



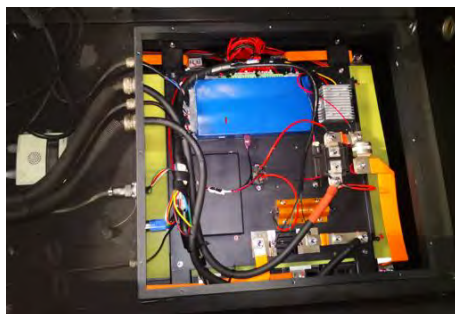
LITHIUM BATTERY STRUCTURE, MAINTENANCE & FAULT FINDING MANUAL

Based on ZIBO LI-ION, EIKTO and HOUJU lithium battery

valid for the above lithium batteries

Date of issue: November 2025

ZIBO LI-ION BATTERY



EIKTO LITHIUM BATTERY



HOUJU LITHIUM BATTERY



INTRODUCTION

This manual is intended to provide an understanding of the key working principles of a lithium battery, by means of presenting the structure layout, key components and charging operation. In addition the purpose of a more informed understanding is expected to promote the correct and proper use, maintenance and repair management of a lithium battery. The correct handling and operation of a lithium battery will ensure that the designed performance and service life is achieved.

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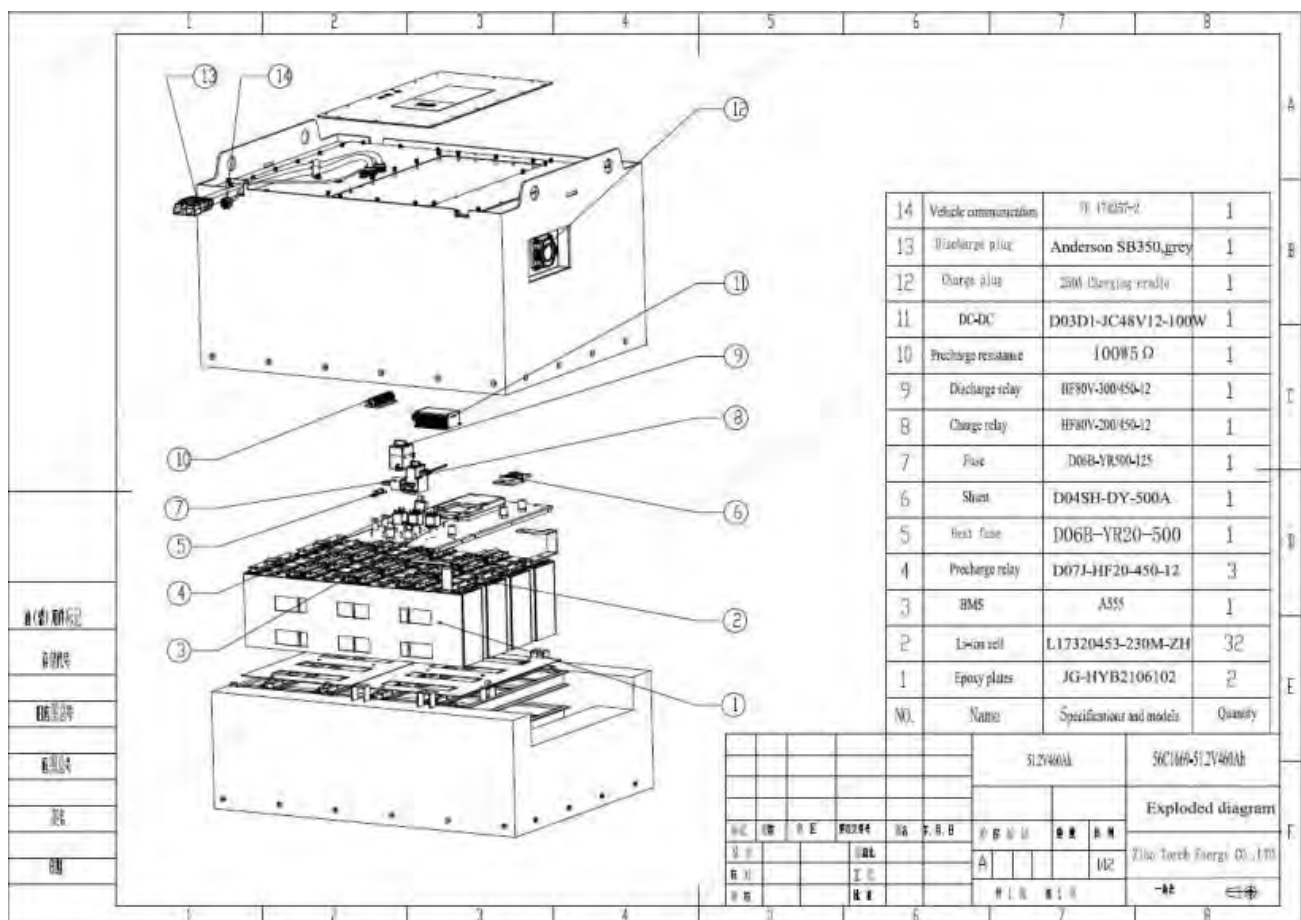
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1 Lithium battery structure

