HYXI C&I ESS O&M Guide

Air Cooling Hybrid ESS Cabinet

HYX-H(50-125)K-BOA215

Contents

1 Purpose

This document provides operation and maintenance recommendations for energy storage cabinets, intended for after-sales inspections and maintenance. To ensure safety, please carefully read this manual before operation to fully understand the safety precautions and the performance and characteristics of the energy storage system.

2 Scope

This document applies only to the overseas air cooling energy storage system HYX-H(50-125)K-BOA215.

3 Reader

This document is primarily intended for the following engineers

- Technical Support Engineer

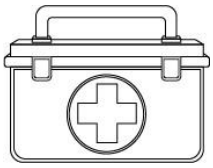
- Maintenance Engineer

4 Recommendations for tools and spare parts

No.	Name	Quantity
1	Multi meter	1 unit
2	Insulation meter	1 unit
3	Vacuum cleaner	1 unit
4	Air dryer	1 unit
5	Electrical tools (screwdrivers, pliers, wire cutters, etc.)	1 set
6	Wool brush with insulated handle	1 set
7	Cleaning supplies (rags, garbage bags, etc.)	Appropriate amount

5 Recommendations for core module inspection & maintenance

5.1 Preparation before maintenance

 Insulating gloves	 Protective gloves	 Goggles	 Dust mask
 Insulated shoes	 Reflective vest	 Helmet	 Seat belt
 First Aid Kit	-	-	-

5.2 System power off

Primary circuit power off:

PCS is in standby mode.

Battery high voltage box is closed.

PCS AC switch and high voltage are disconnected.

The DC switch of the box is turned off, and the system is powered off.

When there is charge and discharge current in the main circuit of the battery system, the system will not be able to power off until current below 5A.

Secondary circuit power off:

After the primary circuit of the energy storage system is powered off, disconnect all circuit breakers in the cabinet. Then disconnect the auxiliary Power switch and UPS Power switch. Primary circuit indicator light will be in red.

If the system still cannot shut down normally after 5 attempts, please contact the manufacturer to troubleshoot the system.

5.3 Quarterly inspection and maintenance

5.3.1 Routine check

(1) Visual inspection

At the equipment operation site, during routine operation, observe the appearance of the cabinet. Check for any rust on the sheet metal, peeling of the powder coating, or other missing or damaged components on the exterior of the cabinet.

(2) Environmental condition inspection

At the equipment operation site, log in to the site energy management system web interface via a laptop connected to the internet. Check for system fault alarms, including communication failure of downstream components, circuit breaker tripping, access control alarms, water immersion alarms, etc. Also, compare the platform interface with the cabinet status indicator lights to ensure consistency.

At the equipment operation site, log in to the site energy management system web interface via a laptop connected to the internet. Check the status of each composite detector in the fire protection system, confirm whether any alarms have occurred, and observe the parameter curves to confirm whether there are any data anomalies.

(3) Dustproof cotton replacement

To ensure dust prevention inside the outdoor energy storage cabinet, a dustproof cotton layer is installed on the air intake side. This dustproof cotton is made of 10 mm thick, 35 PPI black polyurethane filter cotton. To replace it, open the front door of the cabinet, use a screwdriver to remove the relevant fixing sheet metal, and replace the dustproof cotton. When the cabinet operates in an outdoor environment with high dust levels, the replacement frequency of the dustproof cotton should be increased according to the site conditions.

5.3.2 Electrical compartment and combiner box

(1) Inspection cycle and inspection contents

- Ensure that the metal frame inside the electrical compartment and combiner box is properly connected to the base steel using galvanized bolts, and that all anti-loosening parts are in place.

- Busbar joints should be tightly connected, without deformation, blackening from discharge, and with no loose or damaged insulation. Fastening bolts should not be rusted. Check all fasteners and tighten them promptly if any are loose.

- Check whether the indicator lights on each cabinet are normal, whether the switch positions of the controller are normal, and whether the operation is normal. Manually test whether the mechanical interlocking part can be reliably closed, and apply lubricating oil to the moving parts.

