

AiO Box IEC Maintenance Manual



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1. Any damage caused by improper installation, usage, or maintenance that does not follow the instructions in this manual.
2. The product must be used in an environment that complies with the specified design parameters. Failure to adhere to these environmental requirements may result in malfunctions or damage. Any performance issues or component failures arising from non-compliance are not covered under the product warranty.
3. Damage caused by improper handling during transportation, moving, storage, or unpacking.
4. Relocation and reinstallation of the product to a non-original location without prior consent.
5. Warranty has expired.
6. Damage or malfunction caused by natural disasters or other force majeure events (e.g., earthquakes, floods, fires, lightning or typhoons).
7. Corresponding Ground Fault Detection (GFD) equipment is not equipped.
8. Installation or repair performed by unauthorized service providers or

personnel.

9. Use of unauthorized or non-original software, interface devices, parts, or consumables leading to malfunction or damage.
10. Altered or tampered product serial numbers, or failure to provide the product for inspection, testing, or repair.
11. Normal wear and tear or aging, or surface defects, dents, or marks that do not affect product performance.
12. Minor noise or vibration that does not affect product performance.
13. Theft of the product or its components.
14. To avoid internal component damage, please refer to the instruction manual and ensure proper cables are connected to the correct ports. Any damage due to incorrect wiring is not covered under warranty.
15. Damage caused by improper cleaning methods (e.g., using chemical cleaners) is not covered under warranty scope.
16. Damage to fuses or DC/AC surge protectors is not covered under the product warranty scope.
17. The installation height must provide adequate wiring space and account for environmental risks such as flooding or snow accumulation. Any damage caused by failure to meet these requirements is not covered under warranty scope.
18. The company is not liable for consequential, indirect, incidental, or punitive damages arising from disputes related to this disclaimer. The maximum compensation is limited to the actual purchase price of the product.
19. Use in environments not compliant with the product manual (e.g., extreme temperatures, humidity, magnetic fields, static interference, or corrosive gases).
20. Environmental or safety incidents arising from failure to comply with relevant laws or regulations regarding use, recycle or disposal of product.
21. This product is not intended for use in life-support systems, medical equipment, aerospace systems, or other high-risk applications. The company is not responsible for any consequences arising from violation of this provision.
22. This product may contain chemicals identified by local regulations as carcinogenic, teratogenic, or harmful to reproduction. Avoid contact with

internal components. Wash hands if contact occurs.

23. The "DANGER," "WARNING," "CAUTION" and "NOTICE" in this manual are not exhaustive. They serve as a supplement to the complete set of safety instructions that should be followed.
24. Installation, wiring, maintenance, inspection, or replacement of parts must not be carried out by non-qualified personnel. The manufacturer assumes no warranty obligations or legal liability for personal injury or equipment damage arising from failure to comply with these requirements.
25. In case scenario is not addressed in this manual, please contact Delta customer support for guidance.

Additional charges and cost may apply when maintenance services are required due to the improper maintenance of the product.

1 Information on this Document

This manual is a Maintenance Manual. Please refer to the Installation Manual and Operation Manual for installation and operation.

1.1 Validity

This document is valid for:

- AIOA279K125L
- AIOB279K125L
- AIOC279K125L

AIOC279K125L represents the top-tier configuration. AIOA279K125L is identical to the AIOC279K125L, except without the PV connection, AIOB279K125L is identical to the AIOC279K125L, except without the PV connection and has no PCS module. The PCS, HV Box, battery modules, liquid cooling unit and connecting wiring within AIOA279K125L are fully factory pre-assembled; The HV Box, battery modules, liquid cooling unit and connecting wiring within AIOB279K125L are fully factory pre-assembled; The PCS, HV Box, battery modules, DD module, liquid cooling unit and connecting wiring within AIOC279K125L are fully factory pre-assembled; AIOA279K125L, AIOB279K125L and AIOC279K125L are abbreviated as AiO Box.

Depending on the functions and selected options, individual sections may be irrelevant for installation and operation. Illustrations in this document are reduced to the essential information and may deviate from the real product. Delta reserves the right to make changes to the product.

1.2 Target Group

This manual is for operators of the power storage plant and qualified technical personnel. The product must and can only be installed by professional technicians who meet the following skills:

- Knowledge of all applicable laws, standards and directives.
- Training in risk prevention when working with electrical installations.
- Knowledge of and compliance with this document and all safety information.
- Be familiar with local standards and relevant safety regulations of electrical systems.

1.3 Levels of warning messages

To ensure the safety of the users and their properties when they use the product and to make sure that the product is used in an optimal and efficient manner, this manual provides users with the relevant safety information highlighted by the following symbols.

Below is a list of symbols that are used in this manual. Review them carefully to make better use of this manual.

** DANGER**

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

** WARNING**

Indicates a moderately hazardous situation which, if not avoided, will result in death or serious injury.

** CAUTION**

Failure to transport and store the product in accordance with the requirements in this manual may invalidate the warranty.

NOTICE

Failure to transport and store the product in accordance with the requirements in this manual may invalidate the warranty.

1.4 Symbols in the Product

Sings on the product

**Beware of dangerous voltage**

The product operates at high voltages. All work on the product must only be performed as described in the documentation of the product.

**Beware of incorrect operation**

Personals must operate correctly, if not avoided, could result in serious personal injury or device damaged.

**Beware of hot surface**

The product can get hot during operation. Do not touch the product during operation.

**Beware of shock**

Live parts! Do not touch them until 5 minutes after disconnection from the power sources.

**Beware of extrusion**

Don't put hands in the movable and/or rotation parts of product.

**Arc Flash Hazard**

There is an arc flash hazard associated with all electrical equipment.

There is an increased risk of arc flash with any equipment modification (e.g., open doors). Serious injuries can occur in arc flash incidents. Appropriate PPE and training as per local codes and regulations are required.

**Fire Hazard**

Fire is possible under certain, extreme fault conditions.

**Beware of noise**

The product generates loud noise. When working on the product, wear hearing protection.

**Unlock direction**

Unlock direction labels, which locate on the doors.

**Center of gravity**

Center of gravity label, which is on the enclosure of product.

1.5 Primary risks associated with AiO Box

The primary risks associated with the AiO Box system are:

1.5.1 Hazardous voltage

Hazardous Voltage

- High AC voltage at AIO input.
- 1200Vdc at battery side and 1500Vdc at PV interface side.

Consequence

Electrocution, Fire, Explosion.

Avoidance

- Only qualified and authorized person should only be allowed restricted access.
- Equipment barriers must remain in place.
- PPE must be appropriate for the task and equipment

1.5.2 Arc fault

Arc fault

When insulation breakdown or accidental contact between high voltage conductors, an arc fault will be happened through the air gap between conductors.

Consequence

- Arc fault creates an electrical explosion.
- Light and heat emitted from the explosion is known as arc flash.
- Pressure wave caused by the tremendous temperatures of the arc flash is known as arc blast.

Avoidance

- Only qualified and authorized person should only be allowed restricted access.
- Restricted access.
- Equipment barriers must remain in place.
- PPE must be appropriate for the task and equipment.

1.6 Arc flash hazard boundary

The US National Fire Protection Association (NFPA) has developed specific approach boundaries designed to protect employees while working on or near

energized equipment. These boundaries are:

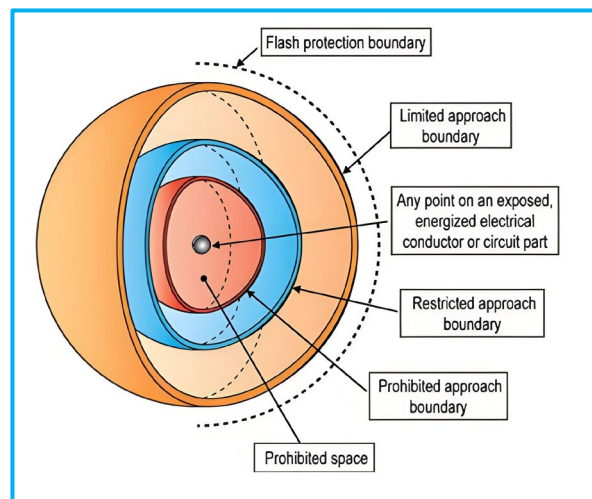


Figure 1-1: Arc flash boundaries (Refer to NFPA 70E)

- Flash Protection boundary (outer boundary) – this is the farthest established boundary from the energy source. If an arc flash occurred, this boundary is where an employee exposed to a curable second-degree burn. The issue here is the heat generated from a flash that results in burn.
- Limited approach – An approach limit at a distance from an exposed live part where a shock hazard exists.
- Restricted approach – An approach limit at a distance from an exposed live part which there is an increased risk of shock.
- Prohibited approach (inner boundary) – A distance from an exposed part which is considered the same as contacting the live part.

1.7 Arc flash label

According to “Maximum Power Method” in NFPA 70E, the estimated DC arc flash incident energy at the maximum power point can be calculated, and then the hazard boundary is defined as following Figure 1-2.

 WARNING			
ARC FLASH AND SHOCK HAZARD PRESENT APPROPRIATE PPE REQUIRED			
ARC FLASH PROTECTION		SHOCK PROTECTION	
Working Distance	455 mm(1 ft 6 in.)	Shock Hazard	System voltage: 1500Vdc(DC), 400V(L-L, Main power), 230V(L-N, Auxiliary power),
Incident Energy	2.07 Cal/cm ²	Limited Approach	1.5 m(5 ft 0 in.)
Arc Flash Hazard Boundary	678.18mm (2 ft 2.7 in)	Restricted Approach	0.5 m(1 ft 8 in.)
		Glove Class	0
Refer to NFPA 70E for PPE requirements			

Figure 1-2: Arc flash label for reference

1.8 Personal protective equipment (PPE)

The PPE is determined by the incident energy which is the temperature produced (in cal/cm²) at a distance (usually eighteen inches) from an arc flash.

PPE requirement for AiO box system operational precautions is category 1.

PPE CATEGORY 1	PPE CATEGORY 2	PPE CATEGORY 3	PPE CATEGORY 4
Minimum Arc Rating of 4 cal/cm²  Arc Rated Clothing: • AR long-sleeve shirt and pants, or AR coverall • AR face shield, or AR flash suit hood • AR jacket, parka, rainwear, or hard hat liner (as needed) Protective Equipment: • Hard hat • Safety glasses or safety goggles • Hearing protection (with inserts) • Heavy-duty leather gloves • Leather footwear (as needed)	Minimum Arc Rating of 8 cal/cm²  Arc Rated Clothing: • AR long-sleeve shirt and pants, or AR coverall • AR flash suit hood, or AR face shield and AR belaclova • AR jacket, parka, rainwear, or hard hat liner (as needed) Protective Equipment: • Hard hat • Safety glasses or safety goggles • Hearing protection (with inserts) • Heavy-duty leather gloves • Leather footwear	Minimum Arc Rating of 25 cal/cm²  Arc Rated Clothing: • As required: AR long-sleeve shirt, AR pants, AR coverall, AR flash suit jacket, and/or AR flash suit pants • AR flash suit hood • AR gloves • AR jacket, parka, rainwear, or hard hat liner (as needed) Protective Equipment: • Hard hat • Safety glasses or safety goggles • Hearing protection (with inserts) • Leather footwear (as needed)	Minimum Arc Rating of 40 cal/cm²  Arc Rated Clothing: • As required: AR long-sleeve shirt, AR pants, AR coverall, AR flash suit jacket, and/or AR flash suit pants • AR flash suit hood • AR gloves • AR jacket, parka, rainwear, or hard hat liner (as needed) Protective Equipment: • Hard hat • Safety glasses or safety goggles • Hearing protection (with inserts) • Leather footwear (as needed)

Figure 1-3: PPE category

1.9 LOTO procedure

1. Check the status of PCS and battery racks from EMS, make sure that the circuit breakers/contactors of PCS DC side are all disconnected, and the HV contactors of racks are disconnected.
2. PPE1 is required for operator.
3. Turn off the on-site AC circuit breaker (QA1) which supplies the power of AiO box. Apply a LOTO adapter and LOTO lock and tag to the circuit breaker handle to prevent it from being turned back on.
4. Switch off the isolation switch of the battery to "OFF" state. Pull out the LOTO ring of the isolation switch handle and apply LOTO lock and tag to the LOTO

ring to prevent it from being turned back on.

5. Turn off the QB4 and QB6, which supplies auxiliary power of AiO box.
6. After 5 minutes, check, with a multi-meter, that the 220VAC auxiliary power input connection terminal breaker reads 0V.
7. Check, with a multi-meter, that the 1,200VDC bus bar reads 0V.

1.10 Term & Abbreviations

Term/Abbreviation	Explanation
PCS	Power Conditioning System
MCB	Main Circuit Breaker
MC	Main Contactor
SSC	Soft Start Contactor
HMI	Human Machine Interface
DC	Direct Current
AC	Alternating Current
PC	Computer
CT	Current Transformer
MCU	Main Control Unit
UPS	Uninterruptible Power Supply
PDU	Power Distribution Unit
ACB	Air Circuit Breaker
MPCB	Motor Protection Circuit Breaker
PF	Power Factor
OVP	Over Voltage Protection
UVP	Under Voltage Protection
OCP	Over Current Protection
BMU	Battery Management Unit
BMS	Battery Management System
BESS	Battery Energy Storage System
FSS	Fire Suppression System
MBMU	Master Battery Management Unit
SBMU	Slave Battery Management Unit
MSD	Manual Switch Disconnecter
SOC	State of Charge
SOH	State of Health
TMS	Thermal Management System

2 General safety instruction

Important Safety Instructions

SAVE THESE INSTRUCTION

This manual contains important safety instructions for AiO Box that shall be followed during installation and maintenance of the inverter, if ignored, maybe result in personal injury or device damaged. So before starting installation, operation, commissioning or maintenance of AiO Box, read through the entire manual and note all **DANGER!** **WARNING!** **CAUTION!** and **NOTICE!** statements.

AiO Box is designed and tested to meet all applicable international safety standards. However, like all electrical and electronic equipment, safety precautions must be observed and followed during installation, operation and maintenance of AiO Box to reduce the risk of personal injury and to ensure installing safety.

Only qualified personal who are licensed and/or satisfy state and local jurisdiction can perform installation, commissioning and maintenance work, and must wear suitable safety protective equipment.

All installations must confirm with the local laws, regulations, codes and standards applicable in the jurisdiction of installation, even though it has conflict with this manual.

2.1 General Safety Rules

DANGER

Touching the terminals or contactors connected to the grid may lead to electric shock!

- Do not touch the terminals or conductors connected to the grid.
- Respect all safety instructions on the grid connection.

DANGER

Lethal voltages are present inside the device!

- Pay attention to and follow the warning signs on the device.
- Respect all safety instructions in this manual and other pertinent document.

** DANGER**

Electric shock or fire may occur due to device damage or system fault.

- Visually inspect the AiO Box for device damages or other hazards.
- Check if the external devices and circuit connections are safe.
- Only operate the device when it is safe to do so.

** WARNING**

All installations and operations on the AiO Box must be in full accordance with the national and local regulations and standards.

** WARNING**

Ensure that the installation environment (such as voltage, temperature, humidity, altitude, pollution level, water-proof and dust-proof level) is within the scope of equipment specifications.

** WARNING**

The installation, electrical connection, commissioning, maintenance, and troubleshooting must be carried out by professional electrical technicians conforming to local codes. Before performing operations, operators should have read this manual completely and mastered the safety issues related to the operation.

2.2 Ground Fault Protection

DANGER

If a ground fault occurs in the system, some parts that are supposedly voltage-free may carry lethal voltage. Accidental touch may cause serious damage. Make sure there is no system ground fault before performing operation and take proper protective measures.

2.3 Warning label setting

During on-site transportation, installation, repair, maintenance and other operations of the AiO Box, in order to prevent irrelevant personnel from approaching and mis-operation or accident, shall take the following precautions:

- Perform Lockout-Tagout procedure strictly.
- Set up warning signs or safety warning belts near the site operation area.

2.4 Live Line Measurement

DANGER

Before electrical connection, please ensure that the AiO Box and electrical equipment inside it are intact and hazard-free. All electrical connections must meet electrical standards of local country/region.

⚠ DANGER

High voltages are present inside the device. Death can result from burning and electric shock due to touching the live components of the AiO Box. During live line measurement:

- Use suitable protective equipment (e.g. wear insulated gloves, etc.).
- Accompanied by other persons.

2.5 Measuring Instrument

The instrument for measuring the electrical parameters should meet the following requirements:

⚠ WARNING

- The instrument for measuring the electrical parameters should be a 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.
- Use suitable protective equipment, for example, dielectric gloves during live line measurement.

2.6 Voltage-free Operations

Perform operations on the AiO Box only when all devices inside the AiO Box are completely voltage-free.

- Avoid any inadvertent re-connections.
- Verify that no voltage or current is present with appropriate testing devices.
- Ground and short-circuit whenever necessary.
- Cover possible live parts to avoid inadvertent touch.
- Ensure sufficient escape room.
- After the AiO Box stops, wait at least 10 minutes before operating it.
- Ensure that the AiO Box is completely voltage-free.

2.7 ESD Protection

CAUTION

Devices may be damaged irreversibly by electrostatic discharge (ESD).

- Avoid unnecessary touching of the printed circuit board (PCB).
- Observe all the ESD-related safety instructions. Wear proper personal protective equipment (PPE) such as wrist strap.

2.8 General Safety instruction

DANGER

- Pre-Installation & De-Energization
Ensure the AiO Box is fully de-energized before installation.
Maintain adequate safety clearance for operation and maintenance.
- Personal Protective Equipment (PPE)
Always wear appropriate PPE before performing any work.
Ensure PPE complies with local laws, regulations, and safety standards.
- High-Voltage (MV) Equipment Operation When operating MV equipment:
 - Stand on an insulated mat or stool.
 - Wear insulated gloves, shoes, and protective clothing.Direct contact with live parts is strictly prohibited, even when wearing PPE.
- Pre-Energization Testing
Conduct and pass insulation tests and voltage withstand tests before energizing the system.
- Capacitor Discharge Safety
AiO Box contains capacitors; ensure they are fully discharged and residual Voltage is below safety thresholds before handling.
- Weather Precautions
Do not open equipment doors on rainy days to prevent water ingress, which may damage components or cause electric shock.