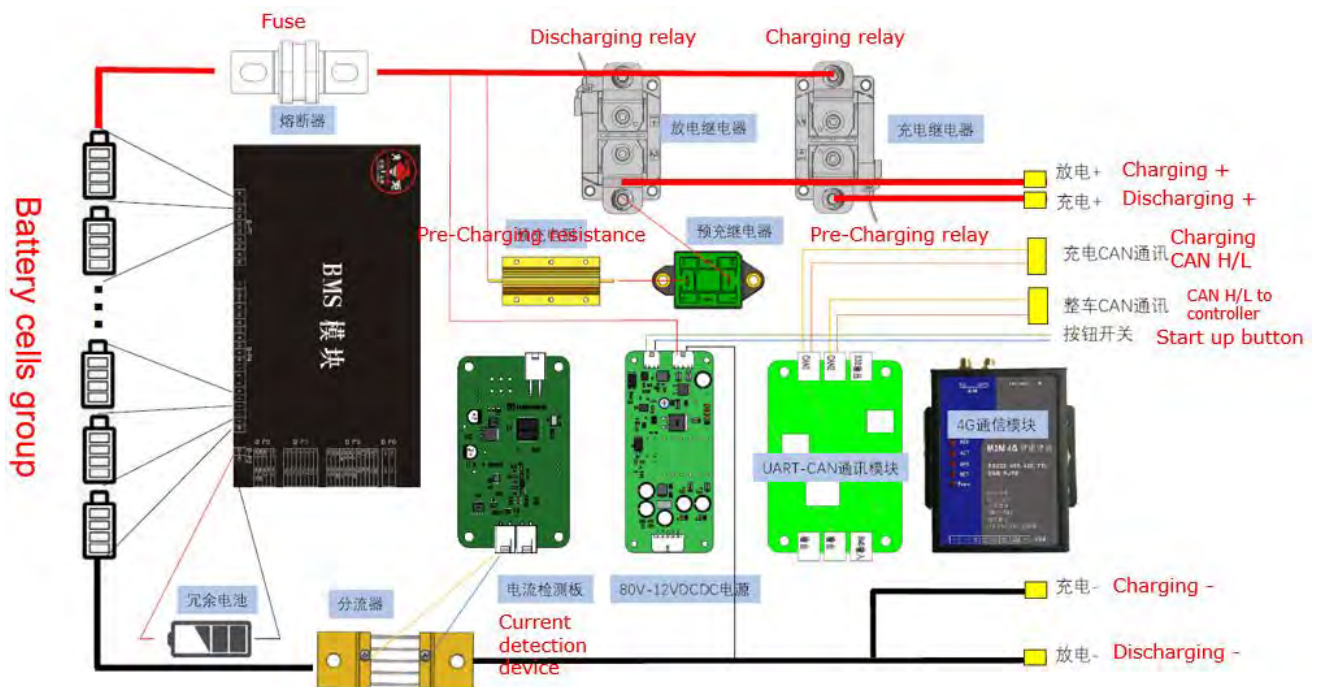
1.1 Structure overview

The lithium battery consist of the following components:

1. Epoxy plates
2. Li-ion cell
3. BMS (Battery management system)
4. Pre-charge relay
5. Heat fuse
6. Shunt
7. Main fuse
8. Charge relay
9. Discharge relay
10. Pre-charge resistor
11. DC/DC convertor
12. Charge plug
13. Discharge plug
14. Communication unit

