kVA / 2400kW
Rated grid frequency	50/60Hz
Medium voltage ranging	6-35kV
Vector Group	Dy1, Dy11
Cooling class	ONAN
Insulating fluid	Biodegradable oil, FR3 type or equivalent
Environment	
Protection degree	IP54
Cooling	Forced air cooling
Operating temperature range	-4°F to +113°F / -20°C to +45°C * For the condition of -22°F to +140°F / -30°C to +60°C, consult the manufacturer for solutions.
Storage temperature range	-22°F to +140°F / -30°C to +60°C

Operating humidity	0-95% (no condensation)
Operating altitude	9843ft/3000m (>6562ft/2000m derating)
Display and communication	
Communication	RS485 / Ethernet / CAN
Modbus data mapping	CPS
Mechanical	
Dimensions (W x H x D)	6058×2896×2438mm
Weight	16000kg
Safety	
Certifications and standards	IEC 62109, IEC 62477, IEC 61000, IEC 62920, EN 50549-2:2019, EN 50549-10:2022, RfG:2016, NC RfG:2018, PTPiREE:2021, UNE 217001:2020, RD 647:2020, RD 1699:2011, RD 661:2007, RD 413:2014, UNE 217002:2020, NTs Version 2.1, VDE 4110, VDE 4120
Smart-grid features	Volt-Ride Thru, Freq-Ride Thru, Ramp-Rate, PF, Volt-VAR, Freq-Watt, Volt-Watt
Protective functions	
Black start	Yes
Reverse polarity protection	Yes
Overvoltage protection	Yes
Grid monitoring	Yes
Ground fault monitoring	Yes
Active / reactive power response time	< 100ms

8 Quality Assurance

8.1 Exemption from liability

- Be damaged during transportation;
- Be operated in environments beyond those specified in this manual;
- The product is used incorrectly or improperly (including installation and use);
- Change products or software provided without authorization;
- Ignore the safety warnings and relevant statutory safety specifications contained in products and documents;
- Unpredictable disasters or irresistible accidents occur;

8.2 Quality terms (warranty)

- For products that fail during the warranty period, our company will repair or replace with new products free of charge;
- The replaced unqualified products shall be returned to us;
- We need a reasonable time to repair the device.

If you have any questions about the CPS PSW2M-EU / PSW2.4M-EU, please contact us. We will be very happy to serve you.

9 Routine Maintenance

Environmental factors such as ambient temperature, humidity, dust, and vibration accelerate aging and wear of internal components in the PCS Skid ESS, potentially leading to operational failures. Regular maintenance is therefore essential to ensure normal functionality and extend service life.

All actions aimed at maintaining the PCS Skid ESS in optimal operating condition fall under the scope of maintenance work.

9.1 Safety precautions

High voltage DANGER! Electric shock DANGER!

Serious injury or death!

After shutdown, please wait at least 10 minutes before opening the door. Before performing maintenance work, make sure that the interior of the device is completely de-energized.

Only qualified and authorized personnel may perform operations such as maintenance on the PCS Skid ESS.

During maintenance, do not leave metal parts such as screws and washers in the PCS Skid ESS, otherwise the equipment may be damaged!

The entry of wind, sand and moisture may damage the electrical equipment in the PCS Skid ESS or affect the operation performance of the equipment!

- Do not open the equipment cabinet door in the PCS Skid ESS in the wind and sand season or when the relative humidity in the surrounding environment is greater than 95%.
- Maintenance work can only be started when there is no wind and sand and the weather is clear and dry.

In order to ensure the safety of operators when maintaining or overhauling the PCS Skid ESS, be sure to abide by the following five safety rules:

- Professionals ensure that PCS Skid ESS cannot be re-energized accidentally.
- Use electrical inspection equipment to ensure that the interior of the PCS Skid ESS is completely de-energized.
- Have the necessary ground and short-circuit connections made by professionals.
- For possible live parts near the operating part, use insulating cloth to cover them.
- Check whether the escape route is blocked.

9.2 Maintenance

9.2.1 Overview

The PCS Skid ESS has IP54 protection grade and is suitable for outdoor use. However, harsh environment or long-term operation will cause the aging of the PCS Skid ESS or damage to the internal equipment. Regular maintenance and inspection of the PCS Skid ESS, and replacement of aging and damaged components will effectively prolong its service life and improve the performance of internal equipment.