 DANGER

- **Equipment Startup Safety**

Never start equipment with doors open; ensure all enclosures are securely closed.

- **Grounding Requirements**

All power cable trays and equipment must be properly grounded to an earth electrode.

Grounding cables must comply with local safety standards.

- **Printed Circuit Board (PCB) Safety**

When the AiO Box is energized, PCBs (especially AC/DC voltage sampling boards) may carry high voltage.

Exercise caution when using test instruments (e.g., oscilloscopes) to avoid electric shock.

- **Fault Condition Safety**

In case of a fault, main and auxiliary circuits may still carry hazardous voltage. Always measure voltage and ensure it is below safety limits before performing any operation.

- **Lifting & Transportation Safety**

Use proper lifting tools and slings with sufficient capacity to prevent accidents. Some AiO Box components are extremely heavy; always use mechanical assistance to avoid injury.

 WARNING

- The cooling fan may continue rotating after system shutdown. Never touch the blades or rotating components.
- Always wear protective gloves and safety glasses when disassembling AiO Box components to prevent injury from sharp edges.
- Avoid contact with heatsinks or heating surfaces immediately after shutdown due to burn risk. Allow sufficient cooling time before handling.
- Maintenance must be performed with a second person present to ensure personal safety at all times.

**CAUTION**

- Remove all conductive debris from the cabinet during equipment installation to prevent potential damage.
- Install the AiO using bolts with the specified strength ratings, in strict compliance with the installation requirements.
- Ensure adequate heat dissipation by confirming that all ventilation pathways remain clear and unobstructed.
- When handling fiber optic cables: Never grasp the fiber body directly; Avoid contact with fiber end faces;
Maintain a minimum bending radius of 35mm at all times.
- Under no circumstances open current transformer (CT) secondary wiring while the AiO is energized.
- All live bolted connections must be tightened to the exact torque values specified in this documentation.
- This equipment is designed exclusively for use with IT systems (IEC 60364 standard).
- Prolonged periods of non-operation may adversely affect the system's overall lifespan, particularly battery performance.

NOTICE

- All dimensions in this document are in millimeters (mm), unless otherwise specified.
- Do not remove or damage safety signs. Replace any damaged signs immediately to maintain compliance.

2.9 Maintenance

Make sure the doors of the AiO Box are closed and locked during daily operation to prevent internal devices from damages caused by rain or rodents. Regularly check and maintain the AiO Box and internal devices to ensure long-term and reliable operation of the AiO Box.

2.10 Disposal of Waste

When the AiO Box has come to the end of its service life, it cannot be disposed of together with household wastes. Some inside components can be recycled while some components can cause environmental pollution.

Please contact the local authorized collection point.

3 Product maintenance

This manual introduces the AiO Box maintenance. Due to environment temperature, humidness, dust and vibration, the internal components of system will be aging, abrasion and looseness, thereby, will lead to malfunction. So it's necessary to perform routine maintenance to guarantee device running reliably.

3.1 Safety instruction

WARNING

- Only Delta authorized personnel can perform maintenance. Before maintenance, make sure the following work was done.
- Stop system and shut off the power.
- Disconnect the system input and output.
- Shut off power and wait for 5mins at least before open door, make sure capacitors discharged completely.
- Check system input and output voltage and DC bus voltage to ensure no dangerous voltage.
- Do not leave any screws, washers or other metallic parts inside the inverter to avoid damages to AiO Box.

CAUTION

- Make sure the following breakers are switch off, and need to verify AC input is un-energized and DC isolate switch is turned off.

NOTICE

Moisture can damage the system. For normal operation, please comply with the followings requires:

- Do not open cabinet doors when relative humidity is higher than 95%.
- Do not perform maintain or service in rainy or other bad days.

Table 3-1 Switch status (maintenance mode)

Name	Description	State
AC breaker	AC input breaker	Open
QS1	DC isolate switch	Open
QB1	Reserved	Open
QB2	Switch for SMPS1	Open
QB3	Switch for dehumidifier	Open
QB4	Switch for TMS	Open
QB5	Switch for SMPS2	Open
QB6	Switch for external aux power	Open
QB7	Switch for PV combiner box	Open

3.2 Recommend tools

The tools required for disassembling components are listed following:

SN	Name	Specification
1	Insulated Cross and Torx screwdrivers	2.5–6 mm
2	Small slot type insulated screwdrivers	
3	Set of insulated hexagon key wrenches	
4	Side cutting plier	
5	Set of insulated wrenches or sockets	6-19mm
6	Set of insulated ratchet combination spanners	6-19mm
7	Insulated Torque wrench	0~150N•m
8	Multi meter	0~1500Vdc
9	Insulation resistance meter	1000V
10	Lifting forklift	> 500kg

3.3 Preventive maintenance

CAUTION

- Once any unconformity is found during regular maintenance of system and internal devices please make correction immediately. If any doubts arise, please contact Delta engineer.
- Read and repeat the steps in [Safety instructions](#) above prior to starting work.

3.3.1 Cabinet maintenance

No.	Components	Checking Items	Description	Frequency
1	Cabinet	Cabinets structure	Check whether the cabinet body has obvious inclination, deformation and damage.	Annual
2		Cabinets Color	Check whether the cabinet body has obvious discoloration, or if there is a cabinet which has obvious color difference from the others.	Annual
3		Coating	Check whether the surface coating (especially the base position) is warped, cracked, peeled off, rusted, etc.	Annual
4		Indicator light	Check whether the run/stand-by/fault indicator works normally.	Semi-Annual
5		Label & nameplate	Check whether the labels and nameplates have abnormal phenomena such as falling off, blurring and tilting.	Annual
6		Biological invasion	Check whether there are creatures inside the cabinet.	Semi-Annual
7		Abnormal odor	Check there is a pungent or burning odor inside the cabinet/module.	Semi-Annual
8		Abnormal sounds	Check whether there is a crackling fire sound in the module during the operation of the system.	Semi-Annual
9		Inside situation	Check the dust situation inside the cabinet. If the pollution is particularly serious, it is necessary to find the location from where the dust enters.	Semi-Annual
10		Water	Check whether there is condensed water, accumulated water traces or water inlet traces on the inner wall, corner, cabinet top, cabinet bottom, wiring harness surface, connector	Semi-Annual

			surface and other visible areas of the cabinet.	
11		Filter cotton	Replace filter cotton every year.	Annual
12		Rubber seal strip	Check if the seal strip is damaged. Replace it every 10 years.	Annual

The enclosure is not allowed to have rust, bend structure during whole product lifecycle.

Conduct an inspection of cabinet every twelve months and make inspection record, if the paint on the surface have following damage scenarios, repaint it according to the following steps.

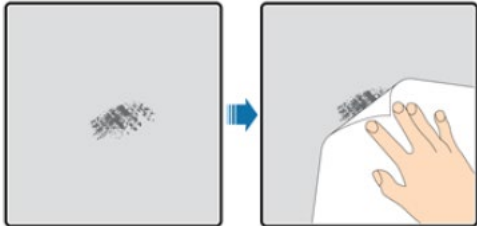
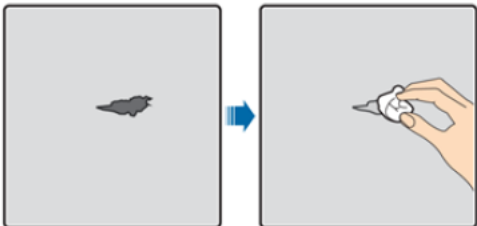
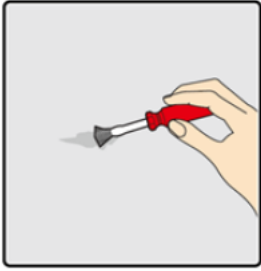
Shallow scratch (not exposed steel substrate)

- A stain or rust that cannot be wiped
- A stain or rust that cannot be wiped
- Deep scratch (damage of primer, exposure of steel substrate)

Precondition

- In the outdoor environment without shelter, it is strictly forbidden to repaint in bad weather
- Prepare the corresponding paint with the same color of the AiO Box surface.
- Visually inspect the severity of the surface paint damage of the AiO Box, prepare corresponding tools and materials, and evaluate the quantity of materials on site based on the repainting situation.
- Paint that meets requirements has been prepared based on the paint surface color number RAL7035 of cabinet.
- The exterior of the AiO Box should be intact. If the paint on the surface of the AiO Box is damaged or broken, repaint it immediately.
- Tools and Materials: Hand spray paint or paint, brush (for painting a small area), fine sand paper, anhydrous ethanol, cotton cloth, and spray gun.
- AiO Box cabinet doors are not allowed to be open when wind speed is higher than 13.8m/s.
- Procedure

Step	Procedure
1	Gently polish the damaged area with fine sandpaper to remove dirt or rust.

	
2	Moisten the cotton cloth with anhydrous ethanol, wipe the polished area or area to be repaired, remove dirt and dust, and wipe dry with a clean cotton cloth. 
3	According to the damage degree of the paint, evenly apply paint to the damaged coating by using one of the following methods until no damage is visible: 1. A small number of scratches and small area of stains, rust recommended to use hand spray paint or brush paint. 2. A large number of scratches and large areas of stains and rust should be sprayed with a paint spray gun.  
4	Leave the paint on for 30 minutes, and then observe whether the repainting area meets requirements.

Note that: 1. If the substrate is exposed in the area to be repaired, paint primer until the substrate is not exposed after the paint dries, and then apply middle layer paint and polyurethane topcoat. Use primer or polyurethane top coat of the corresponding color.

2. Note that the paint film should be as thin and even as possible. The paint film should not be droplet shape and the surface should be smooth. If there are different colors on the box body pattern, use adhesive tape and white paper to cover the parts of other colors except the damaged paint before painting, so as to avoid contamination of the parts of other colors during painting repair.

3. The paint patch area should be consistent with the color of the

surrounding area, without obvious boundaries, obvious bumps, damage marks, and paint peeling phenomenon.

If the user wants to spray paint, it's advised to spray it three times and then check whether it meets the requirements. If not, repeat until the requirements are met.

3.3.2 TMS maintenance

- It is strictly forbidden to let the unit work when there is no coolant in the waterway.
- It is strictly forbidden to operate the unit under the condition of soaking in water.
- It is strictly forbidden for personnel to touch the unit while the unit is running.
- It is strictly forbidden to disassemble by non-professionals.
- It is strictly forbidden for the unit to be squeezed by heavy objects.

No.	Components	Checking Items	Description	Frequency
1		Fans of TMS	1. There is no dust in the fan and no foreign matter blockage at the tuyere. If not clean the dust of the fan with a brush and clean the foreign matter at the tuyere after 1 minute of power off. 2. The fan blades are not damaged, and the fan rotates smoothly without abnormal noise. If not after 1 minute of power off, fasten the fixing screws of the fan and check whether there is any internal cable or other objects interfering with the rotation of the fan. If the fan fails, please replace it.	Semi-Annual
2		Power cable and power terminal of wiring panel	1. No looseness of electrical cables and terminals that the heating mode function is normal. If not tighten the loose cables and terminals with a screwdriver after 1 minute of power off. 2. There is no aging, damage, abnormal heating and other abnormalities in the power cable. If	Semi-Annual

			not replace the power cable after 1 minute of power off. 3. There is no dust at the wiring panel. If not clean up the dust with a brush after 1 minute of power off.	
3		Condenser cleaning	1. Condenser is free of dust and foreign matter blockage. If not clean the condenser with compressed air or a vacuum with a brush head after 1 minute of power off. 2. Fins are not seriously deformed. If not use tools such as a fin comb to correct it after 1 minute of power off.	Semi-Annual
4		Coolant	Concentration meets range requirements; the PH value and the concentration of each electrolyte meet the requirements; no dirt, precipitation, algae, etc. If not replace the coolant after 1 minute of power off.	Semi-Annual

Replace the coolant every five years. If the coolant is degraded below any of the following levels replace the coolant.

- PH value PH value < 7.5 or PH value > 8.5
- Chloride concentration > 60ppm
- Appearance: turbid coolant with impurities such as precipitated particles or flocculent impurities that are easily seen as shown below:

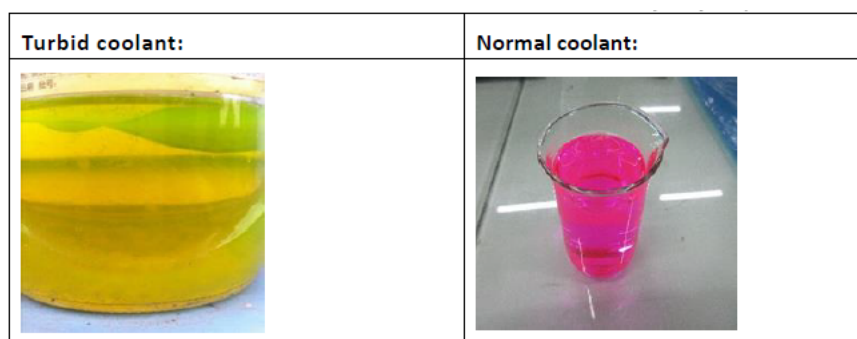


Figure 3-1 Coolant appearance

The coolant element is EC-45, only following approved supplier & type can be used.

Table 3-1 Coolant specification

Supplier	Supplier type	Mark
BASF	G30-50	

Note that:

- 1. Mixed coolant from different supplier or type is not allowed, otherwise, the cooling capacity will be lost.**
- 2. Any damage to the relevant parts of the battery compartment caused by using other coolants which are not recommended or approved is not covered by the warranty.**

3.3.3 Fire suppression system maintenance

No.	Components	Checking Items	Description	Frequency
1	Fire suppression system	Aerosol	Check whether the aerosol is installed firmly, whether the appearance is damaged, and whether the aerosol reaches the service life.	Annual
2		Smoke Detector	Use the smoke tester to trigger the smoke sensor, check whether the upper computer system reports a fault, check whether the smoke sensor is installed firmly, and whether the harness connection is normal.	Annual
3		Gas Detector	Use hydrogen to trigger gas detector. Check whether the upper controller system reports faults, check whether the gas sensor is installed firmly, and whether the harness connection is normal. The gas detector shall be zeroed and calibrated once every six months.	Annual
4		Smoke trigger	Use the smoke tester to trigger the smoke sensing. After a delay of some seconds, the indicator light of smoke detector will be on	Annual

			to check whether smoke sensing is triggered normally.	
5		Gas trigger	Use hydrogen to trigger the gas sensor. After a delay of some seconds, gas sensor is triggered normally.	Annual

3.3.4 Battery system maintenance

No.	Components	Checking Items	Description	Frequency
1	BMS	BMS monitor inspection	Read information by BMS monitor.	Semi-Annual
2		Historical data collection	Collect local 6-month operation data for analysis.	Semi-Annual
3		SOH statue analysis	Refer to the collected data, analyze the SOC consistency, historical failure, voltage difference and other information of the battery.	Semi-Annual
4		Harness appearance	Check whether the wiring harness is damaged, ablated or aged.	Semi-Annual
5		Connector appearance	Check whether the connector is yellowing, blacking or even ablated.	Semi-Annual
6		Connector connection reliability	Shake the connector plug to see if the connector interface is loose.	Semi-Annual

3.3.4.1 Maintenance instructions before substation completion

We recommend checking the battery voltage at least every 6 months and if the battery voltage (minimum cell voltage in the rack/module) lower than 3.186V, the battery rack/module needs to be re-charged for further storage. It is recommended to the customers to charge the battery rack/module with 0.25P to certain voltage level as below:

Either a) charge to cell voltage $\geq 3.355V$,

or b) cell voltage $\geq 3.294V$ after 2 hours resting.

3.3.4.2 Maintenance instructions for normal operating system

Note that: 1. Check to ensure environmental safety, system safety, no alarm, no fault before performing maintenance operations.

2. After the battery maintenance of AiO box is completed, it's suggested to notify Delta after-sales engineer to perform data analysis for free.

Perform battery maintenance according to following plan on the system every twelve months to prevent battery damage.

1) Plan 1 (This plan is applicable when SOC of the battery system is low)

- Discharge the battery system to the cut-off condition (the lowest voltage<2.8V), then stop discharging, standing for 1 hour.
- Full charging automatically to the battery system (The highest voltage>3.6V), after charging, standing for 1 hour.
- Discharge the battery system to 30% and stop.

2) Plan 2 (This plan is applicable when SOC of the battery system is high)

- Full charging automatically to the battery system (The highest voltage>3.6V), after charging, standing for 1 hour.
- Discharge the battery system to the cut-off condition (the lowest voltage<2.8V), then stop discharging, standing for 1 hour.
- Charge the battery system to 30% and stop.

3.3.4.3 Maintenance for short duration idle mode after COD

(This plan is applicable for short time storage 0-6 months)

Note that: The minimum cell voltage should not be less than 2.5V in any case; otherwise, the warranty will be invalid.

The minimum cell voltage should not be less than 2.0V in any case; otherwise, the battery will be over-discharged and may not be able to be repaired.

- The SOC should be kept at least above 5% (cell voltage≥3.186V) when idle.
- Customers should notice that the monthly battery self-discharge rate is ≤3% and the function module in BMS will draw≤9% SOC from the battery side when idle. If the battery rack needs to be staying in standby mode after COD, it needs to be re-charged to certain level which can cover the 3% self-discharge rate and 9% BMS power consumption to avoid over-discharge.

3.3.4.4 Maintenance for long duration idle mode after COD date

If the energy storage system keeps on idle mode for a long time, it will cause irreversible damage to the battery. Please perform regular maintenance.