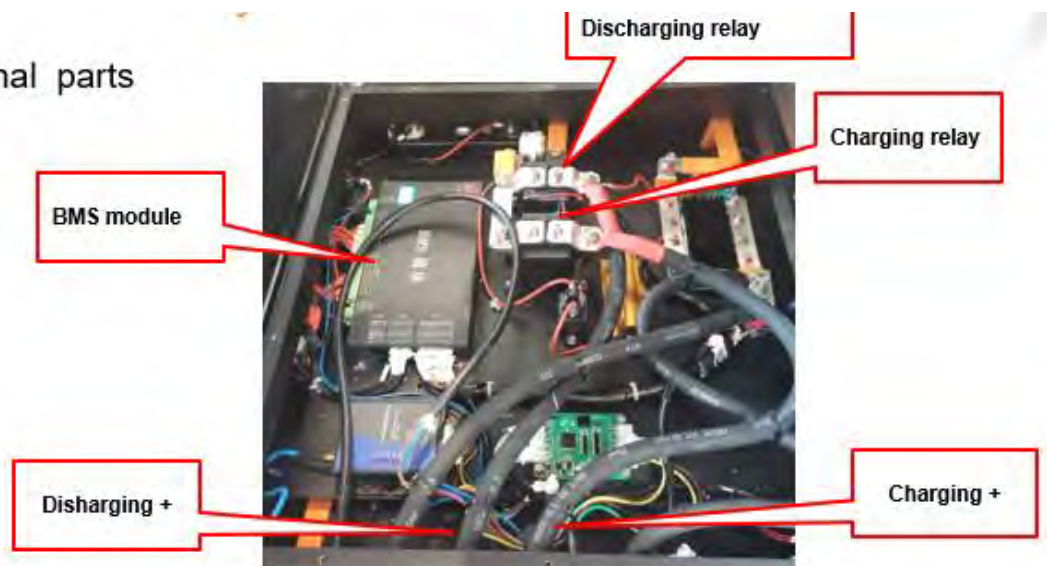


1.2 Main component layout



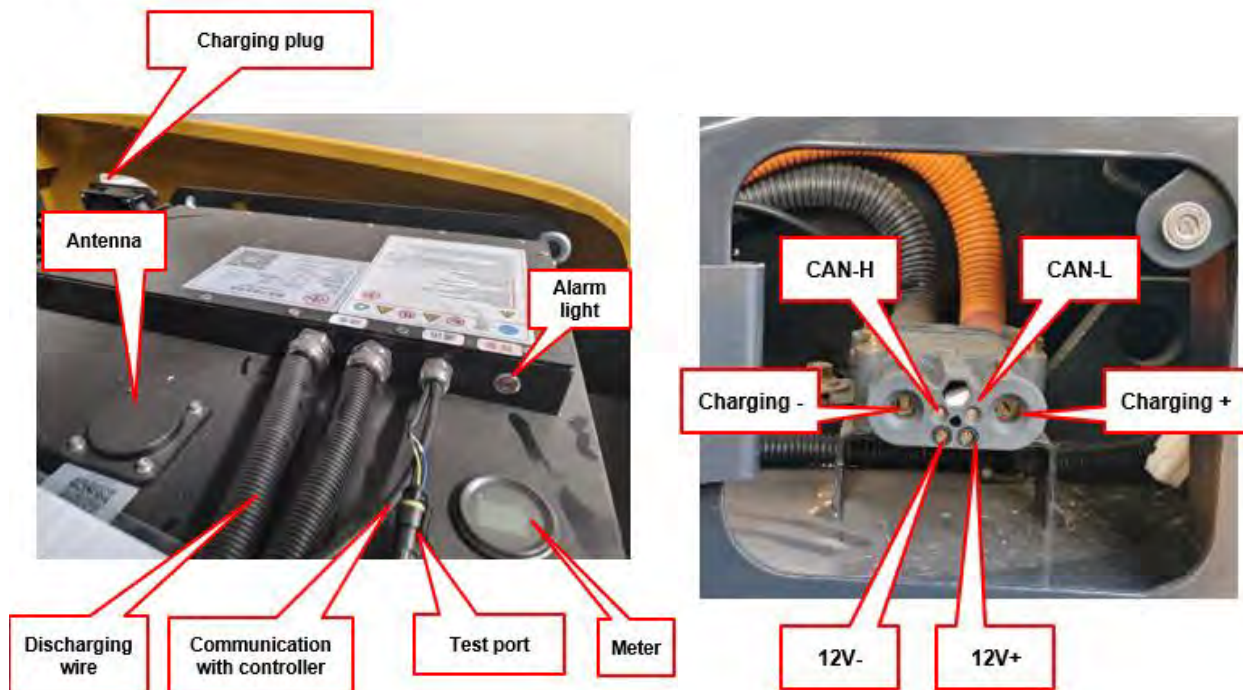
Note: The above principle layout is found in all lithium batteries from 24v to 308v systems.