Non-routine inspections should be prioritized, particularly when system performance shows significant degradation.

9.2.2 Maintenance period

In order to ensure the good operation of the equipments in the PCS Skid ESS, the PCS Skid ESS should be maintained regularly.

The maintenance intervals given in this section are reference values. The actual maintenance period should be reasonably determined based on the actual environmental conditions of the project site. If the operating environment of the PCS Skid ESS is relatively harsh, such as in a desert area, the corresponding maintenance period should be shortened. In particular, internal and external cleaning, anti-corrosion and anti-rust work, etc., should be more frequent.

If the PCS Skid ESS is installed in a desert area, it is recommended that the inside and outside of the PCS Skid ESS should be carefully inspected and thoroughly cleaned after each sandstorm.

Failure to comply with the torque requirements may cause fire at the connection!

During the electrical connection process, the bolts must be tightened strictly to the torques described in this manual.

Incorrect wiring sequence may cause fire. Please pay attention to the connection sequence of the wiring parts. When connecting, make sure that the connector is tight. Inadequate connections or oxidation of the contact surfaces can also cause excessive heat which may cause fire.

9.3 Maintenance items

Routine inspection and maintenance must comply with the relevant regulations of the power company. Inspection, maintenance and repair can only be performed by trained personnel who are familiar with the equipment. Personnel must be certified and comply with safety regulations issued by the power company.

Table 9- 1 Maintenance items

Inspection item	Inspection method	Period
System Status and Cleaning	Check whether the PCS Skid ESS and internal equipment are damaged or deformed.	Once a month
	Check whether there is abnormal noise during the operation of the internal equipment.	
	Check whether the temperature inside the PCS Skid ESS is too high.	
	Check that warning signs, labels, etc. are clearly visible and not defaced. Replace if necessary.	
	Check whether the humidity and gray scale are too heavy, and clean the equipment if necessary.	
	Check whether there is oxidation or corrosion signs inside the PCS Skid ESS. If any, remove rusts.	
Cable connection	Check whether the power cable is loose. If it is loose, tighten it according to the torque specified in the manual.	Once every half a year after the first commissioning and once every two years thereafter.
	Check whether the power cables and control cables are damaged, especially whether the skin in contact with the metal surface has any signs of cuts.	
	Check whether the insulating wrapping tape of the power cable terminal is peeled off.	
Fan / heat exchange	Clean or replace the dust filter.	Once every half a year after the first commissioning, and once every half a year to once a year thereafter.
	Check the operating status of the fan/heat exchanger.	
	Check whether the fan / heat exchanger makes abnormal sound during operation.	

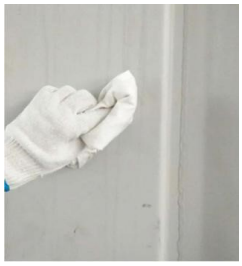
Inspection item	Inspection method	Period
Equipment maintenance	For maintenance of various internal equipment, please refer to relevant manuals.	/
Medium voltage ring network cabinet	Check the SF6 barometer to see if the pointer is within the green range. If the pointer approaches red, please stop the operation and replenish gas to it.	Once a month
	Check the live indicator and check whether the L1 / L2 / L3 indicators are normal. If it is abnormal, please replace the L1 / L2 / L3 indicators when the power is off.	
Transformer	Check the transformer oil level indicator. If the oil level is low, please power off the PCS Skid ESS and fill in oil in time.	Once a month
	Check whether there is oil leakage around the pressure relief valve. If any, tighten the valve.	
	Check the sheath of low-voltage cabinet and medium-voltage cabinet to see if there is oil leakage. If any, tighten the valve. Check whether there is oil leakage at the joint between the transformer radiator and the oil tank flange. If any, please tighten the valve in time.	
	Check whether the real-time temperature of the oil thermometer is normal. If abnormal, measure the resistance of PT1/PT2 and PT3 with a multimeter. If the result is unqualified, it means that the temperature controller is faulty and needs to be repaired in time.	
	During operation, check whether the sound of the transformer is normal.	
Low voltage cabinet	Check whether the lightning arrester indicator is normal (green) or faulty (red).	Once a month
	Check for condensation on inside panels and top cover.	
Other equipment	Replace damaged lamps promptly.	When necessary