- Suggested SOC range of battery storage: 30%~60%.
- If the battery system keeps on idle mode more than 180 days, the battery is suggested to have SOC equal or about 50%. 3.186Vdc shall in any case be considered as a minimum voltage level for per cell, in case that this voltage level is reached, battery system must be recharged immediately. It is recommended to the customers to charge the battery rack with 0.25P to certain voltage level as below:

Either a) charge to cell voltage $\geq 3.355\text{V}$,

or b) cell voltage $\geq 3.294\text{V}$ after 2 hours resting.

- Battery capacity test about 100% SOC charge and 0% SOC discharge must be conducted every 12 months.
- When recover the system from idle mode over 180 days to discharge/charge mode, the battery system must perform SOC calibration applying one of the possible methods, including:
 - Static Calibration
 - Dynamic Calibration
 - High Voltage Calibration

3.3.4.5 Battery module spare parts maintenance

Spare Batteries are shipped out from CATL at SOC=30%.

- The initial maintenance of the spare battery needs to be conducted after 12 months period. Charge the battery to 50% SOC (Equipment used: Pack-level charge and discharge machine)
- After the initial recharge, charge the battery once a year. Charge the battery to 50% SOC. (Equipment used: Pack-level charge and discharge machine)
- The spare parts should be maintained as follows before use.

First discharge the battery until the minimum cell voltage 2.8V; evaluate the battery consistency according to the OCV curve table, if the SOC imbalance (that is, the SOC corresponded to average voltage – the SOC corresponded to the lowest cell voltage) > 5%, you need to perform balanced maintenance first. (Equipment used: Pack-level charge and discharge machine、

Equalization equipment)

Remark:

Charging duration (h) = (target SOC - current SOC) *nominated capacity
(Ah)/machine constant charging current (A)

Discharging duration (h) = (current SOC - target SOC) *nominated capacity
(Ah)/machine constant discharging current (A)

3.3.5 PCS, DC/DC power module and other parts maintenance

No.	Components	Checking Items	Description	Frequency
1	PCS, DC/DC power module and other parts	Harness appearance	Check whether the wiring harness is damaged, ablated or aged.	Annual
2		Connector appearance	Check whether the connector is yellowing, blacking or even ablated.	Annual
3		Connector connection reliability	Shake the connector plug to see if the connector interface is loose.	Annual
4		AC input insulation test	Insulation detection with a multi-meter.	Annual
5		Y board connection reliability	Shake the connector plug to see if the connector interface is loose.	Annual
6		Transformer	Visually inspect the transformer for normal surface color and any abnormalities at the connection terminals.	Annual
7		Sealing check	Check cable entry sealing.	Annual

4 Major components replacement

WARNING

- The electrical components of system must be replaced by the same components from the same manufacturer and with the same model number. The model number can be acquired from the marking of the system or the component itself. If otherwise, please contact Delta.
- If the field work needs to replace the components with products from other manufacturer or with different model number, a prior analysis and confirmation by Delta is needed. Failure to follow this procedure may lead to physical injury or death and void all warranty from Delta.

CAUTION

- Must shut off AC and DC power supply to ensure system is un-energized before start to disassemble any components of system.
- Read and repeat the steps in [Safety instructions](#) above, before starting the work.
- If you replace the PCS, Y board or BMS, don't forget to update FW to project required. Please update the software version to the current usage version, and adjust the parameters to match the current one.

4.1 Filter cotton replacement

The filter cotton of AiO Box is R NONWOVEN UL900 1360*240*14 WHT.

A. Take out filter cotton

1. Unlock the handle with correspond keys, then the handle will be popup, hold the handle and turn it in anticlockwise direction, then the door will be opened.

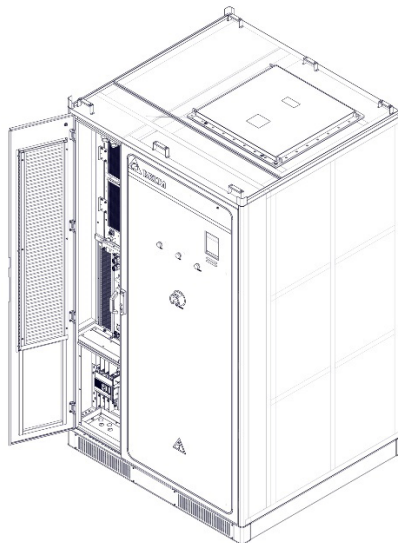


Figure 4-1 Open the door

2. Remove the six screws as shown in the figure below.

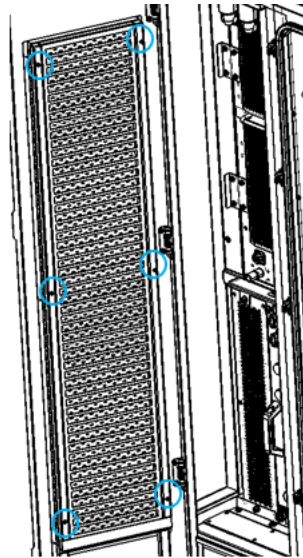


Figure 4-2 Remove the screws

3. Remove the sheet metal part; then take out the filter cotton.

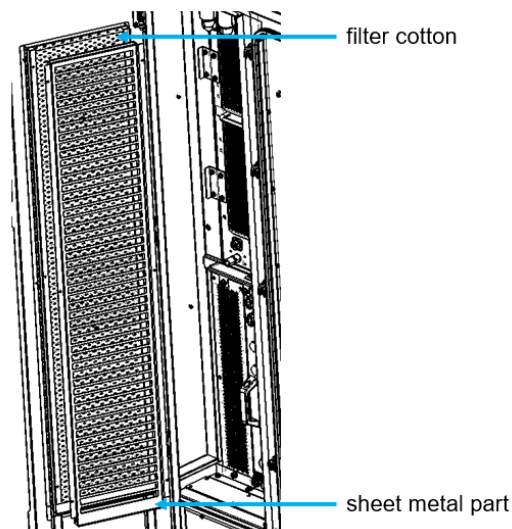


Figure 4-3 The sheet metal part and filter cotton

B. Install the filter cotton

1. Install the new filter cotton onto the cabinet door; then reinstall the sheet metal part.

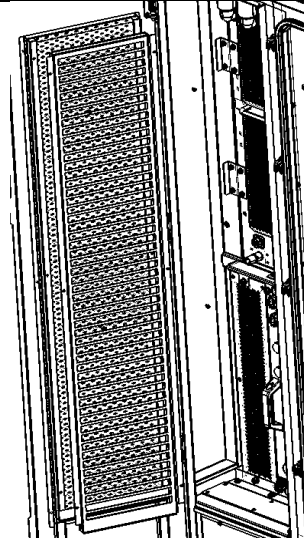


Figure 4-4 Install sheet metal part and filter cotton

2. Reinstall the fixing screws for the sheet metal part.

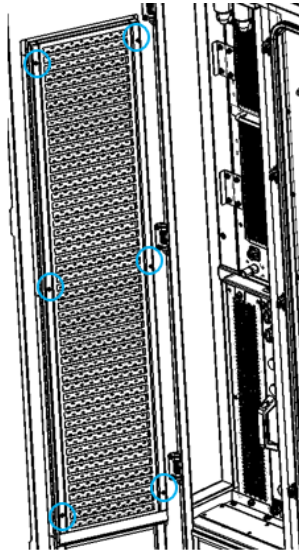


Figure 4-5 Reinstall screws

3. Close the door and lock the handle.



Figure 4-6 Close the AiO Box door

4.2 PCS replacement

The PCS of AiO Box is PCS125HVM.

A. Take out PCS

1. Unlock the handle with correspond keys, then the handle will be popup, hold the handle and turn it in anticlockwise direction, then the door will be opened.

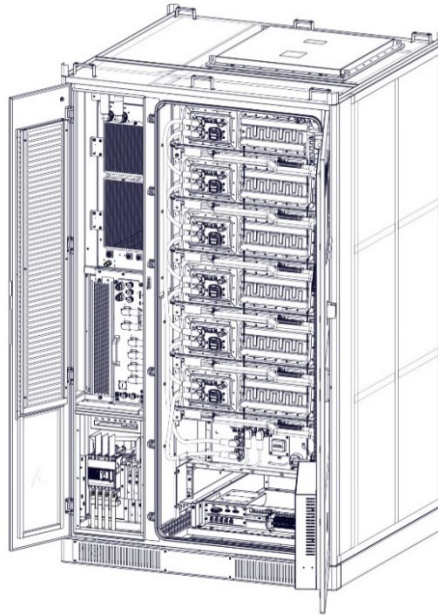


Figure 4-7 Open the door

4. Turn off the DC isolation switch and AC breaker to shut off power, then turn off auxiliary power switch QB1.



Figure 4-8 Turn off AC breaker & DC isolation switch and auxiliary power switch

5. Unplug AC/DC power cable of PCS, then pull out signal wire connector and communication connector of PCS.

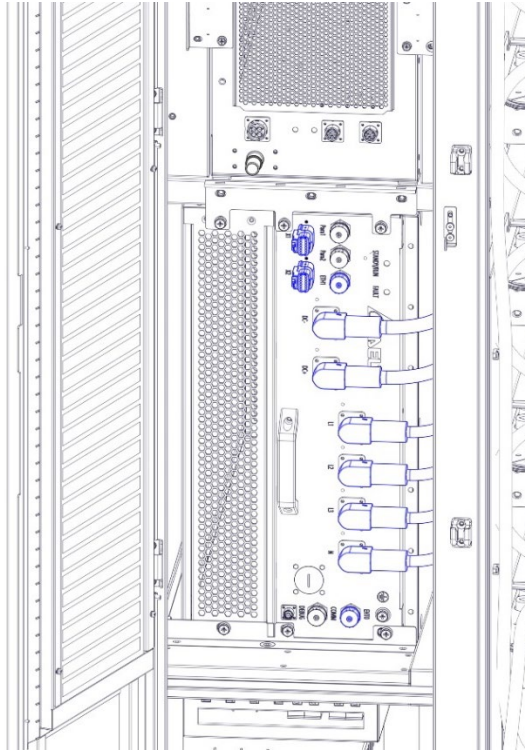


Figure 4-9 Unscrew fixing screws

6. Unscrew retaining bolts of PCS bracket and remove the bracket.

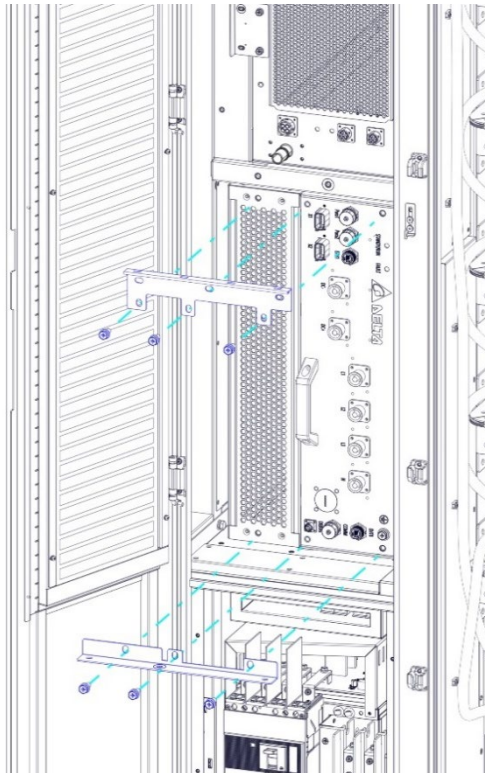


Figure 4-10 Take down bracket

7. Pull PCS module and slide out it onto forklift, then move forklift to

opened area to put it down.

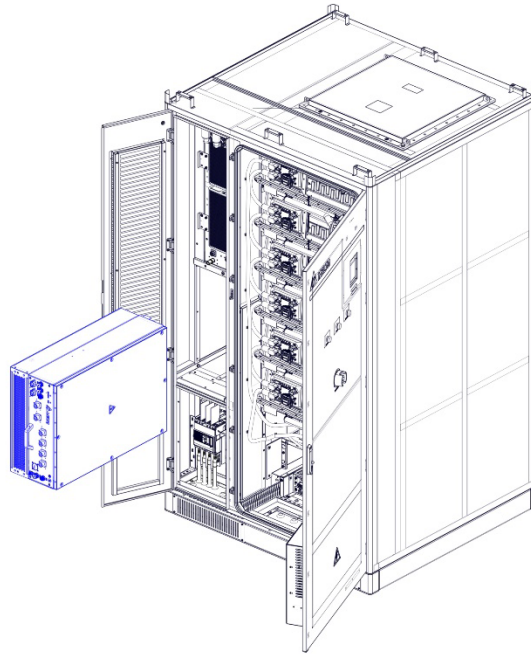


Figure 4-11 Take down PCS module

C. Install PCS

1. Lift up PCS module with forklift and push it into its compartment.

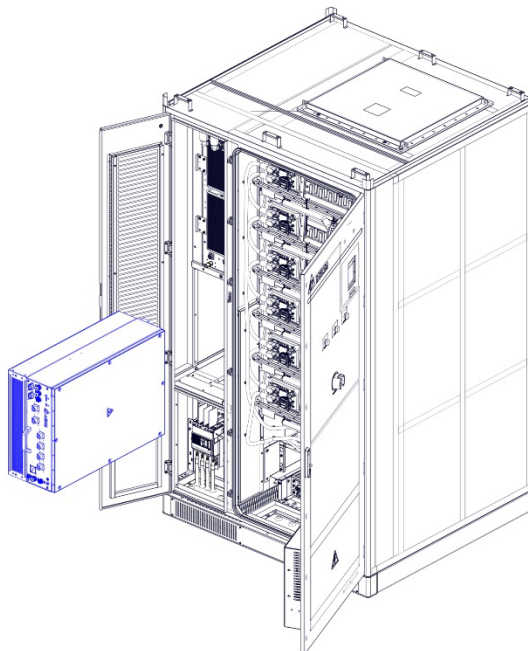


Figure 4-12 Install PCS module

2. Fix module bracket and tighten its retaining bolts.

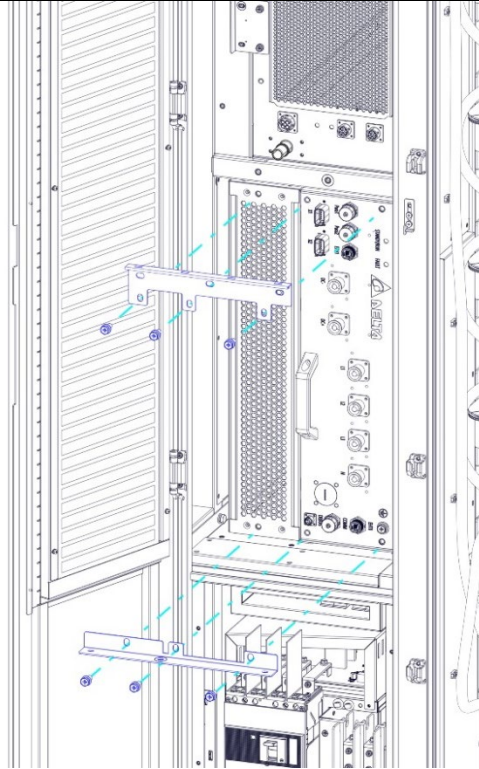


Figure 4-13 Fix bracket

3. Plug power cable and signal wires connector into PCS corresponding ports.



Figure 4-14 Re-connect power cable and signal wires

4. Turn on auxiliary power switch QB1, AC breaker and DC isolation

switch.

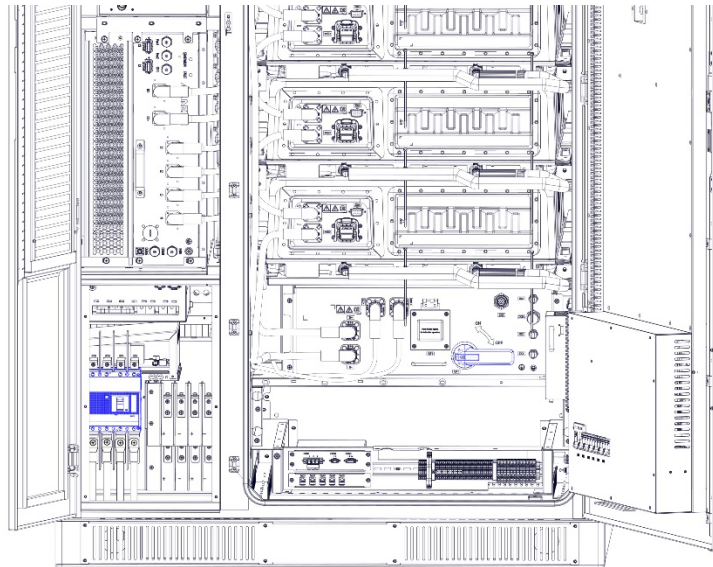


Figure 4-15 Turn on AC breaker and DC switch

5. Close the door and lock it.

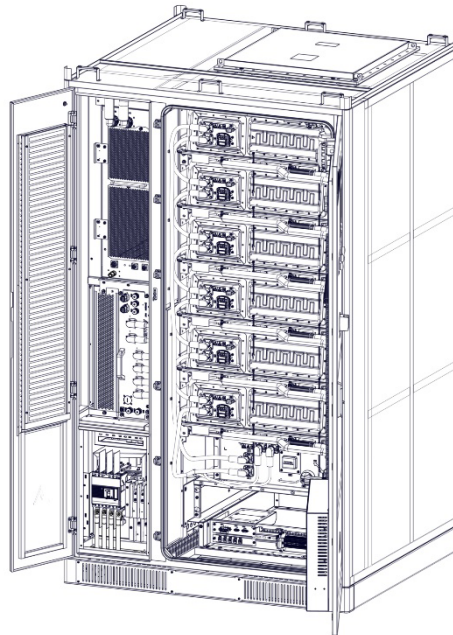


Figure 4-16 Close the door

4.3 Liquid Cooling Unit of TSM replacement

The Liquid Cooling Unit of TMS is LCI-50CR-02A6Z3-1227CU.