Internal parts



Battery cells group

External parts



2 Working principles

2.1 Active state

The lithium battery is switched **ON** by engaging the **Main power switch** to the uppermost position.



The emergency button (main power switch) via the DC-DC convertor supplies 12v to wake the BMS, that in turn energises the discharge relay (output relay) allowing the presence of battery voltage at the output plug.

2.2 None active state

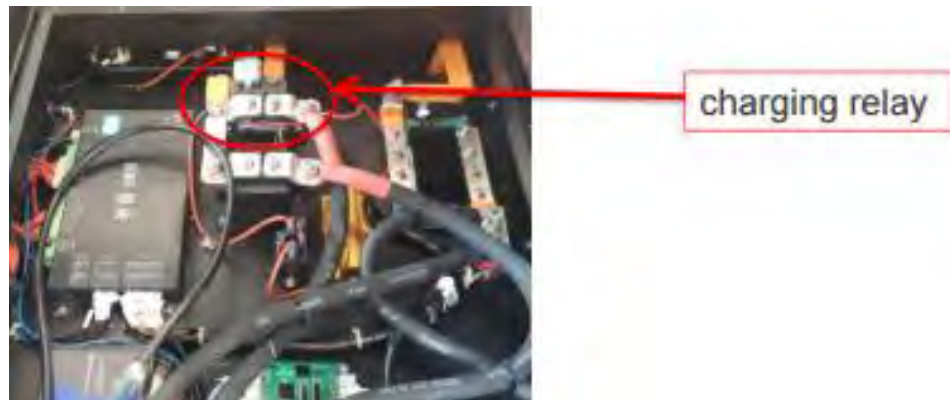
When the emergency button is depressed, switching is broken (open circuit) at the DC-DC convertor and 12v power is disconnected to BMS unit, that disconnects the energising 12v to the discharge relay, high current connection between battery cells and output plug is shut off.

Note: If the battery is left **ON** without shutting off at the emergency switch, the BMS will automatically enter the sleep mode, effectively switching **OFF** the battery.

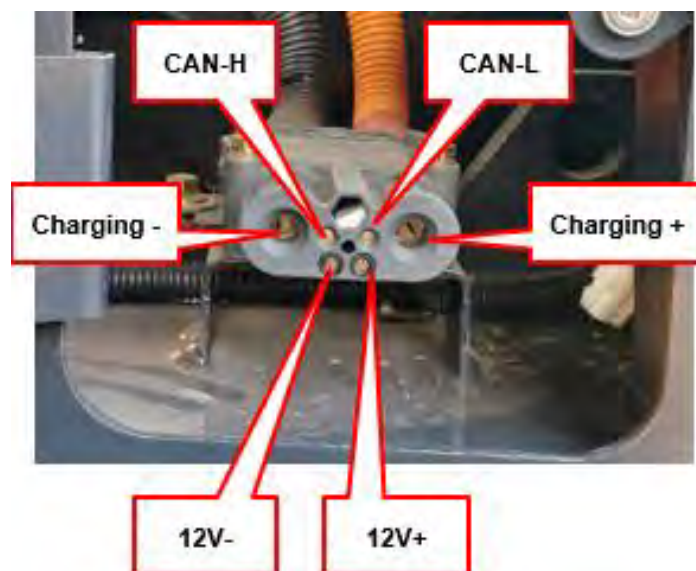
For various lithium battery models, the length of time for this sleep mode activation can be from 20 minutes to 2 hours depending on the particular brand and model of lithium battery.

2.3 Charging state

When the charging plug is connected and the charger is turned **ON** the charger supplies a 12v input to energise the charging relay coil.



The charging relay now closes and provides a connection for the positive charging current to charge the battery cells.



The **CAN** connection between the charger and the BMS provided via the charging plugs auxiliary pins, allows the BMS to communicate with the control unit of the charger to manage the charging process of the battery cells.