- Check the auxiliary circuit connectors for deformation, blackening from discharge (usually silver), and rust on the grounding wire (check if the solder joints are normal). Tighten the connecting screws. Replace any rusted bolts to ensure a tight connection.

- Check the three-phase voltage and current parameters of the low-voltage incoming line, the AC/DC voltage parameters of the secondary circuit, and reset the leakage protection button if the circuit is configured with leakage protection function.

- Perform thorough dust removal inside electrical equipment cabinets. Electrical equipment easily attracts dust, so it is essential to keep each cabinet clean and dust-free to prevent flashover (an insulation discharge phenomenon caused by humid air). Dust removal must be performed by an electrician using a vacuum cleaner; wet clothes or similar tools must not be used.

- The secondary circuits of the server rack are divided into communication circuits and power supply circuits according to their functions. When there is a communication failure alarm for lower-level devices on the cloud platform, the relevant circuits need to be checked during the inspection process. Referring to the factory drawings inside the rack, tighten the screws of the relevant circuits with a screwdriver (turn the screws clockwise to secure them). In other cases, only the power distribution circuits such as miniature circuit breakers and terminal blocks need to be tightened with a screwdriver (turn the screws clockwise to secure them. A flathead screwdriver should be used to tighten the terminal block screws). After the system inspection is completed, check the voltage of the relevant circuits to confirm that the voltage of each circuit conforms to the schematic diagram.

(2) Cable maintenance

- The cable entry and exit points should be properly sealed, and there should be no holes with a diameter greater than 10mm. Otherwise, fireproof sealant should be used to seal them.

-In areas where the cable exerts excessive pressure or tension on the equipment casing, the cable's support points should be intact.

- The cable protection steel pipe should not have perforations, cracks, or significant unevenness, and the inner wall should be smooth. The metal cable pipe should not have severe corrosion. There should be no burrs, hard objects, or garbage. If there are burrs, they should be filed smooth and then wrapped with the cable sheath and tied tightly.

- Accumulated materials and garbage in outdoor cable wells should be cleaned up in a timely manner. If the cable sheath is damaged, it should be repaired.

- When inspecting indoor cable trenches, take precautions to prevent damage to the cables. Ensure that the supports are grounded and that the trenches have good heat dissipation.

- The markers along the direct-buried cable route should be intact. There should be no excavation near the route. Ensure that there are no heavy objects, building materials, or temporary facilities piled up on the ground along the route, and no corrosive substances discharged. Ensure that the outdoor cable protection facilities are intact.

- Ensure that the covers of cable trenches or cable wells are intact. There should be no standing water or debris in the trench. Ensure that the supports in the trench are firm and free from rust or looseness. The outer sheath and armor of armored cables should not have severe rust.

- For multiple cables laid in parallel, the current distribution and the temperature of the cable sheath should be checked to prevent the cable connection points from burning out due to poor contact.

- Ensure the cable termination is properly grounded, the insulating bushing is intact, clean, and free of flashover discharge marks. Ensure the cable phase colors are clearly visible.

- Metal cable trays and their supports, as well as the metal cable conduits leading in or out, must be reliably grounded (PE) or connected to neutral (PEN). Grounding wires must be reliably connected between cable trays.

(3) Precautions

- For maintenance of AC distribution cabinets, the start and end times of power outages should be notified in advance, and all necessary tools should be prepared.

- After a power outage, the power should be checked to ensure that maintenance is performed in a state where the distribution cabinet is not energized.

- When operating the AC side circuit breaker, insulated boots and gloves should be worn, and a dedicated person should supervise the operation.

Distribution cabinet after maintenance, check whether any tools have been left inside the distribution cabinet.

- After the distribution cabinet is maintained, power is supplied step by step from the main switch downwards.

5.3.3 Grounding and lightning protection

(1) The connection between the battery grounding system and the building structure steel bars should be reliable.

(2) The connection between the battery bracket, container house, cable metal armor and roof metal grounding grid should be reliable, and the grounding resistance of the primary equipment should be less than 4Ω.