A. Take down TMS

1. First of all, open the door and turn off AC breaker and DC isolation switch to shut off power, then turn off auxiliary power switch QB1 and QB4.

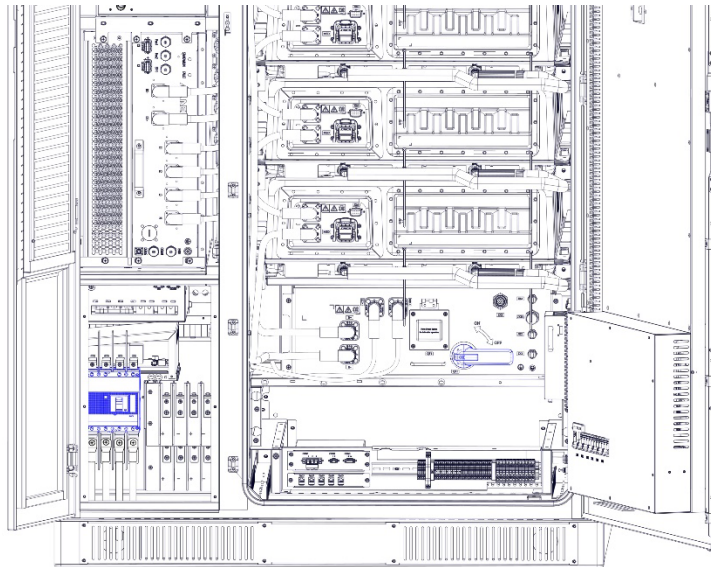


Figure 4-17 Turn off AC and DC switch

2. First, refer to section 4.1 to remove the PCS. Then vent the pressure of the cooling system via the Manual Exhaust Valve, which is located in the upper left corner of the cabinet; then connect a drain line to the Drain Port to drain all coolant from the chiller system.

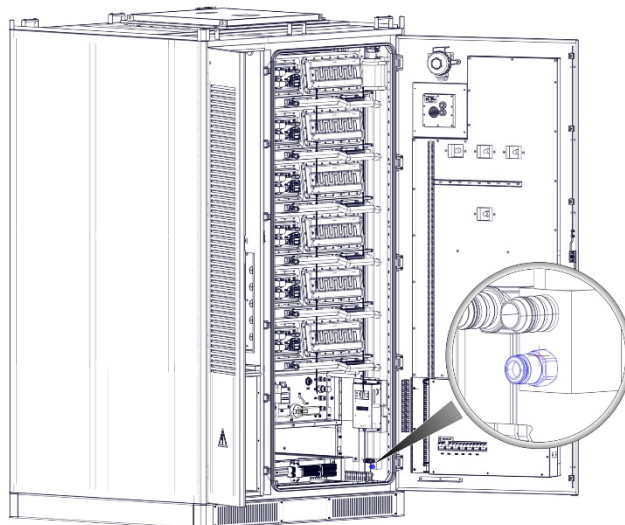


Figure 4-18 Plug drain line onto drain port

3. Unplug the signal cable connector from the TMS.

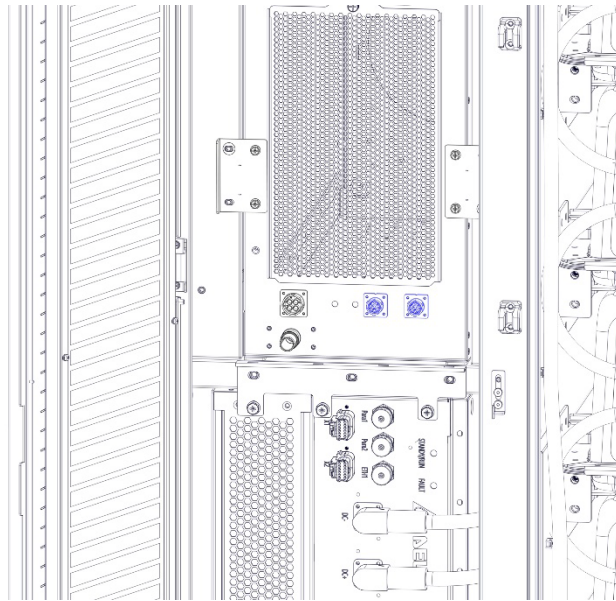


Figure 4-19 Unplug signal cable connector

4. Unplug pipeline connector to remove the pipeline.

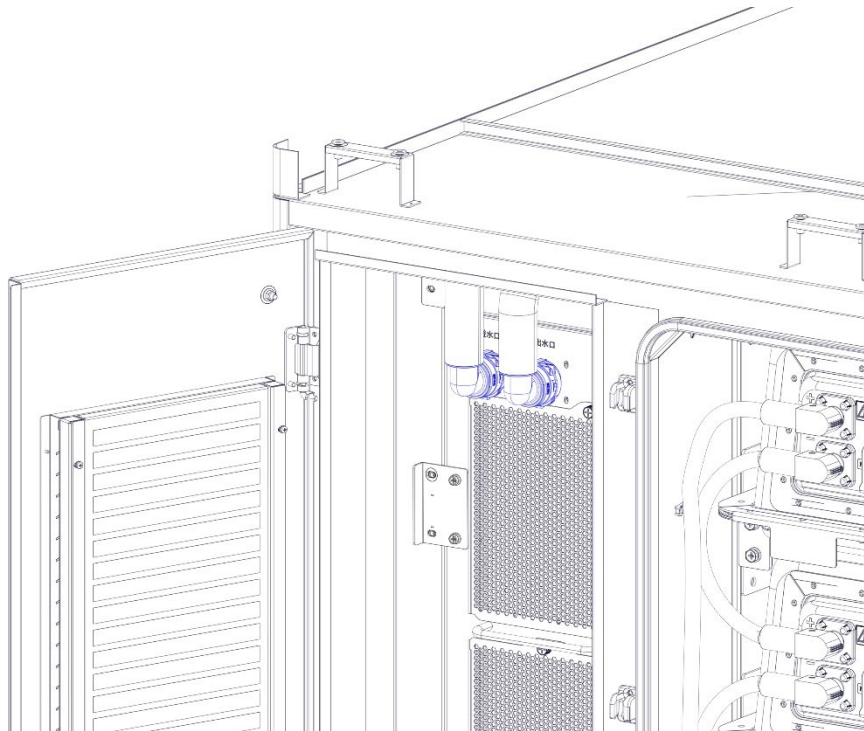


Figure 4-20 Unplug pipeline connector

5. Unscrew the retaining screws on the bracket, then remove it

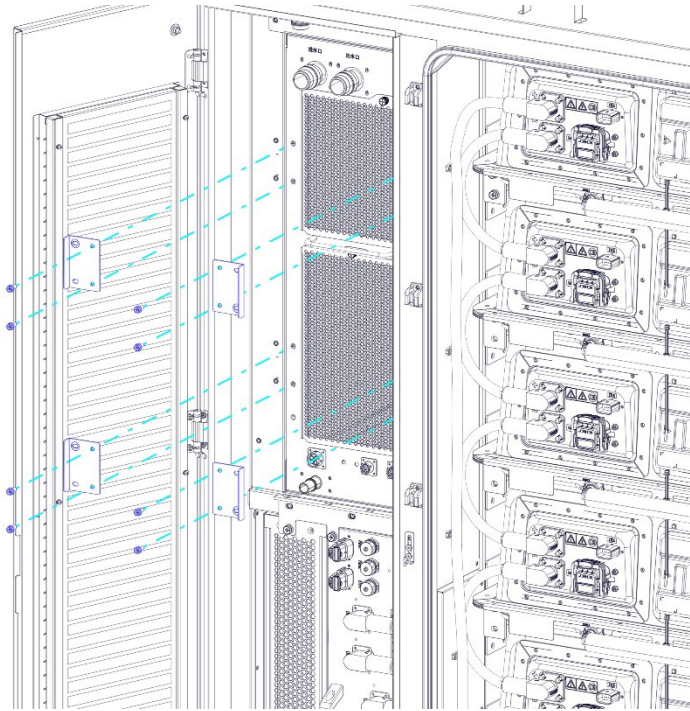


Figure 4-21 Remove retaining bracket

6. Remove the two mounting screws from the bottom of the TMS.

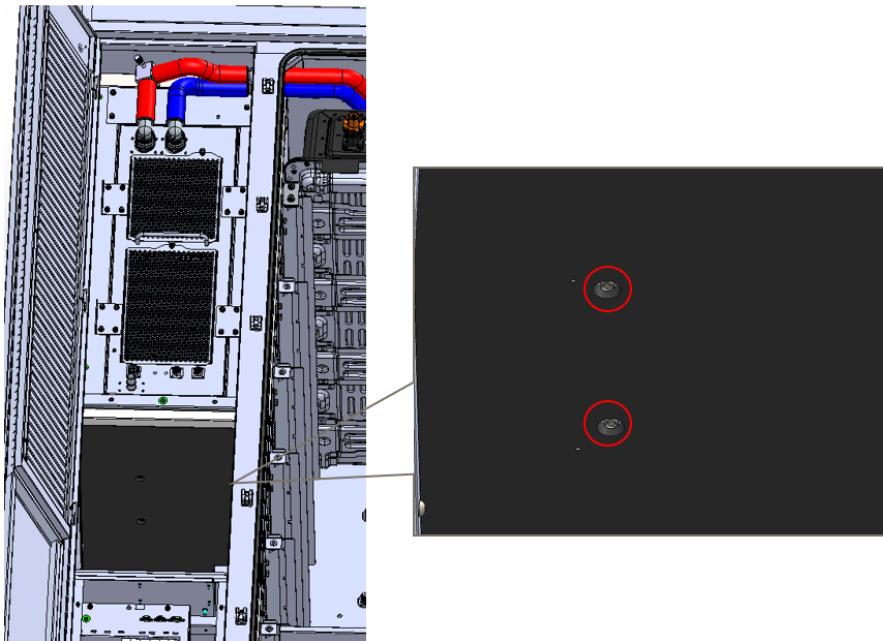


Figure 4-22 Remove mounting screws

7. Pull the TMS module and slide it out onto the forklift, then move the forklift to an open area to set the module down.