Once the SOC (state of charge) has reached 100% the charger will automatically terminate the charging process.

Note: During the charging process DO NOT unplug the charger socket if charging has not yet reached 100% SOC and the charger has not stopped working, depress and hold the RED stop button on the charger to introduce the charging SHUTDOWN function. Only when the charging current has reached 0% as indicated on the charger display, then the charging plug can be removed from the battery.

Perform a full 100% SOC cycle once every week to maintain healthy cell balance, (the charger performs cell balancing from a 95% SOC until complete stop at 100% SOC).

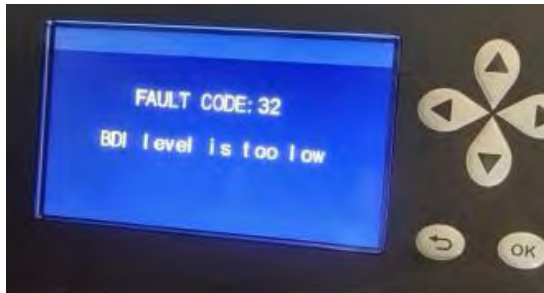
3 Operation precautions

3.1 Precautions when using lithium battery

1. Before use check the SOC (battery state of charge), if greater than 50% the battery is good to operate, if less than 25% the capacity is low and should be charged to at least above 50%.



2. Be sure of the working environment temperature when in use, the operating temperature of the battery is between (-20 degrees C & 50 degrees C) and optimal charging and discharging temperature is (25 degrees C & 55 degrees C).
3. When the battery SOC is depleted to an over-discharged state (**10%**) the battery low power alarm sounds and normal charging will not be possible.



4. To prevent this over-discharged condition, charging should be performed at 20% SOC.
Note: If the battery enters an overdischarged state due to not being charged in time, the BMS protection circuit will not allow normal charging to commence. (Be aware that continued over-discharged conditions will reduce battery cell carrying capacity, shorten service life and can lead to irreversible damage to the battery system).
5. When the forklift is parked, turn **OFF** the forklift key switch (key lock) as well as the battery emergency button (button **depressed** position).



6. If the above measures for switching **OFF** were not performed and the forklift is left parked for an extended period of time, the BMS will after a pre-set period of time, automatically introduce the sleep mode. To restart the battery from this sleep state, the emergency stop button will need to be depressed (**OFF** position) for about 5 seconds, and thereafter switched **ON** (pulled up) position, the key switch turned **ON** and the forklift will start normally.

3.2 Precautions for lithium battery charging

1. Before charging the battery, observe that the key switch (key lock) is in the **OFF** position.
2. When handling the charging cable and plug socket, ensure that no moisture is present.
3. Under no conditions should the charging plug, cables, power line and communication harness be pulled, twisted or handled in a manner that may cause damaged.

Note: (The charger plug has a handle for connecting and removal of the charging cable).



4. Ensure that the charger male to female sockets/plugs fully mates for a proper connection.
5. While charging is in progress, it is prohibited to remove the charging socket/plug from the battery.

Note: Repeat of the above action, will eventually cause damage to the charger and failure.

3.3 Precautions for storage of lithium battery

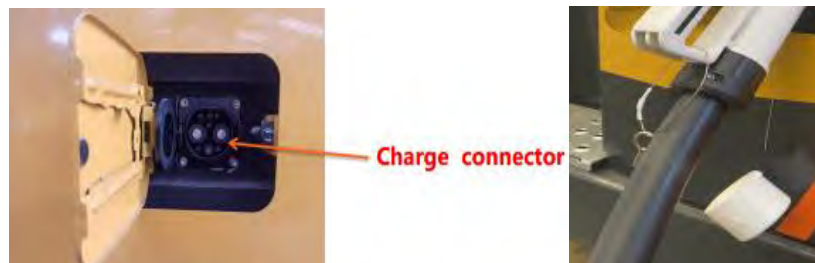
1. If the forklift is not in use (more than a day) turn **OFF** the key switch and battery emergency button pressed to the **OFF** position.
2. When not in use for more than a month, maintain 40-60% SOC and the preferred temperature in storage should be between -10 & 40 degrees C.
3. If the battery is stored for more than 3months, maintain a SOC of 40-60% and if stored for more than 6months repeat the maintenance of 40-60% SOC every 3months.