Inspection item	Inspection method	Period
	Replace damaged smoke sensors and fire extinguishers promptly.	
	Replace the temperature and humidity controller in time.	
	Clean the screen	Once half a year
	Replace the screen	Once a year

9.4 Paint repair measures

Check the appearance of the cabinet for damage:

Case 1: Surface dirt caused by water stains and dust can be cleaned

Illustration	Step
	1. Use a rag (or other scrubbing tool) dampened with water to scrub the dirty parts of the surface. 2. If it cannot be cleaned with water, scrub with 97% alcohol until the surface cleanliness reached an acceptable range. (You can also try to use a non-corrosive cleaner commonly used in your area)

Material:

- Rag
- Water
- Alcohol or other non-corrosive cleaning agents

Case 2: The surface is dirty & the topcoat is damaged, and the surface traces cannot be cleaned.

Illustration	Step
	1. Use sandpaper to polish the rough or scratched parts of the surface paint to make the surface smooth.
	2. Using a cloth dampened with water or 97% alcohol, scrub the damaged area to remove surface stains.
	3. After the surface is dry, use a soft brush to touch up the scratched parts of the paint, and try to keep the paint brushing as uniform as possible.

Material:

- Sandpaper
- Rag
- Water
- Alcohol
- Brush
- The color number is RAL7035 paint

Case 3: The primer is damaged and the substrate is exposed.

Illustration	Step
	1. Use sandpaper to polish the rough or scratched parts of the surface paint to make the surface smooth.
	2. Using a cloth dampened with water or 97% alcohol, scrub the damaged area to remove surface stains and dust.
	3. After the surface is dry, spray zinc-rich primer to protect the exposed parts of the substrate. The coating shall completely cover the exposed substrate.
	4. After the primer is dry, use a soft brush to touch up the damaged parts, and try to keep the paint brushing as uniform as possible.

Material:

- Sandpaper
- Rag
- Water

- Alcohol
- Zinc rich primer
- Brush
- The color number is RAL7035 paint

It is necessary to check whether the protective paint sprayed on the shell of the PCS Skid ESS has peeled off, peeled paint, etc. If any, please repair it in time. The entire exterior of the PCS Skid ESS should be repainted with special protective paint every 5 years.

9.5 Filter screen maintenance and replacement

The position of filter sceen is shown as below:

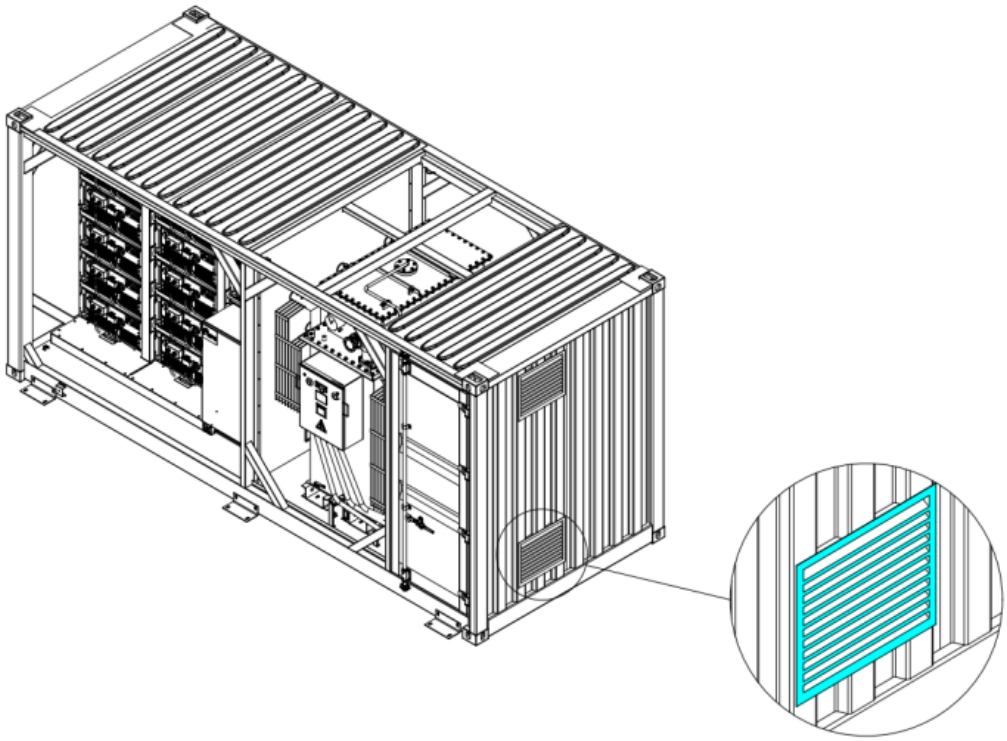


Figure 9- 1 Filter screen inside the support panel

The fixing bracket of the filter screen is fixed with a lock, as shown in the figure below. When replacing it, you need to open the lock with a key, then tilt the support panel, take out the filter screen, replace it with a new filter screen, and then lock the support panel in a correct position.