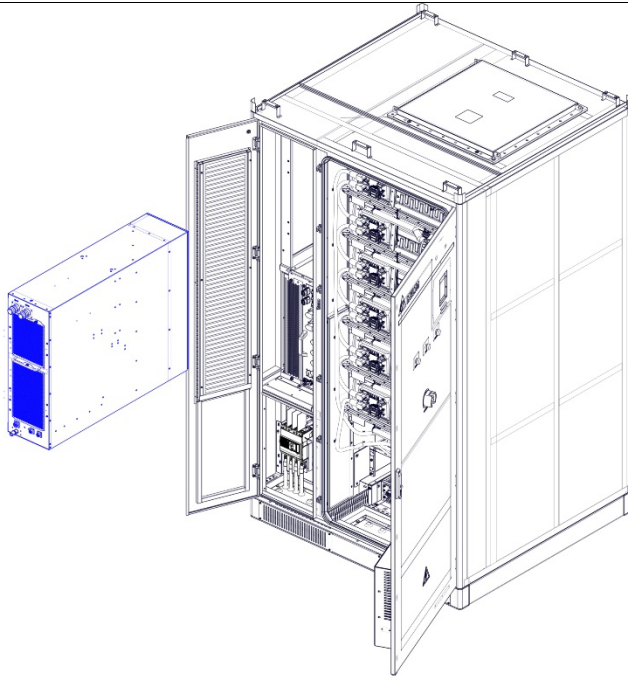


Figure 4-23 Take down TMS module

B. Install TMS

1. Lift up TMS module with forklift and push it into its compartment.

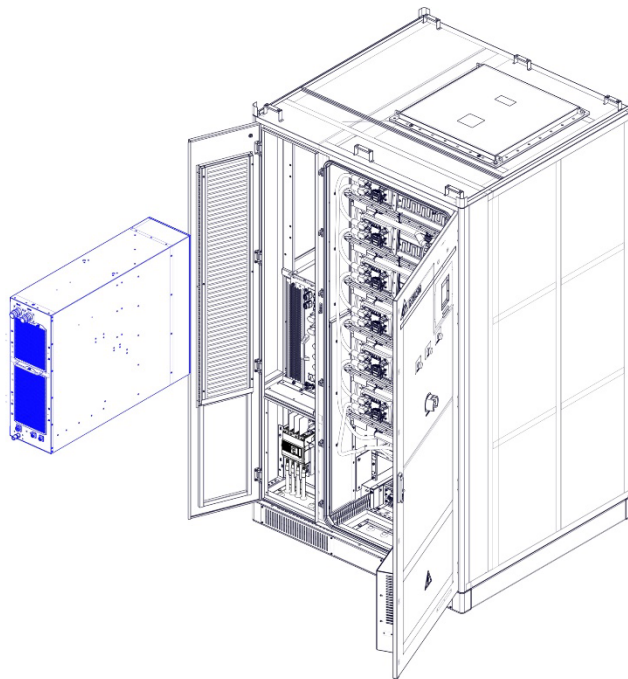


Figure 4-24 Install TMS module

2. Install the mounting screws from the bottom of the TMS.

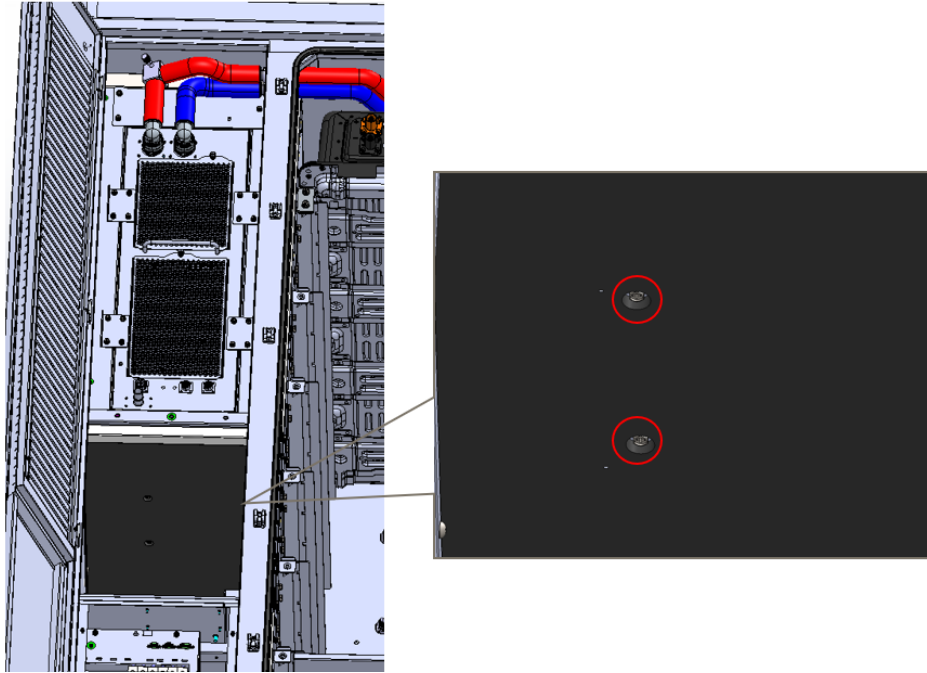


Figure 4-25 Install mounting screws

3. Fix retaining bracket and tighten its bolts.

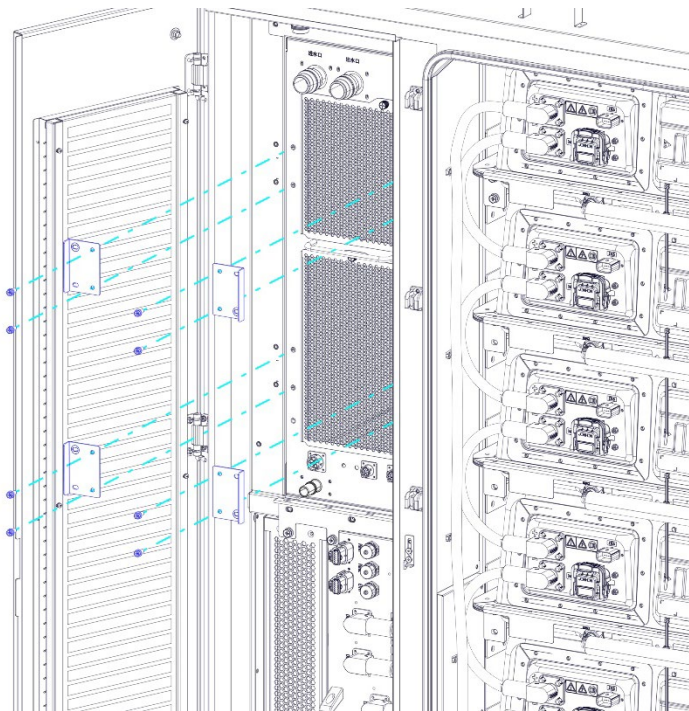


Figure 4-26 Fix retaining bracket

4. Plug pipeline connector into TMS port.

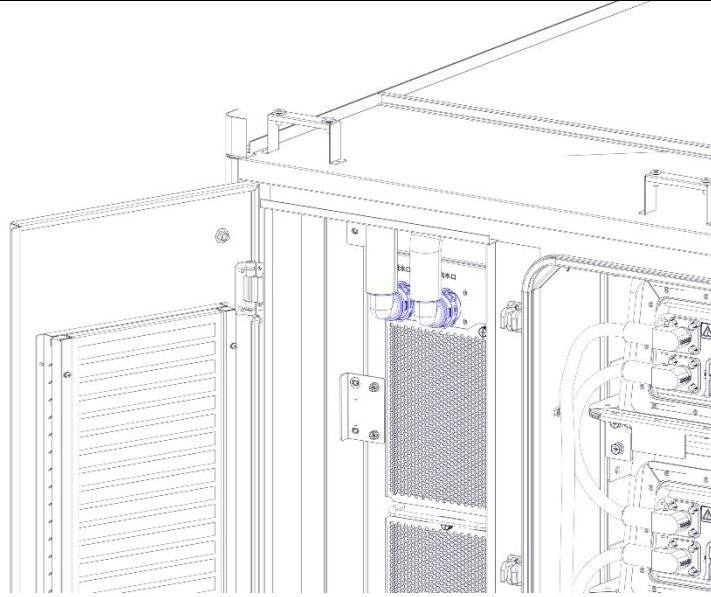


Figure 4-27 Plug pipeline connector

5. Reconnect all signal wires connector to TMS.

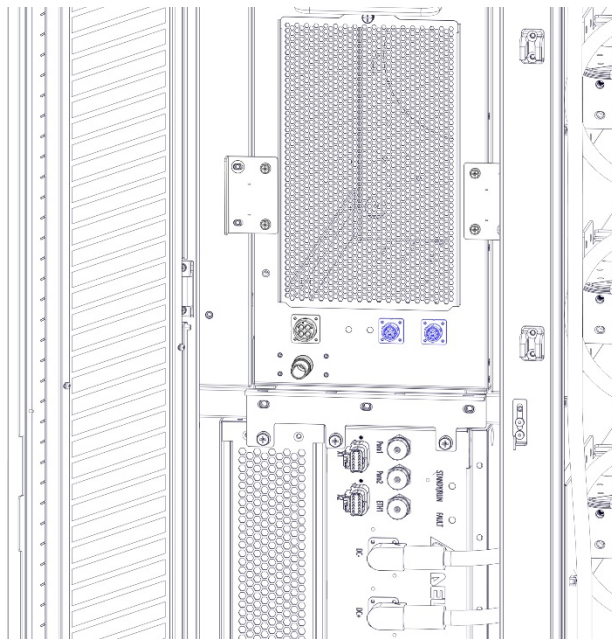


Figure 4-28 Reconnect signal wires

6. Refer to section 4.1 to install the PCS.
7. Turn on auxiliary power switch QB1, AC breaker and DC isolated switch.

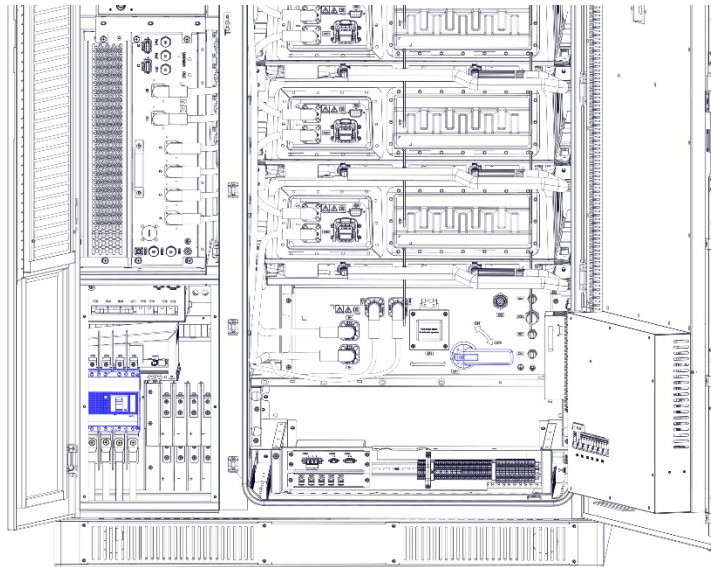


Figure 4-29 Turn on AC breaker and DC switch

8. Inject coolant into TMS.

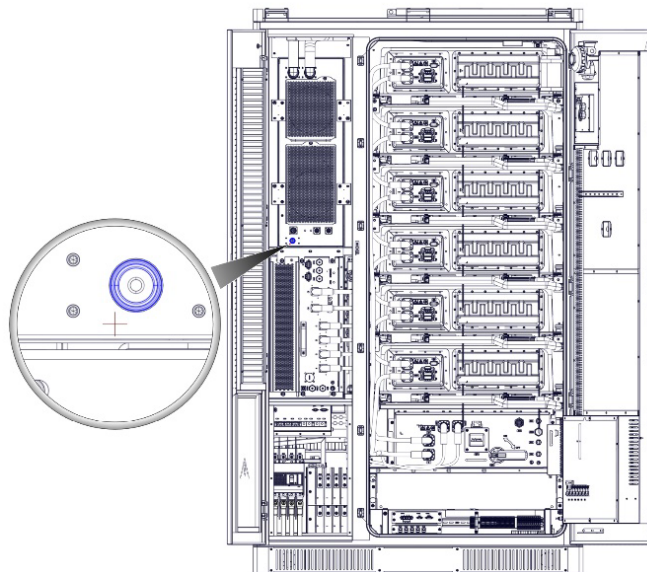


Figure 4-30 Inject coolant into TMS

4.4 HV box replacement

The HV box module type name is Ctrl-Box (PN:780300-00162).

A. Take down control box

1. First of all, open the door and turn off AC breaker and DC isolation switch to shut off power, then turn off auxiliary power switch QB1.

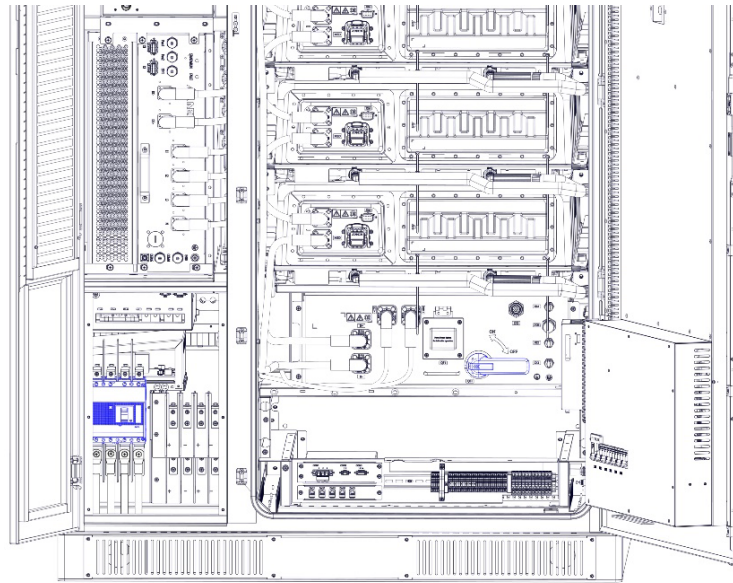


Figure 4-31 Turn off AC breaker and DC switch

2. Unplug signal and communication connector of HV box.

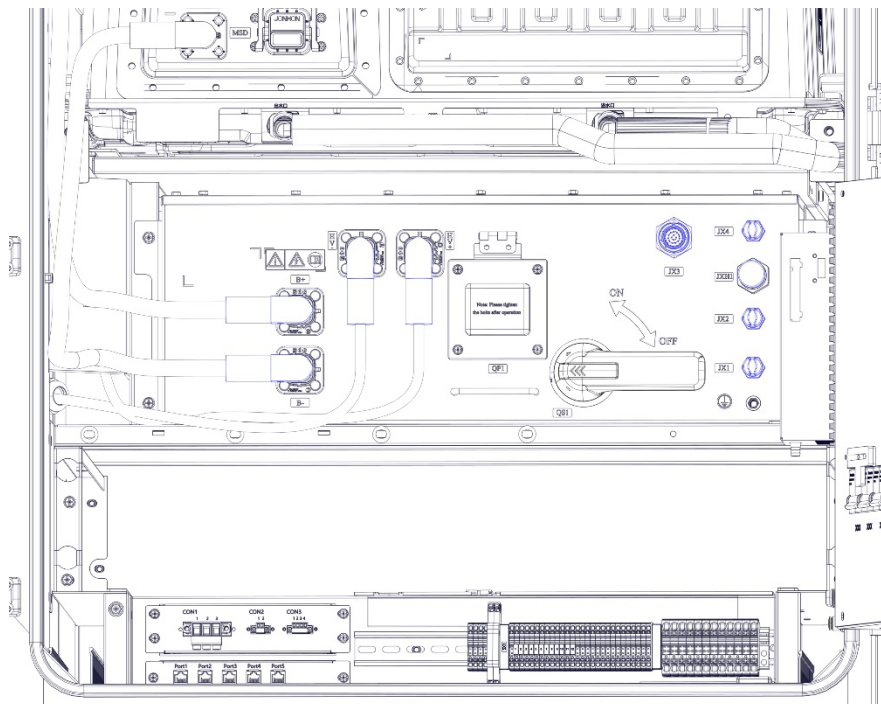


Figure 4-32 Unplug signal wires connector

3. Unscrew retaining bolts of HV box.

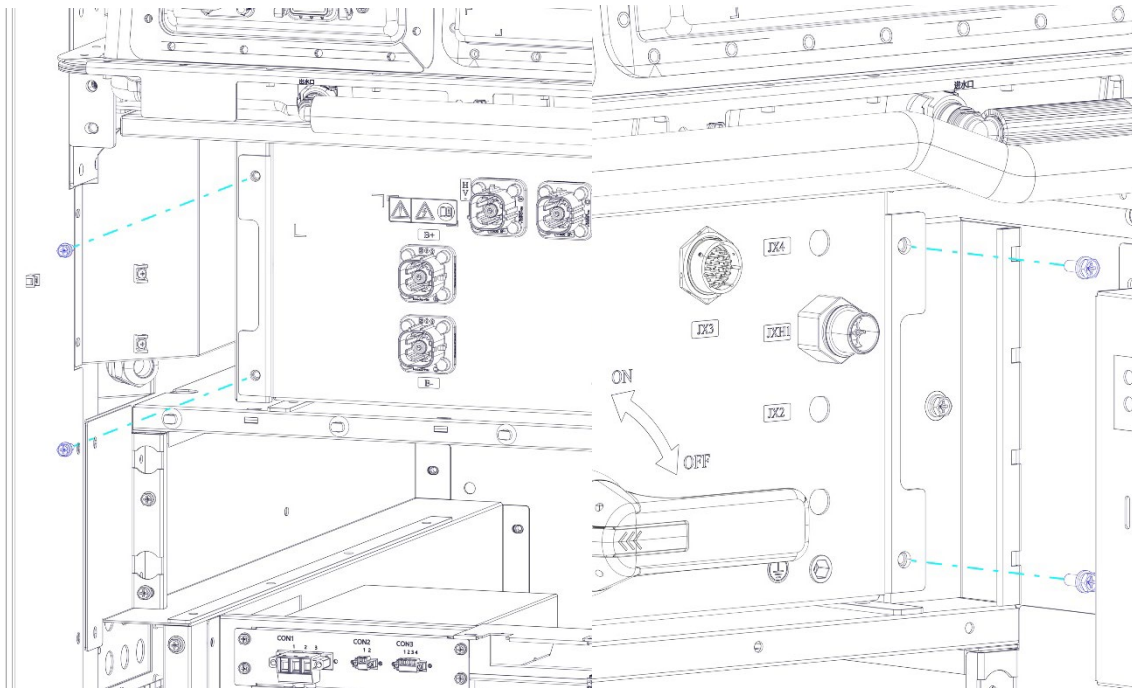


Figure 4-33 Unscrew retaining bolts

4. Pull HV box and slide out it onto forklift, then move forklift to opened area to put it down.

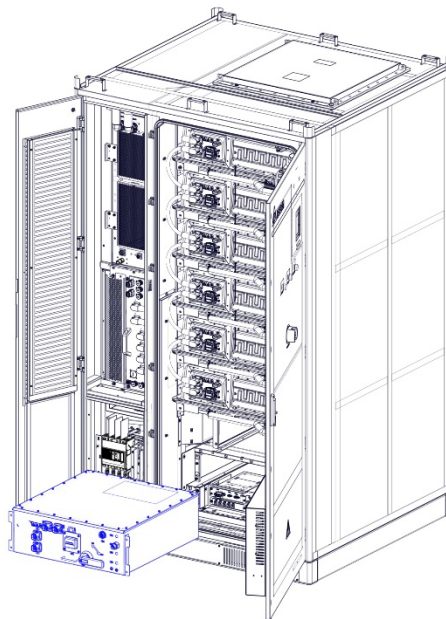


Figure 4-34 Take down HV box

B. Install HV box

1. Lift up HV box with forklift and push it into its compartment.

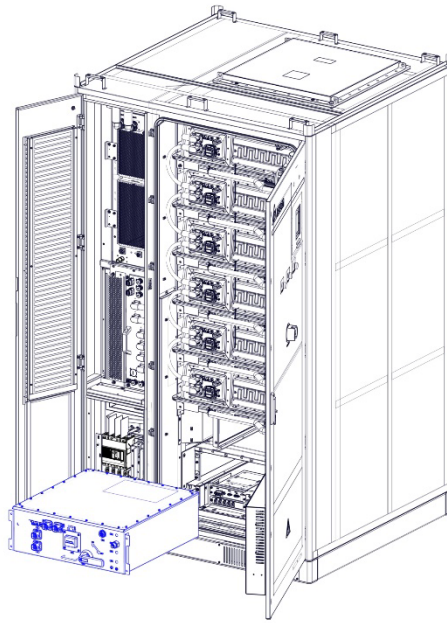


Figure 4-35 Install HV box

2. Fasten HV box retaining bolts.

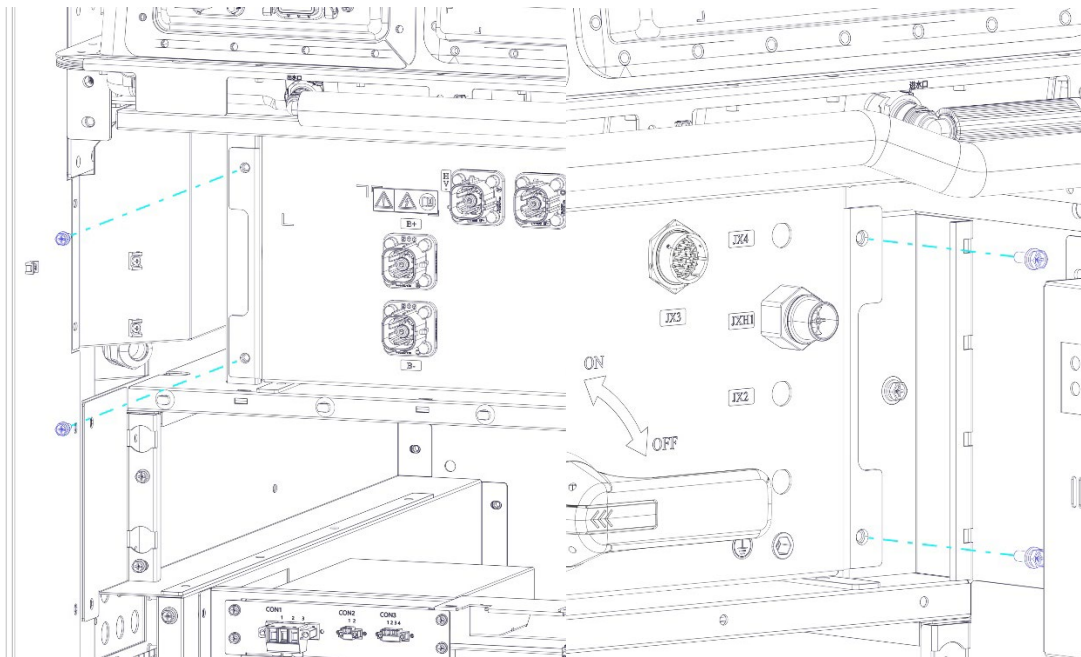


Figure 4-36 Fasten retaining bolts

3. Reconnect signal wires connector to HV box.

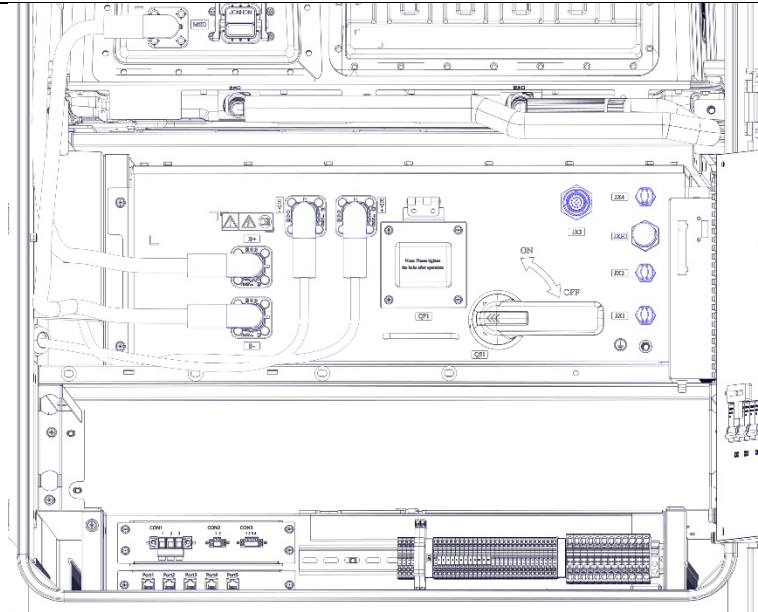


Figure 4-37 Reconnect signal wires

4. Turn on auxiliary power switch breaker1, AC breaker and DC isolated switch.

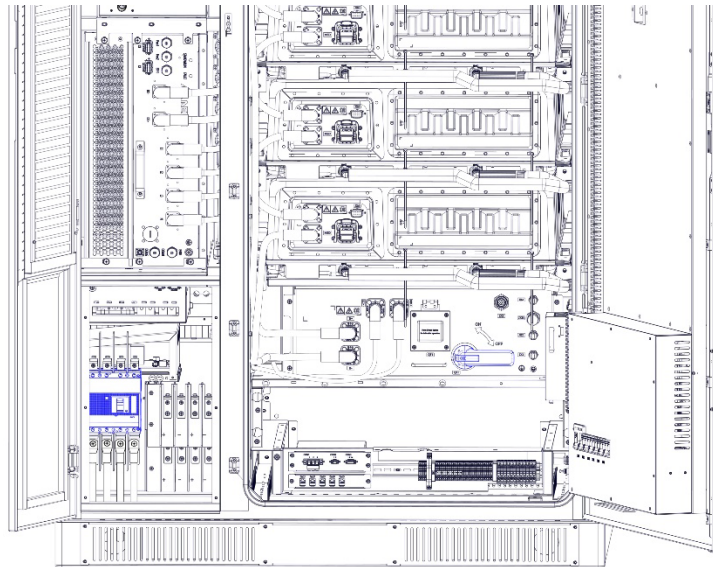


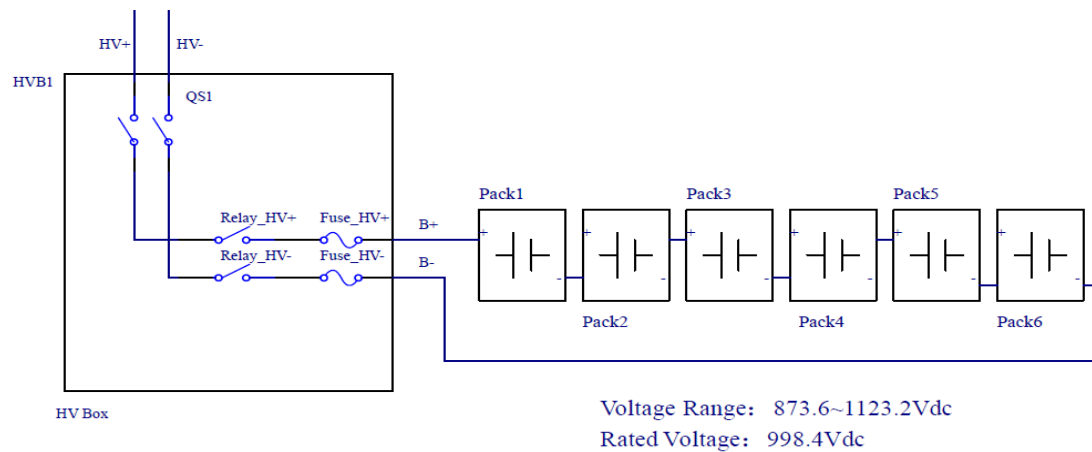
Figure 4-38 Turn on AC breaker and DC switch

4.5 Battery module replacement

The battery module is M52280-E.