Note: (Ensure that storage environment is clean, ventilated, cool, dry, avoid direct sunlight, high temperature, corrosive gas, soaking rain, violent vibrations, mechanical impact and high pressure).

4 Maintenance

4.1 Routine inspection

1. Inspect discharge/output connector (battery plug) for any physical or heat damage.
2. Inspect the charge connector, handle, dust cover and charge port flap for damage.



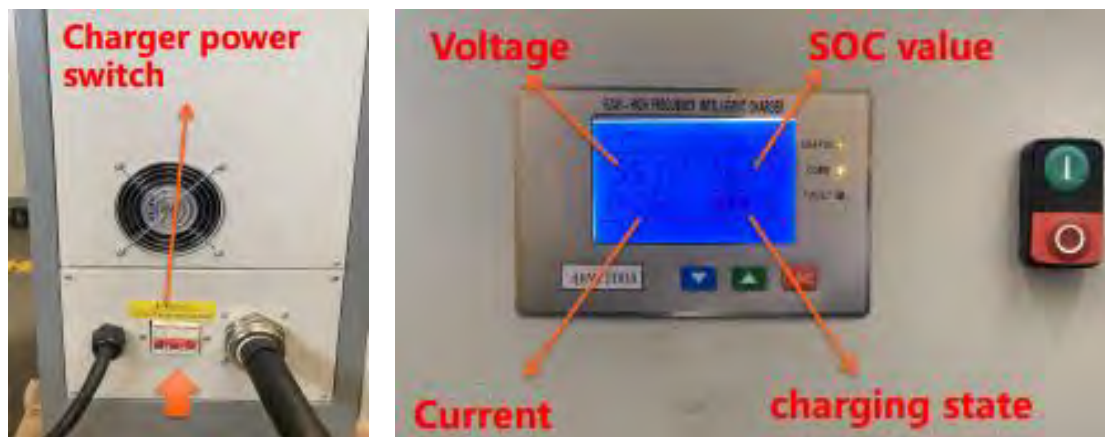
3. Inspect that the emergency button is firmly secured and all securing screws are in place.
4. Inspect the battery display is operating and displaying hour meter SOC information.
5. Regularly check that all battery case bolts and cover screws are in place and for tightness.
6. Ensure that the battery case cables and plugs are kept clean and free of dust and grime etc.

4.2 Performance maintenance

1. Regularly measure output voltage at forklift main contactor and compare voltage reading with battery displayed voltage.
2. Connect the charger cable to the charging socket of the battery and inspect fitment and proper docking of male to female connectors.



3. After connecting the charger, switch **ON** charger power switch and observe charger display information, and check that the communication LED on the charger is lit to indicate **CAN** line is active.



4. For normal charging the charger display becomes active with information displayed for voltage, SOC, current and charging state, charging commences and observed as below.



5 Trouble shooting and handling methods

5.1 Fault codes – applicable for the ZIBO Li-Ion battery

Fault codes	Fault code explanation
1	Cell overvoltage
2	Cell undervoltage
3	Battery group voltage overvoltage
4	Battery group voltage undervoltage
5	Battery Cells voltage imbalance
6	Discharge overcurrent
7	Charging overcurrent
8	Temperature is too high
9	Temperature is too low
10	Temperature difference is too large
11	SOC is too low
12	BMS self-check hardware failure
13	Voltage cable fell off
14	The temperature sensor cable fell off
15	Relay sticking failure
16	Precharge failed



5.2 Common faults

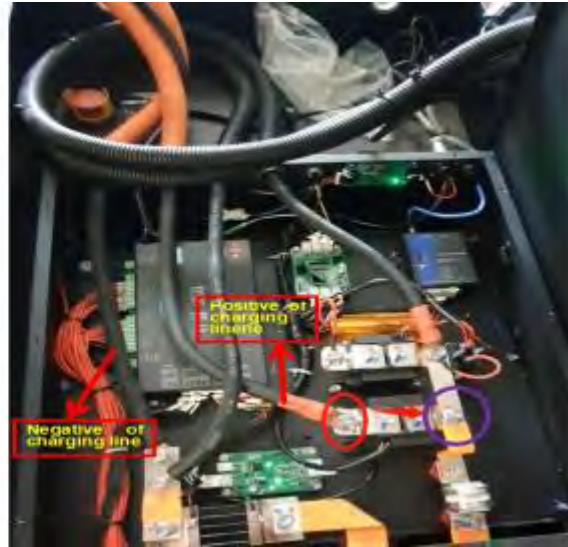
1. Battery cannot be charged or discharged
 - 1.1 The forklift cannot operate, the alarm sounds, the instrument panel is lit, charger does not operate but displays voltage.
 - 1.2 Charging relay fault.
 - 1.3 Replace with new relay.