1. Open the lock with keys attached and tilt the support panel.

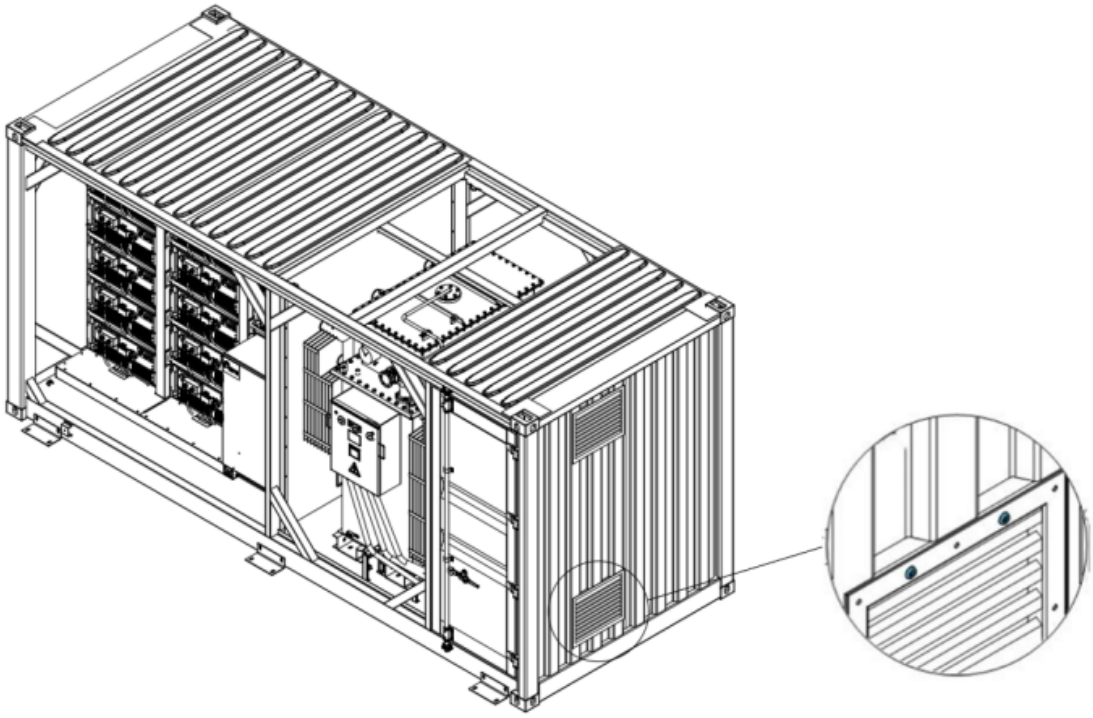


Figure 9- 2 Open the locks of the support panel

2. Unlock the buckles on the inner support panel.

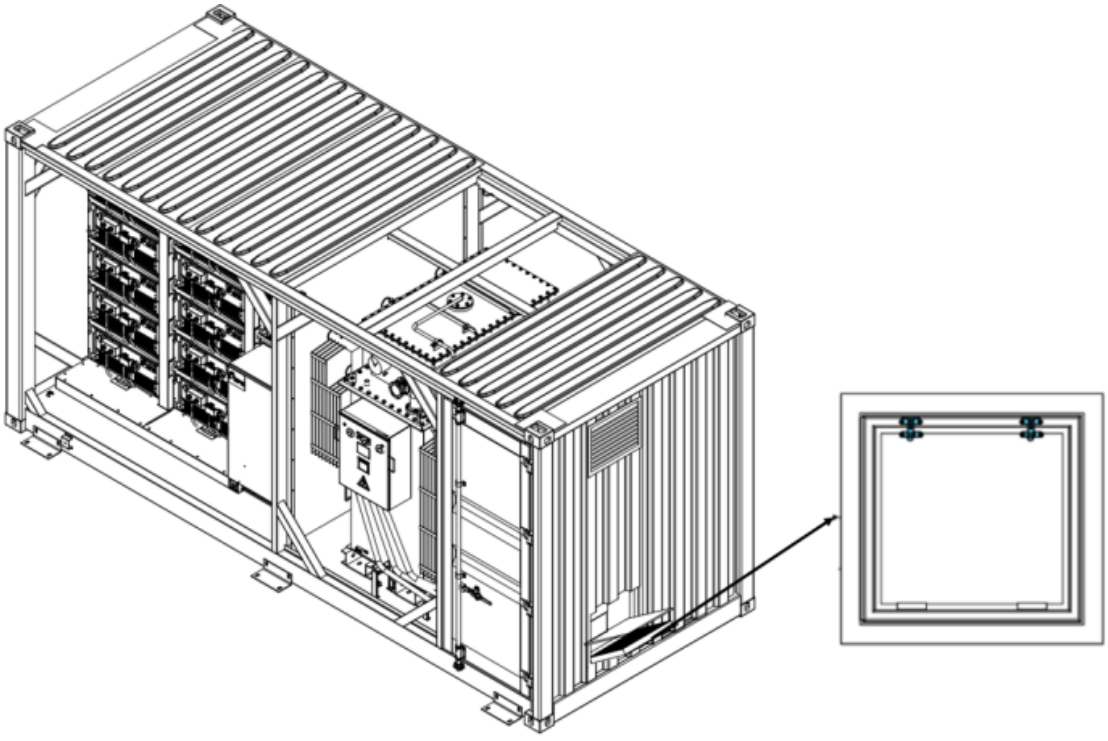


Figure 9- 3 Buckles on the inner support panel

3. Pull out the filter screen at first, insert a new one and then fasten it with buckles.

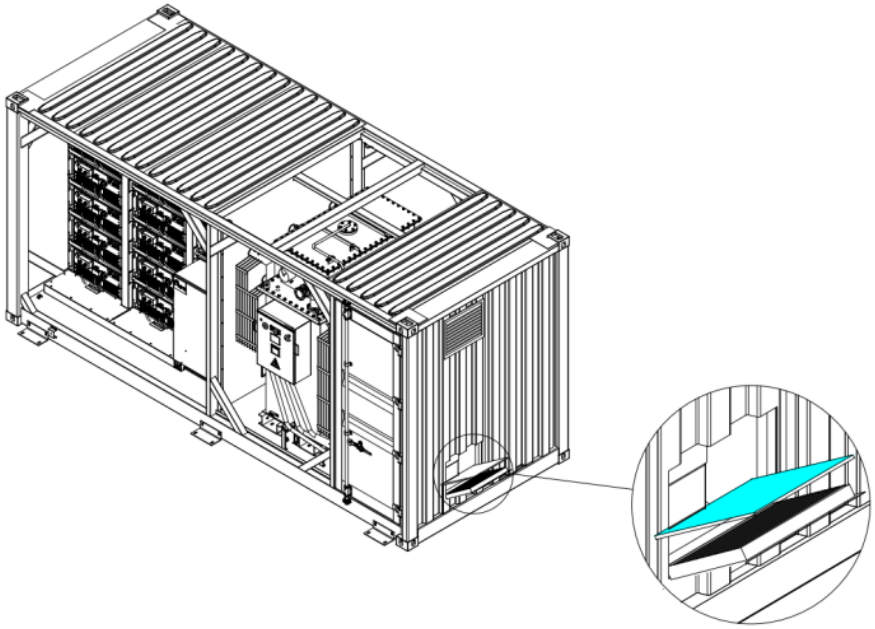


Figure 9- 4 Replace the filter screen

4. Install the support panel to its original position and lock it.

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