5.3.4 Hybrid inverter module

(1) Inverter operation condition

- Observe whether the inverter is firmly installed, and whether there is damage or deformation. Listen to the inverter for abnormal sounds.

- When the system is connected to the grid, check various variables.

- Check whether the inverter housing is heating normally, and use a thermal image to monitor the system heating.

(2) Inverter cleaning
- Check the humidity and dust in the environment around the inverter, and clean the inverter if necessary.

(3) Electrical connection
- Check whether the system cable connection is loose and the inverter wiring terminals are loose, and then tightening them according to the method specified in user manual.
- Check the cable for damage, especially if there are cuts on the skin that contact the metal surface.
(4) Safety functions
- Check the inverter LEDs and system shutdown function. Simulate the shutdown and check the shutdown signal communication.

- Check the warning label and replace it if necessary.

5.3.5 Battery Pack

(1) The main circuit and secondary circuit of the battery pack should be reliably connected and there should be no rust, dust accumulation or other phenomena.

(2) The battery module should have a normal appearance and there should be no deformation, leakage or other phenomena.

(3) The insulation and grounding resistance of the energy storage battery should be normal.

(4) The smoke and temperature detectors inside the battery cabinet or container should be working properly.

(5) Regularly check the working status of the fan to prevent debris from blocking the air outlet and air inlet. The fan inside the battery pack should rotate smoothly without jamming or making abnormal noise when it reaches the preset temperature. If any fan stops running, it should be repaired or replaced in time.

(6) The surface of the front panel vent is kept clean, the screws are fixed, the power supply harness is in a normal connection state and there is no loosening.

5.3.6 High-voltage box

(1) The electrical connections of the battery management system should be intact and free from rust, dust, etc.

(2) The battery management system should function normally, and the temperature, voltage and other parameters should be tested normally.

(3) The communication function of the battery management system should be normal, and the upper-level equipment should be able to read the data normally.

(4) When key components of the battery management system are replaced or the software is upgraded and restarted, functional tests and protection tests of the battery management system are required.

5.3.7 UPS

(1) Check the input and output cable terminals once, and carefully check whether the contact is good.

(2) Check the working status of the exhaust fan to prevent the air outlet from being blocked by debris. If it is damaged, it should be replaced.

(3) Check the battery pack voltage to ensure that the battery voltage is normal.

(4) Check the system's working status to ensure that faults are detected in a timely manner.

5.3.8 Air conditioner

(1) Visual inspection

- Check if the air conditioner is damaged or deformed, and listen for any abnormal noises when it is running.

- Check if the air conditioner casing is heating up normally, and use a thermal imaging camera or other monitoring system to check the heating status.

- Observe whether the air intake and exhaust are normal.

- Check the humidity and dust levels around the air conditioner, and ensure all air inlet filters are functioning properly.

(2) Electrical related inspections

Inspect all connector contacts and tighten them. Check the equipment's protective grounding. Check the equipment's insulation. A detailed maintenance checklist is provided below:

Routine maintenance

No.	Check items	Check methods	Troubleshooting Solution
1	Power line firm	1. Turn off the power supply to the air conditioner. 2. Pull the power cord by hand to check if it is loose. 3. Use a screwdriver to loosen the screws on the power cord terminals and check for any looseness.	If you find any power cords loose or detached, you should tighten them again with cable ties and use a screwdriver to tighten any loose screws.

2	Voltage stability	Use a multimeter to measure the air conditioner's input voltage and observe whether the voltage is within the normal range.	the voltage is outside the normal power supply range, please immediately turn off the power supply. Do not turn the air conditioner back on until the power supply stabilizes.
3	Secure mounting screws	Use a screwdriver to tighten the air conditioner's mounting screws and check if they are loose.	If there is any looseness, tighten the screws. If the screw is loosening, please tighten it.

5.4 Semi-annual inspection and maintenance

5.4.1 PCS module, DC-DC module, STS module

(1) Power circuit connection

Check for loose power cable connections and tighten them to the specified torque. Inspect power and control cables for damage, especially for cuts on the sheaths that come into contact with metal surfaces. Check for any loose insulation tape on the power cable terminals.