The battery electrical connection diagram is as follows.

Note: During battery maintenance and installation, all wiring connections must be performed strictly in accordance with the electrical diagrams.



A. Take down battery module

1. First of all, open the door and turn off AC breaker and DC isolation switch to shut off power, then turn off auxiliary power switch QB1.

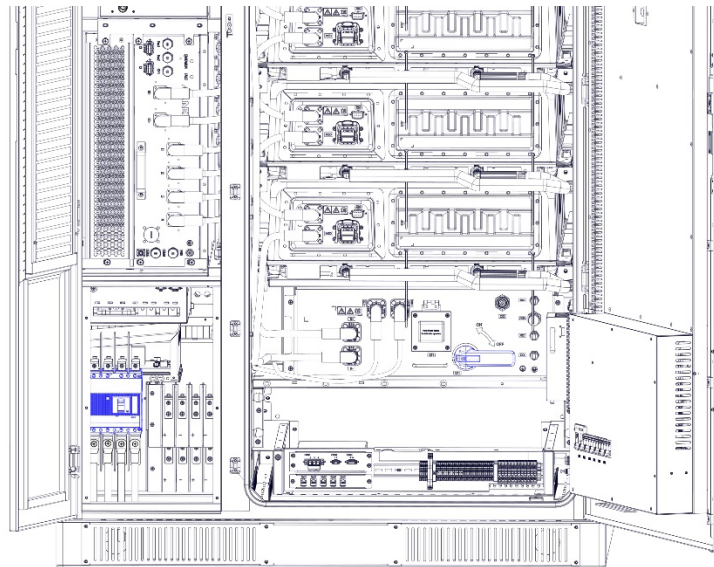


Figure 4-39 Turn off AC breaker and DC isolation switch

2. First, release the pressure in cooling system at the manual exhaust valve, which position in the upper left corner of the cabinet; then connect one pipeline to drain port to drain out all coolant from TMS.

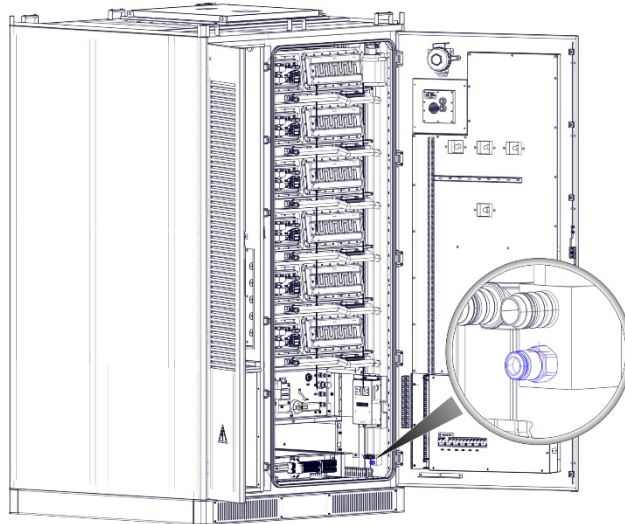


Figure 4-40 Plug pipeline onto drain port

3. Unplug battery MSD from battery module.

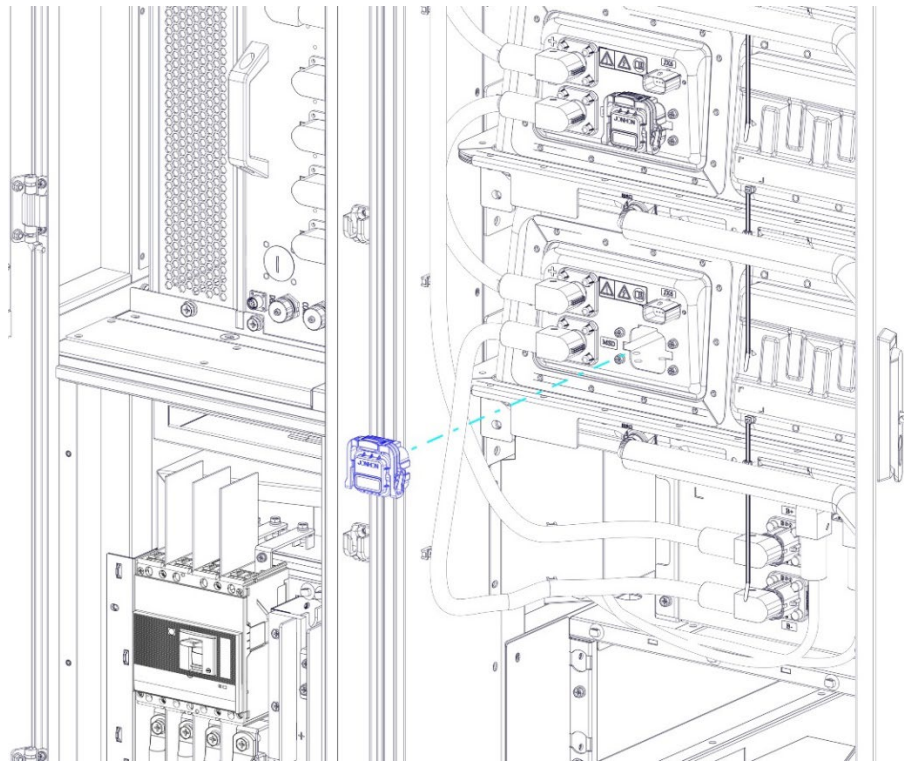


Figure 4-41 Unplug battery MSD

4. Unplug power cable and signal wires connector from battery module.

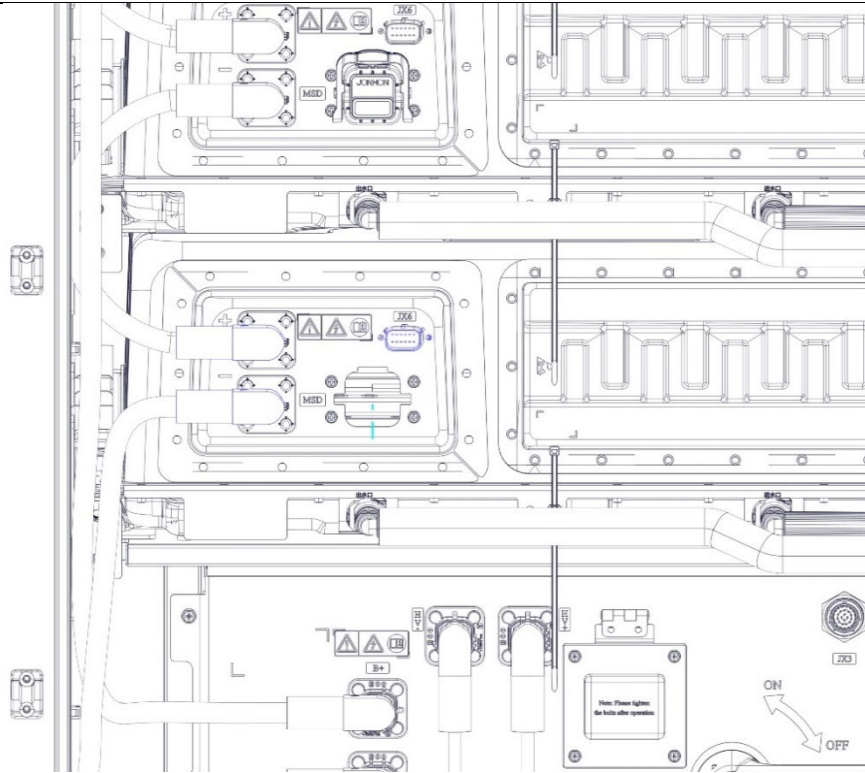


Figure 4-42 Unplug power cable and signal wire connector

5. Unplug pipeline connector from battery module.

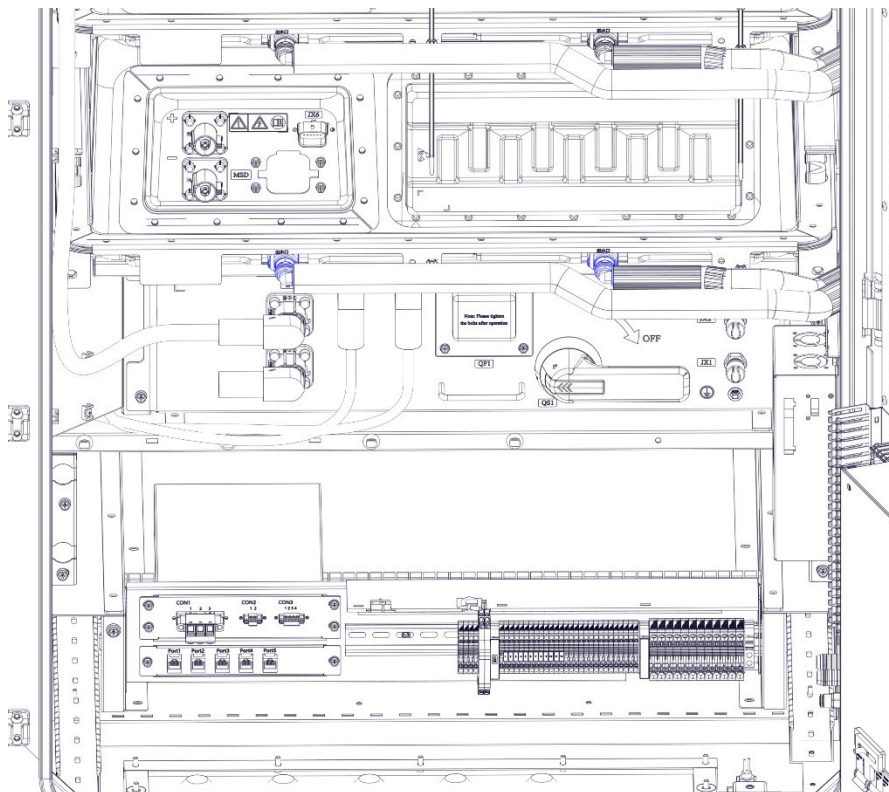


Figure 4-43 Unplug pipeline connector

6. Pull battery module and slide out it onto forklift, then move forklift to

opened area to put it down.