(2) Terminal and ribbon cable connection

- Check if the control terminal screws are loose and tighten them with a screwdriver. (Training provided by the manufacturer)

- Check the main circuit terminals for poor contact and for signs of overheating at the screw locations. Inspect the copper busbars or screws for any discoloration.

- Visually inspect the connections and cable distribution of equipment terminals, etc.

(3) Precautions

Disconnect all external connections to the module , as well as the connection to the internal power supply of the device.

- Ensure the module is not accidentally powered on again.

- The PCS module, DC-DC module, and STS module contain internal energy storage capacitors. After powering off, you must wait at least 30 minutes and use a multimeter to ensure that the module is completely de-energized.

- Implement necessary grounding connections and circuit breaks.

- Insulate and cover any potentially live parts near the operating area with insulating fabric.

- To prevent damage caused by dust intrusion and moisture penetration, perform maintenance work in a dry and dust-free environment.

5.4.2 EMS

(1) Software and data inspection:

- Check the EMS platform's operating status. There are no abnormalities such as lag or crashes, and all functional modules (monitoring, control, alarm, and reports) can be accessed normally.

- Verify the integrity of real-time data. Ensuring that key parameters such as battery SOC/SOH, charge/discharge power, voltage, current, and temperature are accurately collected and consistent with the display on the field equipment.

- Upon checking the historical data storage, the database showed no loss or errors, backup tasks were executed as planned, and data could be exported and queried normally.

- The alarm system is confirmed to be effective, the alarm thresholds are set reasonably, and alarms can be triggered in a timely manner by sound, light, and SMS notifications when anomalies occur. The alarm log is complete.

(2) Communication link inspection

- Check the communication status between EMS and energy storage battery clusters, PCS, fire protection, air conditioning, electricity meters and other equipment. There are no interruptions or packet loss, and the communication delay is within the allowable range.

- Verify that the network devices (switches, routers, gateways) are functioning normally, the port connections are secure, the indicator lights are in compliance with standards, and there is no abnormal overheating.

- Check that the wireless/wired communication module (such as 4G/5G, Ethernet) signal is stable, the SIM card/network cable interface is not loose, and the communication protocol (Modbus, IEC 61850, etc.) is operating normally.

(3) Hardware equipment inspection

- The EMS server, monitoring host, and other hardware were inspected and found to be undamaged, with indicator lights functioning normally and no abnormal noise or overheating. The server power supply, hard drive, and memory were also checked and no fault indications were found.

(4) Control and strategy inspection

- Verify the execution of control strategies. Preset strategies such as peak shaving and valley filling, backflow prevention, and demand control are operating normally as configured, without deviation.

- Check the effectiveness of the remote control function. Commands such as charging/discharging start/stop and power adjustment issued by EMS can be executed accurately and the equipment responds promptly.

- Verify that the access control is compliant, that the operation permissions of different operation and maintenance roles are clearly defined, that there are no records of unauthorized access, and that the operation logs are complete and traceable.

5.4.3 Fire protection system

(1) Check whether the smoke detector is working properly.

(2) Check whether the temperature detector is working properly.

(3) Check the appearance of the gas detector for deformation, rust, aging, etc.

(4) Check whether the gas detector is securely installed.

(5) Check the appearance of the fire alarm device for deformation, rust, aging, etc.

(6) Check whether the fire alarm is securely installed.

(7) Check whether the electric louvers and explosion-proof fans are deformed, rusted, aged, etc.

(8) Check whether the electric louvers and explosion-proof fans are securely installed.

⚠ DANGER

- Inspecting, testing, maintaining, troubleshooting, or replacing equipment, ensure that the wiring of the aerosol fire extinguishing device is disconnected to prevent accidental aerosol spraying.
- After the operation is completed, the wiring of the aerosol fire extinguishing device should be restored in a timely manner.

5.5 Annual inspection and maintenance

5.5.1 Fire protection system

(1) Check whether the aerosol fire extinguishing device is damaged.

(2) Check whether the aerosol fire extinguishing device has expired.

(3) Check whether the fixed bracket of the aerosol fire extinguishing device is loose.

(4) Inspect the structure of the battery compartment protected by the aerosol fire extinguishing system and eliminate any adverse effects that may cause changes in the fire extinguishing volume.

(5) Use a smoke temperature gun to test the function of the detection component. If the red light is constantly on, replace the smoke detector.

(6) Use a smoke gun to test the function of the detection component. If the red light is constantly on, replace the temperature detector.

(7) Testing is conducted using calibration gas. When a level one alarm for combustible gas is triggered, the explosion-proof ventilation system is activated.

(8) If the sound and light alarm does not participate in the system linkage and emits sound and light alarms during the linkage test, check the circuit and replace it with a new sound and light alarm.

(9) Linkage test or manual start-up: turn on the louvered fan and the exhaust fan. If it does not start normally, check the fan start-up line and power line. If there is no line problem, replace the exhaust fan.

6 Appendix

6.1 Simplified Handling Methods for Alarm Messages from Air Conditioners

No.	Alarm information	Cause of the fault	Processing method
1	Return air temperature sensor malfunction	Return air temperature sensor short circuit or open circuit	1. Use a multimeter to check if the return air temperature sensor has an open circuit or short circuit.
2	Condensing coil temperature sensor malfunction	Condensation temperature sensor short circuit or open circuit	1. Use a multimeter to check if the condenser temperature sensor has an open circuit or short circuit.
3	Humidity sensor malfunction	Condensation temperature sensor short circuit or open circuit	1. Use a multimeter to check if the humidity sensor has an open circuit or short circuit.
4	High temperature alarm inside cabinet	The temperature inside the rack is higher than the set value.	1. Check if the high temperature alarm points are set reasonably. 2. Open the rack door to allow for ventilation until the alarm is cleared.
5	Low temperature alarm inside cabinet	The temperature inside the rack is lower than the set value.	1. Check if the low-temperature alarm point is set correctly. 2. Check if the heater is working properly.
6	External input alarm	External input function alarm	1. Check if the access control and smoke alarm wiring is correct.

7	Evaporator coil temperature sensor malfunction	Evaporation temperature sensor short circuit or open circuit	1. Use a multimeter to check if the evaporation temperature sensor has an open circuit or short circuit.
8	High humidity alarm	The humidity inside the server rack is higher than the set value.	1. Check if the cable entry and exit holes of the cabinet are sealed.
9	Evaporator freeze alarm	Evaporation temperature sensor short circuit or open circuit	1. Check if the air inlet and outlet on the evaporator side are blocked. 2. Check if the evaporator fan is operating normally.
10	High temperature condensation alarm	The condenser outlet temperature is higher than the set value.	1. Check if the air inlet and outlet on the condenser side are obstructed. 2. Check if the condenser fan is operating normally.

6.2 Other air conditioner malfunctions analysis and handling methods:

No.	Fault status	Cause Analysis	Troubleshooting methods
1	After the power is turned on, the temperature inside the cabinet is too high, but the air conditioner does not work.	1. Power outage or no power supply. 2. Set temperature is higher than the internal temperature of the cabinet. 3. System malfunction.	1. Check the power supply and circuit. 2. Set the compressor start temperature as needed. 3. Please contact a professional repair technician.
2	The equipment is operating normally, but the cooling effect is not ideal.	1. The cooling capacity of this model is not matched with the load. 2. The ambient temperature is too high. 3. Other system failures	1. Add refrigeration equipment according to the load size. 2. Please ensure that the machine's operating temperature is within the normal operating range. 3. Please contact a professional repair technician.
3	The device suddenly stopped cooling during normal operation, even though there were no faults in the electrical system.	1. The cabinet temperature has reached the set temperature 2. Other system malfunctions.	1. Set the compressor start-up temperature as needed. 2. Please contact a professional repair technician.