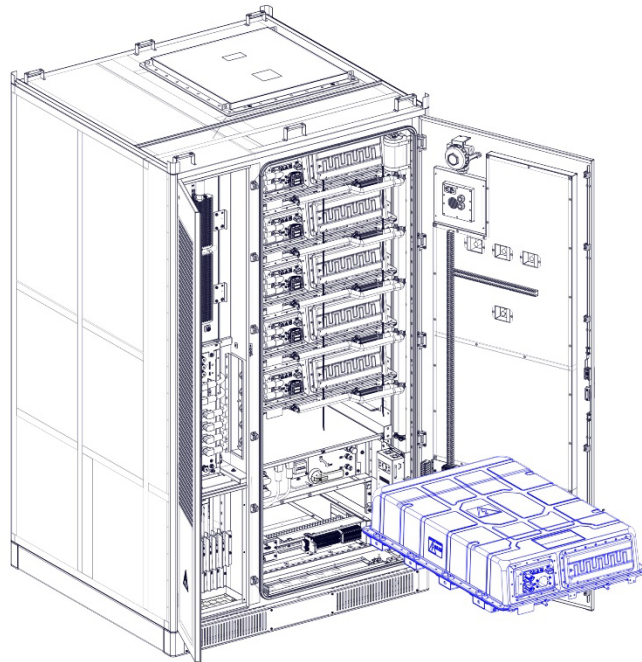


Figure 4-44 Take down battery module

B. Install battery module

1. Lift up battery module with forklift and push it into its compartment.

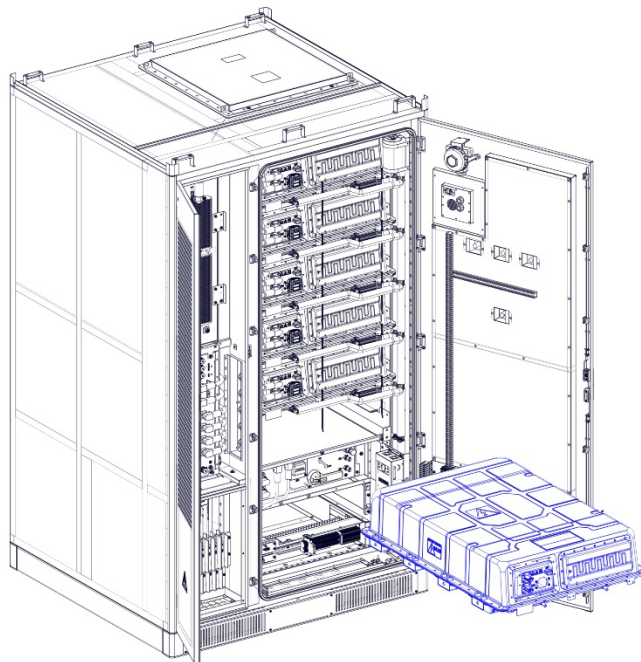


Figure 4-45 Install battery module

2. Reconnect pipeline connector to battery module.

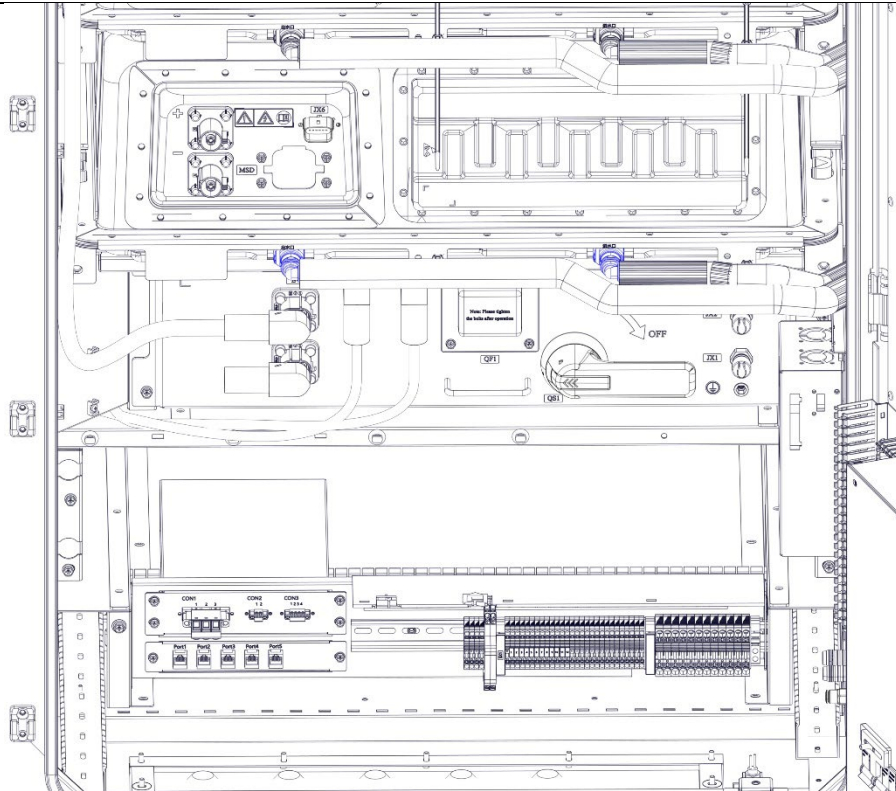


Figure 4-46 Reconnect pipeline connector

3. Reconnect power cable and signal wires to battery module.

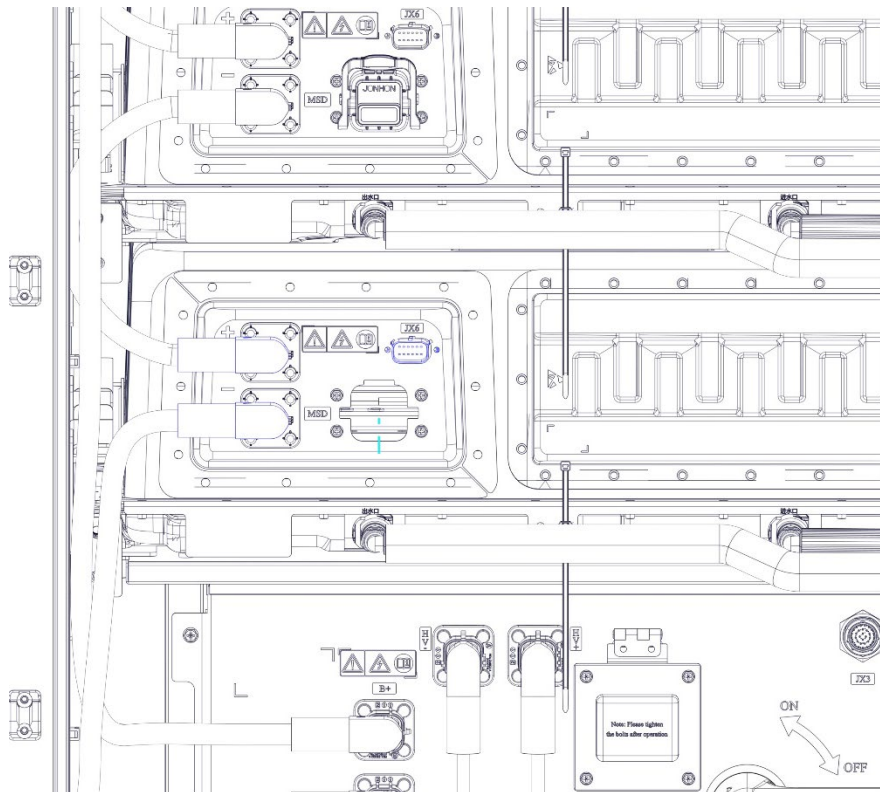


Figure 4-47 Reconnect power cable and signal wires

4. Plug MSD into battery module.

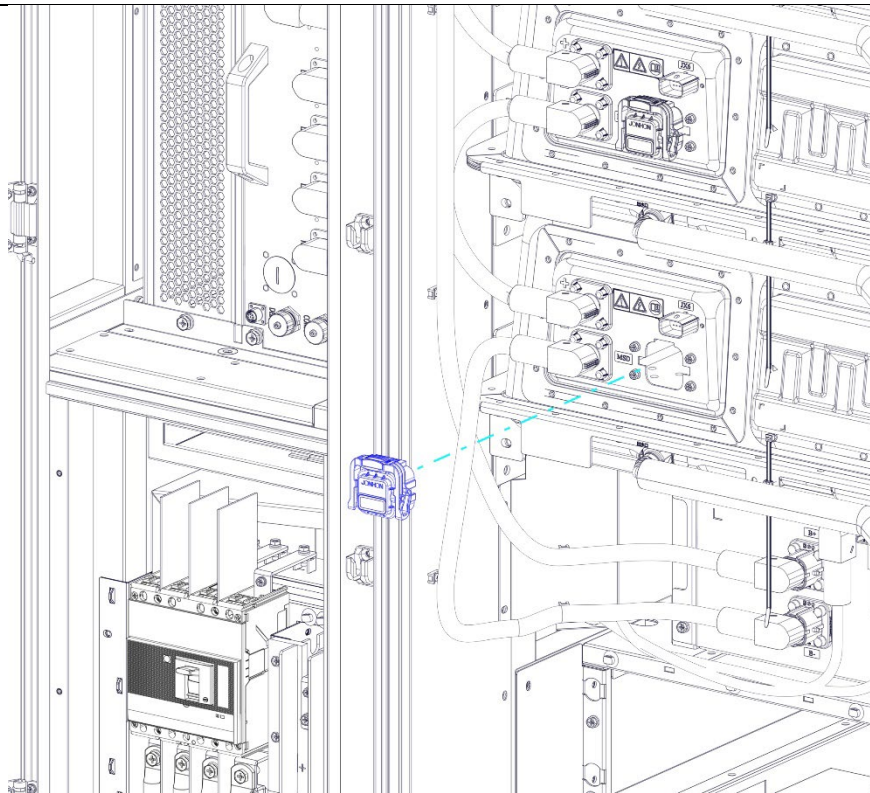


Figure 4-48 Plug MSD into battery module

5. Turn on auxiliary power switch breaker1, AC breaker and DC isolation switch.

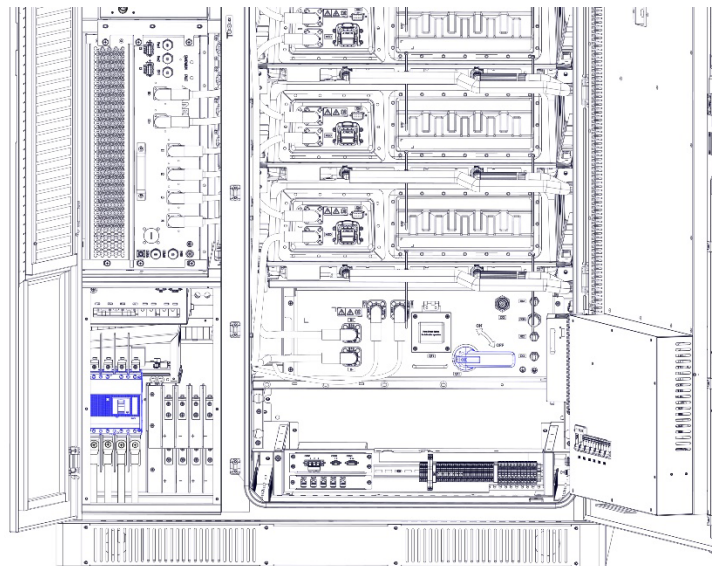


Figure 4-49 Turn on AC breaker and DC switch

6. Inject coolant into TMS.

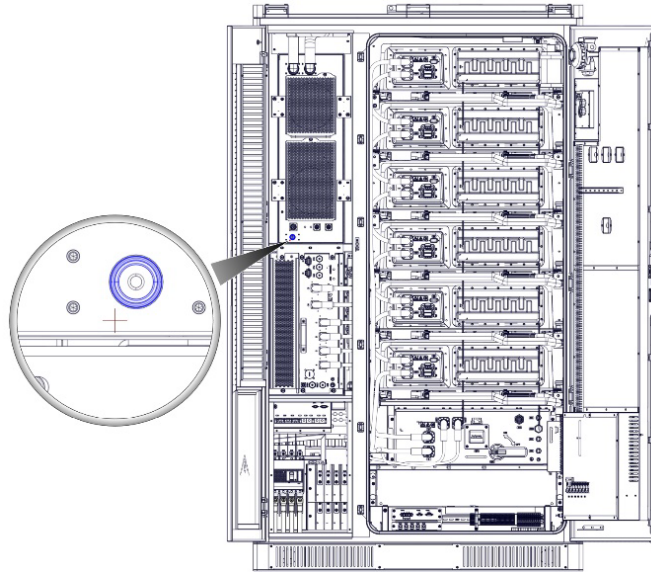


Figure 4-50 Inject coolant into TMS

4.6 Connection cable between battery modules replacement

If the interconnection cables between battery modules inside the AiO Box need to be replaced, please contact Delta.



Figure 4-51 Internal cabinet connection cables

A. Remove cable

1. Cut off all power to the AiO Box completely and verify zero voltage; then put

on the protective gear.

2. Pull out the latch of the connector.

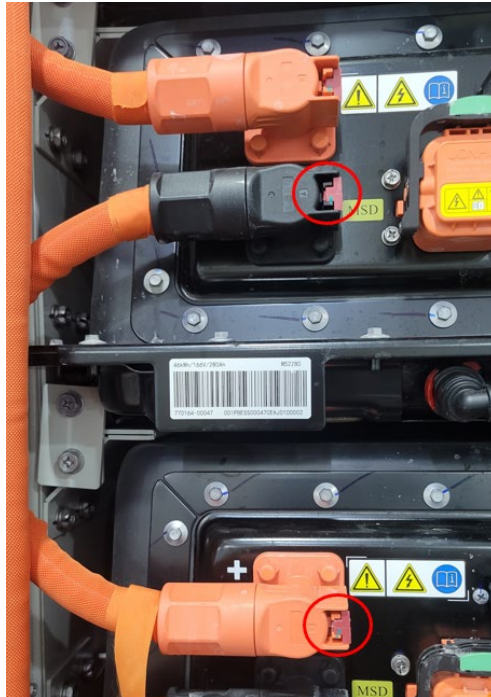


Figure 4-52 Pull out the latch of the connector

3. Unplug the connectors and remove the cable.

B. Install cable

1. Plug the connector into the battery and secure the cable in place.
2. Press the latch of the connector.

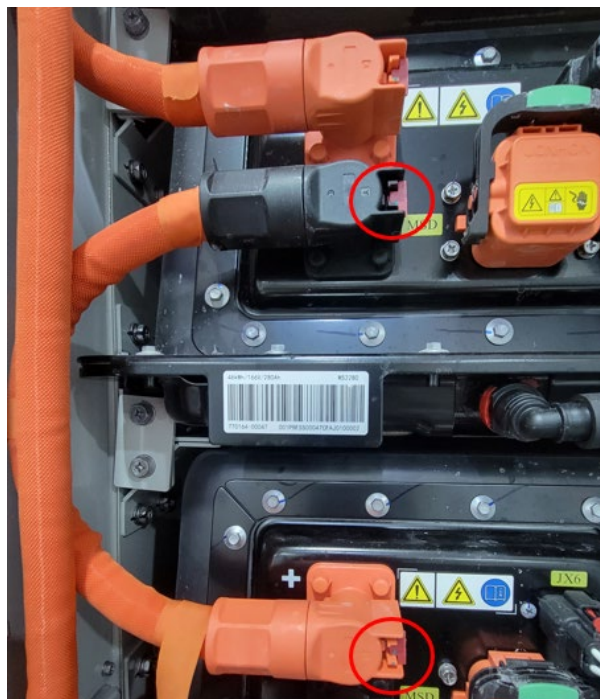


Figure 4-53 Press the latch of the connector

5 Fault tracking

5.1 PCS125HVM fault

Fault Word	Bit	Descriptions	Alarm level
MPU_COMM_FAULT	0	MCU communication fault	Fault
	1	DSP communication fault	Fault
MPU_FAULT_1	0	affiliated Battery Cabinet 1 communication fault	Warning
	1	affiliated Battery Cabinet 2 communication fault	Warning
MPU_FAULT_2	0	SBMU communication fault	Fault
	1	SDUL communication fault	Fault
	2	TMS communication fault	Fault
	3	BB module A communication fault	Warning
	4	BB module B communication fault	Warning
	5	IO communication fault	Fault
FAULT_SYS_GRID_AC	0	Grid RS Over Voltage Fault	Fault
	1	Grid ST Over Voltage Fault	Fault
	2	Grid TR Over Voltage Fault	Fault
	3	Grid RS Under Voltage Fault	Fault
	4	Grid ST Under Voltage Fault	Fault
	5	Grid TR Under Voltage Fault	Fault
	6	Grid RN Over Voltage Fault	Fault
	7	Grid SN Over Voltage Fault	Fault
	8	Grid TN Over Voltage Fault	Fault
	9	Grid RN Under Voltage Fault	Fault
	10	Grid SN Under Voltage Fault	Fault
	11	Grid TN Under Voltage Fault	Fault
FAULT_SYS_AC_SUPPLIMEN	0	Grid Over Frequency Fault	Fault
	1	Grid Under Frequency Fault	Fault
	2	Grid Phase Lock Failed Fault	Fault
	3	PCS AC Start Voltage Over limit Fault	Fault
	4	PCS AC Over Frequency Fault	Fault
	5	PCS AC Under Frequency Fault	Fault
	6	PCS AC Phase Sequence Fault	Fault
	7	PCS AC Phase Lock Fault	Fault
	8	Islanding Fault	Fault
	9	AC Fault Reconnection delay Fault	Fault
FAULT_SYS_PCS_AC	0	PCS RS Over Voltage Fault	Fault
	1	PCS ST Over Voltage Fault	Fault

	2	PCS TR Over Voltage Fault	Fault
	3	PCS RS Under Voltage Fault	Fault
	4	PCS ST Under Voltage Fault	Fault
	5	PCS TR Under Voltage Fault	Fault
	6	PCS RN Over Voltage Fault	Fault
	7	PCS SN Over Voltage Fault	Fault
	8	PCS TN Over Voltage Fault	Fault
	9	PCS RN Under Voltage Fault	Fault
	10	PCS SN Under Voltage Fault	Fault
	11	PCS TN Under Voltage Fault	Fault
	12	Voltage Average Over-Voltage Fault	Fault
	13	Voltage Average Under-Voltage Fault	Fault
FAULT_SYS_DC	0	DC Over Voltage Fault	Fault
	1	DC Under Voltage Fault	Fault
	2	DC Voltage Reverse Connected Fault	Fault
	3	BMS Communication Fault	Fault
	4	BMS Fault	Fault
	5	BMS Warning	Warning
	6	Battery Over Voltage Fault	Fault
	7	Battery Under Voltage Warning.	Warning
	8	BMS SOC High Fault	Fault
	9	BMS SOC Low Fault	Fault
	10	BMS SOC High Warning	Warning
	11	BMS SOC Low Warning	Warning
	12	Battery Cell Voltage High Warning	Warning
	13	Battery Cell Voltage Low Warning	Warning
FAULT_SYS_HARDWARE	0	EPO Fault	Fault
	2	DRM Fault	Fault
	3	Inlet UTP Fault	Fault
	4	Inlet OTP Fault	Fault
	5	RCM self check Fault	Fault
FAULT_SYS_COMMUNICATION	0	Module RS485 Fault	Fault
	1	Module CAN Fault	Fault
	2	System SPI Fault	Fault
	3	System RS485 Fault	Fault
	4	Parallel CAN Loss	Fault
	5	Parallel CAN Loss Fault	Warning
	6	Gridcode change not done	Fault
	7	IMD Check Timeout Fault	Fault
	8	Contactor KGrid Fault	Fault

	9	Contactor KTr Fault	Fault
	10	Static Switch Fault	Fault
	11	CRD Grid Sample Fault	Fault
	12	Extenal Meter RS485 Loss	Fault
	13	Parallel CAN Loss Warning	Warning
FAULT_SYS_SYSTEM	0	ADC Calibration Fault	Fault
	1	Soft Start Fault	Fault
	2	System Restart Fault	Fault
	3	Upgrade Download Warning	Warning
	4	Upgrade Boot load Warning	Warning
	5	System Soft Start Fault	Fault
	7	IMD Low Fault	Fault
	8	EEPROM Fault	Fault
	9	External Flash Fault	Fault
	10	Ambient Over Temperature	Fault
	11	Ambient Under Temperature	Fault
	12	Task Time Over Limit Warning	Warning
	13	Memory Space Over Limit Warning	Warning
	14	EEPROM Data Fault	Fault
	15	System Mode Configuration Fault	Fault
FAULT_DAM_GRID_AC_1	0	Grid RS Over Voltage	Fault
	1	Grid ST Over Voltage	Fault
	2	Grid TR Over Voltage	Fault
	3	Grid RS Under Voltage	Fault
	4	Grid ST Under Voltage	Fault
	5	Grid TR Under Voltage	Fault
	6	Grid RN Over Voltage	Fault
	7	Grid SN Over Voltage	Fault
	8	Grid TN Over Voltage	Fault
	9	Grid RN Under Voltage	Fault
	10	Grid SN Under Voltage	Fault
	11	Grid TN Under Voltage	Fault
	12	AC Capacitor Phase RN Over Voltage	Fault
	13	AC Capacitor Phase SN Over Voltage	Fault
	14	AC Capacitor Phase TN Over Voltage	Fault
FAULT_DAM_GRID_AC_2	0	Grid Over Frequency	Fault
	1	Grid Under Frequency	Fault
	2	Grid Sequence Fault	Fault
	3	Grid Phase Loss	Fault

	4	Grid Phase Lock Fault	Fault
	5	Derating Warning	Warning
FAULT_DAM_CONVERTER	0	Phase R Over Load	Fault
	1	Phase S Over Load	Fault
	2	Phase T Over Load	Fault
	3	Phase R Over Current	Fault
	4	Phase S Over Current	Fault
	5	Phase T Over Current	Fault
	6	Phase Current Unbalance	Fault
	7	Current Offset Fault	Fault
	8	Voltage Offset Fault	Fault
	9	AC Voltage Built Fault	Fault
	10	Firmware AC Over Current	Fault
	11	AC Capacitor Phase R Over Current	Fault
	12	AC Capacitor Phase S Over Current	Fault
	13	AC Capacitor Phase T Over Current	Fault
	14	Open Loop Fault	Fault
	15	Grid PreSync Fail	Fault
FAULT_DAM_DC_SIDE	0	Bus Over Voltage	Fault
	1	Bus Under Voltage	Fault
	2	Bus Capacitor Under Voltage	Fault
	3	Bus Capacitor Over Voltage	Fault
	4	Half Bus Voltage Unbalance	Fault
	5	DC Over Current	Fault
	6	DC Under Voltage	Fault
	7	DC Over Voltage	Fault
	8	DC Input Inverse Fault	Fault
	9	Bus Preload Fault	Fault
	10	Firmware Bus Short Fault	Fault
	11	Bus Soft-Start Fault	Fault
FAULT_DAM_HARDWARE	0	System Disable Fault	Fault
	1	System Hardware Fault(from upper controller)	Fault
	3	FPGA Hardware Fault	Fault
	4	Fan1 Fail	Fault
	5	Fan2 Fail	Fault
	6	Fan3 Fail	Fault
	7	Fan4 Fail	Fault
	8	Fan5 Fail	Fault
	10	System Hardware Fault2	Fault
FAULT_DAM_FPGA	0	Inductor Phase T Current CBC Fault	Fault

	1	Inductor Phase S Current CBC Fault	Fault
	2	Inductor Phase R Current CBC Fault	Fault
	3	AC Over Current	Fault
	4	DC Over Voltage	Fault
	5	IGBT Over Temperature	Fault
	6	Ambient Over Temperature	Fault
	7	Power Supply +12V Fault	Fault
	8	EPO	Fault
	9	DC Over Current	Fault
	10	Bus Over Voltage	Fault
	11	RCM OCP	Fault
	12	Go OFF	Fault
FAULT_DAM_OTHER	0	Ambient Over Temperature	Fault
	1	Ambient Under Temperature	Fault
	2	IGBT Over Temperature	Fault
	3	MCU CAN Loss Fault	Fault
	4	System RS485 Loss Warning	Warning
	5	MCU RS485 Loss Fault	Fault
	6	FPGA SPI Loss Fault	Fault
	7	External Flash SPI Fault	Fault
	8	FRAM Fault	Fault
	9	ADC Calibration Fault	Fault
	10	External Flash File Failure Warning	Warning
	11	Memory Overflow Fault	Fault
	12	Interrupt Overflow Fault	Fault
	13	FRAM Data Scope Fault	Fault
	14	Grid Code Changed Not Done (Reboot)	Fault
	15	IGBT Temperature unbalanced Fault	Fault
FAULT_DAM_RELAY	0	DC Main Relay1 Fault	Fault
	1	DC Main Relay2 Fault	Fault
	2	DC Pre Relay Fault	Fault
	3	AC Pre Relay1 Fault	Fault
	4	AC Pre Relay2 Fault	Fault
	5	AC Pre Relay3 Fault	Fault
	6	AC Main Relay1 Fault	Fault
	7	AC Main Relay2 Fault	Fault
	8	AC Main Relay3 Fault	Fault
	9	N-line Main Relay Fault	Fault
	10	Unidentified Relay Fault	Fault
	11	DC Main Relay1 Warning	Warning

	12	DC Main Relay2 Warning	Warning
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5.2 SBUM fault

Fault Word	Bit	Descriptions	Alarm level
SBMU_FAULT_1	0	Single-cell overvoltage 1	1
	1	Single-cell overvoltage 2	2
	2	Single-cell overvoltage 3	3
	3	Single-cell undervoltage 1	1
	4	Single-cell undervoltage 2	2
	5	Single-cell undervoltage 3	3
	6	Single-cell ultimate overvoltage	4
	7	Single-cell ultimate undervoltage	4
	8	Single cabinet voltage High	1
	9		2
	10	Single cabinet voltage Low	1
	11		2
	12	Excessive cell voltage difference	1
	13	Cell voltage out of range	4
	14	Cell undervoltage-replace fault	5
	15	Cell overvoltage-replace fault	5
SBMU_FAULT_2	2	Discharge current overcurrent 1	1
	3	Discharge current overcurrent 2	2
	4	Discharge current overcurrent 3	3
	5	Discharge current overcurrent 4	4
	6	Charge current overcurrent 1	1
	7	Charge current overcurrent 2	2
	8	Charge current overcurrent 3	3
	9	Charge current overcurrent 4	4
	10	Current sensor fault	4
	14	Cell overtemperature 1	1
	15	Cell overtemperature 2	2
SBMU_FAULT_3	0	Cell overtemperature 3	3
	1	Cell overtemperature 4	4
	2	Cell under-temperature 1	1
	3	Cell under-temperature 2	2
	4	Cell under-temperature 3	3
	5	Excessive cell temperature difference 1	1

	6	Excessive cell temperature difference 2	2
	7	Excessive cell temperature difference 3	3
	8	SBMU main control box overtemperature 1	1
	9	SBMU main control box overtemperature 2	2
	10	SBMU main control box overtemperature 3	3
	11	SBMU main control box overtemperature 4	4
	12	SBMU main control box low temperature 1	1
	13	SBMU main control box low temperature 2	2
	14	SBMU main control box low temperature 3	3
	15	Pack temperature sample fault (single)	4
SBMU_FAULT_4	0	Pack temperature sample fault (multiple)	4
	2	Cell temperature low fault during charge	4
	5	Main positive relay drive power supply short fault	1
	6	Main positive relay drive ground short fault	1
	7	Main negative relay drive power supply short fault	1
	8	Main negative relay drive ground short fault	1
	9	Pre-charged relay drive power supply short fault	1
	10	Pre-charged relay drive ground short fault	1
	11	CSC drive power supply short fault	1
	12	CSC drive ground short fault	1
	13	CSC encoded drive power supply short fault	1

	15	SBUM/DCDC encoded drive power supply short fault	1
SBMU_FAULT_5	0	SBUM/DCDC encoded drive ground short fault	1
	7	Current sensor unable power supply fault	1
	8	Current sensor enable power supply fault	4
	9	CSC 24V power supply fault	4
	10	SBMU 24V power supply fault	4
	11	SBMU 25V power supply warning	1
	15	HV Box fuse fault	4
SBMU_FAULT_6	0	HV Box QS fault	4
	1	Main positive relay adhesion fault	4
	2	Main negative relay adhesion fault	4
	3	Main positive and negative relay adhesion fault	6
	4	Main positive relay open circuit fault	4
	5	Main negative relay open circuit fault	4
	6	Limit switch fault	6
	7	HV box FAN fault	4
SBMU_FAULT_7	5	CCAN Communication fault	4
	6	Current message loss fault	4
	7	MCAN MBMU Communication fault	4
	9	CSC Daisy chain communication fault	4
	11	The balancing circuit fault	4
	13	SOC Low 1	1
	14	SOC Low 2	2
	15	High-voltage circuit open circuit fault	4
SBMU_FAULT_8	3	The pre-charging failed twice	5
	4	Pre-charge overcurrent	5
	5	Cell Voltage sample fault	4
	6	CSC sampling circuit Leakage current fault	4
	9	Rack Battery reverse	6
SBMU_FAULT_9	1	HV Box NTC open warning	3
	2	HV Box NTC short warning	3
	4	CSC number configuration error fault	4
	5	HV fuse fault	4

SBMU_FAULT_10	8	Cabinets excessive temperature warning	2
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5.3 Y board fault

Fault Word	Bit	Descriptions	Alarm level
IO_BOARD_FAULT_1	0	Door Switch	Fault
	1	AC Break Aux Contact	Fault
	2	Floating Switch	Fault
	3	DC SPD1 Feedback	Fault
	4	DC SPD2 Feedback	Fault
	5	AC SPD Feedback	Fault
	6	AuxTransformerOTP1	Fault
	7	AuxTransformerOTP2	Fault
	8	Main Transformer OTP	Fault
	9	DCDC1Alarm	Fault
	10	DCDC2Alarm	Fault
	11	AC Breaker SY	Fault
	12	Gas Detector Fault	Fault
	13	Gas Detector Alarm	Fault
	14	Smoke Detector	Fault
	15	Aerosol	Fault
IO_BOARD_FAULT_2	0	Fan1Fault	Fault
	1	Fan2Fault	Fault
	2	Fan3Fault	Fault
	3	Fan4Fault	Fault

5.4 TSM fault

Fault Word	Brand	Bit	Descriptions	Alarm level
TMS_FAULT_8	Envicool	0	Outlet Coolant Temp Sensor Failure	Fault
		1	Inlet Coolant Temp Sensor Failure	Fault
		2	Exhaust Temp Sensor Failure	Fault
		3	Ambient Temp Sensor Failure	Fault
		4	Inlet Coolant Pressure Sensor Failure	Fault
		5	Outlet Coolant Pressure Sensor Failure	Fault
		6	High Temp of Outlet Coolant	Fault
		7	Low Temp of Outlet Coolant	Fault
		8	Outlet Coolant Temp Sensor Failure	Fault
		9	Inlet Coolant Temp Sensor Failure	Fault
		11	Commun Failure of Freq Converter	Fault

TMS_FAULT_9	12	System High Pressure Alarm Locking	Fault
	13	System Low Pressure Alarm Locking	Fault
	14	Exhaust Temp Too High Locking	Fault
	15	Freq Converter Overcurrent Locking	Fault
	0	Freq Converter Over Temp Locking	Fault
	1	Freq Converter Overvoltage Locking	Fault
	2	Freq Converter Undervoltage Locking	Fault
	3	Freq Converter Phase Loss Locking	Fault
	4	Freq Converter Other Fault Locking	Fault
	7	Add Water Alarm	Fault
	8	System High Pressure Alarm	Fault
	9	Outlet Coolant Pressure Too High	Fault

5.5 SDUL fault

Fault Word	Bit	Descriptions	Alarm level
SDUL_WORKING_STATUS	0	Cold surface temperature sensor fault	Fault
	1	Hot surface temperature sensor fault	Fault
	2	External ambient temperature high/External temperature sensor fault	Fault
	3	External temperature high	Fault
	4	Refrigeration plate malfunction	Fault
	5	Internal Fan Failure	Fault

5.6 BB190 fault

Fault Word	Bit	Descriptions	Alarm level
BB_FAULT_1	0	PortA outer voltage hw OV	Fault
	1	PortB inner voltage hw OV	Fault
	2	PortA fly cap 3 hw OV	Fault
	3	PortB fly cap 3 hw OV	Fault
	4	PortA fly cap 2 hw OV	Fault
	5	PortB fly cap 2 hw OV	Fault
	6	PortA fly cap 1 hw OV	Fault
	7	PortB fly cap 1 hw OV	Fault
	8	PMU PortA current hw OC	Fault
	9	PMU PortB current hw OC	Fault
	10	Phase 3 inductor hw OC	Fault
	11	Phase 2 inductor hw OC	Fault
	12	Phase 1 inductor hw OC	Fault
	13	Hsk temper hw OT	Fault

	14	Air temper hw OT	Fault
	15	PortB Mov Fault	Warning
BB_FAULT_2	0	28377 Fault	Fault
	1	12V Aux power Uv OV	Fault
	2	Safety chip hw active	Fault
	3	EPO input	Fault
	4	Hw fault all trigger Tz	Fault
	5	PortA inner sw OV, may not be use	Fault
	6	PortA inner sw UV, may not be use	Fault
	7	PortB inner sw OV	Fault
	8	PortB inner sw UV	Fault
	9	PortA outer sw OV	Fault
	10	PortA outer sw UV	Fault
	11	PortB outer sw OV, enable when on grid softstart	Fault
	12	PortB outer sw UV, enable when on grid softstart	Fault
	13	PortA fly cap 1 voltage unbalance	Fault
	14	PortB fly cap 1 voltage unbalance	Fault
	15	PortA fly cap 2 voltage unbalance	Fault
BB_FAULT_3	0	PortB fly cap 2 voltage unbalance	Fault
	1	PortA fly cap 3 voltage unbalance	Fault
	2	PortB fly cap 3 voltage unbalance	Fault
	3	PortA fly cap 1 sw UV, replace Q1Q4 OV	Fault
	4	PortB fly cap 1 sw UV	Fault
	5	PortA fly cap 2 sw UV	Fault
	6	PortB fly cap 2 sw UV	Fault
	7	PortA fly cap 3 sw UV	Fault
	8	PortB fly cap 3 sw UV	Fault
	9	Inductor insl 1 sw OC	Fault
	10	Inductor insl 2 sw OC	Fault
	11	Inductor insl 3 sw OC	Fault
	12	PortA PMU I sw5 OC	Fault
	13	PortB PMU I sw5 OC	Fault
	14	PortA PMU I sw3 OC	Fault
	15	PortB PMU I sw3 OC	Fault
BB_FAULT_4	0	PortB relay error	Fault
	1	PortA relay error	Fault

	2	Flash wave log sector breakdown	Warning
	3	Flash event log sector breakdown	Warning
	4	Flash parameter sector breakdown	Fault
	5	Flash App update sector breakdown	Warning
	6	CAN unlink	Warning
	7	Modbus 485 unlink	Warning
	8	Modbus TCP unlink	Fault
	9	Softstart TO	Fault
	10	Fan1 Error	Warning
	11	Air temperature sw OT	Fault
	12	Hsk temperature sw OT	Fault
	13	Air temperature wn OT	Warning
	14	Hsk temperature wn OT	Warning
	15	Ambient temperature too cold, NTC may not be connected	Warning
BB_FAULT_5	0	On/Off Grid Bus side voltage abnormal	Fault
	1	28069 Fault	Fault
	2	IMD Rp impedance low	Fault
	3	IMD Rn impedance low	Fault
	4	Manual Switch Open	Fault
	5	Negative Current Unbalance	Fault

Contact

If you have technical problems with our products, please contact the Delta Service. The following data is required in order to provide you with the necessary assistance:

- Company name.
- Product type.
- Serial number of the product.
- Site location of product (Address / Geographic coordinates).
- A description of the requirement or issue faced.
- Current log files If available.

Appendix 1 Periodic maintenance

Inspect and replace maintenance items																					
Items		Year from start-up																			
			0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5
Equipment start-up		P																			
1	Cabinet body of AiO Box		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
2	Filter cotton of AiO Box			R		R		R		R		R		R		R		R		R	R
3	Fans of AiO Box			I		I		I		I		R		I		I		I		I	R
4	Rubber seal strip			I		I		I		I		I		I		I		I		I	R
5	Clean up dust		C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
6	TMS		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
7	The fans of TMS		I	I	I	I	I	I	I	I	I	R	I	I	I	I	I	I	I	I	R
8	Coolant		I	I	I	I	I	I	I	I	I	R	I	I	I	I	I	I	I	I	R
9	Pipe water cooling		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
10	Aerosol			I		I		I		I		R		I		I		I		I	R
11	Smoke Detector			I		I		I		I		R		I		I		I		I	R
12	Gas Detector		Z	Z	Z	Z	Z	Z	Z	Z	Z	R	Z	Z	Z	Z	Z	Z	Z	Z	R
13	PCS			I		I		I		I		I		I		I		I		I	I

14	The fans of PCS			I		I		I		I		R		I		I		I		I		R
15	Battery of C board in PCS																					R
16	Battery of R board in PCS																					R
17	DC/DC power module			I		I		I		I		I		I		I		I		I		I
18	Transformer			I		I		I		I		I		I		I		I		I		I
19	Battery System		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Inspect and replace maintenance items																						
Items		Year from start-up																				
			10.5	11	11.5	12	12.5	13	13.5	14	14.5	15	15.5	16	16.5	17	17.5	18	18.5	19	19.5	20
Equipment start-up		P																				
1	Cabinet body of AiO Box		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
2	Filter cotton of AiO Box			R		R		R		R		R		R		R		R		R		R
3	Fans of AiO Box			I		I		I		I		R		I		I		I		I		R
4	Rubber seal strip			I		I		I		I		I		I		I		I		I		R
5	Clean up dust		C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
6	TMS		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
7	The fans of Chiller		I	I	I	I	I	I	I	I	I	R	I	I	I	I	I	I	I	I	I	R
8	Coolant		I	I	I	I	I	I	I	I	I	R	I	I	I	I	I	I	I	I	I	R

9	Pipe water cooling		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
10	Aerosol			I		I		I		I		R		I		I		I		I		R
11	Smoke Detector			I		I		I		I		R		I		I		I		I	I	R
12	Gas Detector		Z	Z	Z	Z	Z	Z	Z	Z	Z	R	Z	Z	Z	Z	Z	Z	Z	Z	Z	R
13	PCS		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
14	The fans of PCS		I	I	I	I	R	I	I	I	I	R	I	I	I	I	R	I	I	I	I	R
15	Battery of C board in PCS																					R
16	Battery of R board in PCS																					R
17	DC/DC power module			I		I		I		I		I		I		I		I		I		I
18	Transformer			I		I		I		I		I		I		I		I		I		I
19	Battery System		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I

I = Inspect (visual checking, perform further maintenance if need)

P = Site or off-site work (Commissioning, measuring, testing or other work)

R = Recommend Replace

C = Clean

Z = zero and calibrate

Note: 19 Battery System reference chapter 3.4.

Appendix 2 Spare list for preventive maintenance

Name	Part No.	Description	Qty	Replace Interval	Design No.	Consumable	Remark
Filter cotton of AiO Box	NA	NA	1 pc	1 year	NA	Y	Must
Fans of AiO Box	3620696722	DC FAN ASSY MGT6024XB-W38 G (E202502121)	3 pcs	10 years	Fan1-3		Recommend
Fan of AiO Box	36208A9422	DC FAN ASSY MGT8024VB-W38F(E202508062)	1 pc	10 years	Fan4		Recommend
Rubber seal strip	NA	NA	1 set	10 years	NA	Y	Recommend
The fans of Chiller	NA	NA	2 pcs	5 years	NA		Recommend
Coolant	4020254800	Coolant glycol G30-50	12.5kg	5 years	NA	Y	Recommend
Pipe water cooling	NA	NA	1 set	20 years	NA		Recommend
The fans of PCS	36208A5623	DC FAN ASSY GF80381B1-Q08C-QE9 L500 80 B	7 pcs	5 years	FAN1-7		Recommend
Battery of C&R board in PCS	NA	NA	3 pcs	10 years	NA	Y	Must

Note:

It is recommended to check and clear the filter at least once every six months.

The maintenance interval should be shortened to once every three months or shorter if the dust deposition is heavy.

Cooling air enters the PCS from the front side and hot air leaves the inverter of the back side.

The air inlet window is equipped with filter pads, which can be dismantled, cleaned and replaced.

Appendix 3 Fuses list

No	Spec	Qty	Part No.	Design No.	Remark
1	FUSE gL/gG P 100A 500VAC BLADE	3 pcs	0890033703		AC SPD fuse
2	FUSE gPV P 30A 1500V CLIP	4 pcs	0891808302		DC SPD fuse
3	RSZ307-3-RAZ 400A	2 pcs	NA		DC fuse

Note: Spare parts need to be stored according to the storage conditions of electronic components.