charging relay

2. Battery does not turn on and cannot be charged

- 2.1 Battery over-discharged and BMS has activated over-discharge protection.
- 2.2 Force charging is required to restore over discharged battery cells.
- 2.3 Remove battery cover and identify charging relay and remove charging cable (circled red) and move the charging cable to the input power side (circled purple) of the charge relay as below. **Note: measure battery voltage at output cell cable to confirm low SOC.**



- 2.4 Connect the charging socket/plug to the battery charging input plug.
- 2.5 After the charger has been connected, depress the function key on the charger and hold while turning **ON** the charger power switch, the charger will run the start-up process. **Note: Hold the function key for the entire start-up period, the process is usually around 30seconds. Observe the display till the charging current has increase to 10-20amps on the display, and the function key can be released.**



- 2.6 During force charging the current is limited to **25%** of the particular charger rating, for example 100amp charger will be limited to 25amps.
- 2.7 Allow force charging for 10minutes and observe voltage recovery, ideal recover is 48v to enable normal charging.
- 2.8 When voltage is above 48v for 48v system and 80v for 80v system, restore the charging cable at the charging relay to the original position, connect and start charger as normal.
- 2.9 Observe that normal charging has restored and allow the charging cycle to run the full duration to 100% SOC.

Note: If normal charging does not restore, repeat the force charging procedure for a 2nd 10 minutes. (If voltage has recovered to 48volts and no other fault is present, normal charging should restore).

Common faults continued

Fault	fault conditions	Fault cause	Troubleshooting	notes
Unable to charge or discharge	1. The forklift cannot move, the buzzer alarms, the instrument panel lights up, the battery cannot be charged, the charger has voltage but no current	1. Charging relay adhesion	1. Replace the charging relay	
	2. Third level fault alarm, instrument display fault code, buzzer sound, and vehicle malfunction, except for low battery level	1. Level 3 fault alarm	1. Check relevant components and parameter settings based on fault codes	If the battery level is too low, the fault code is 11AL
	3. The forklift cannot move, the instrument panel does not light up, and cannot be charged	1. Switch failure or switch related circuit disconnection 2. Fuse broken 3. DCDC broken 4. BMS broken 5. Battery over discharge or prolonged storage resulting in low voltage	1. Replace the switch or repair the relevant circuit 2. Replace the fuse and check other components 3. Replace DCDC 4. Replace BMS 5. Fully charge	1. If the fuse is damaged and the relay is stuck, the vehicle needs to be checked for a short circuit
	4. The forklift cannot move and the instrument panel does not light up; When charging, the instrument display is normal but unable to charge. The charger display should be connected to the battery	1. Fuse broken	1. Replace the fuse	

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Fault	fault conditions	Fault cause	Troubleshooting	notes
2. Unable to charge, can discharge	1. The forklift can operate normally, the buzzer and instrument panel are on without alarm, the battery cannot be charged, and the charger shows that please connect the battery	1. The charging plug-in is not properly plugged in 2. The charging relay is stuck and cannot be closed 3. Poor contact of the charging relay supply line	1. Connect and plug in the correct way 2. Replace relay 3. Check if the power supply line is loose and if the line is disconnected	
	1. The forklift can operate normally, the buzzer and instrument panel are on without alarm, the battery cannot be charged, and the charger displays EB3	1. The CAN communication points of the charger output plug-in and the battery charging plug-in do not correspond 2. The CAN line of the battery charging plug-in or the CAN line of the charger is out of stitches or broken	1. Replace the battery or charger CAN communication point so that the point can match 2. Reinstall the CAN cable or charger CAN cable inside the charging plug-in	
	1. When the battery instrument switch is turned off, the forklift can still operate, the buzzer alarms, the instrument lights up, the battery cannot be charged, and the charger shows that please connect the battery	1. Discharge relay adhesion 2. Loose relay harness	1. Replace the discharge relay 2. Tighten the wiring harness	

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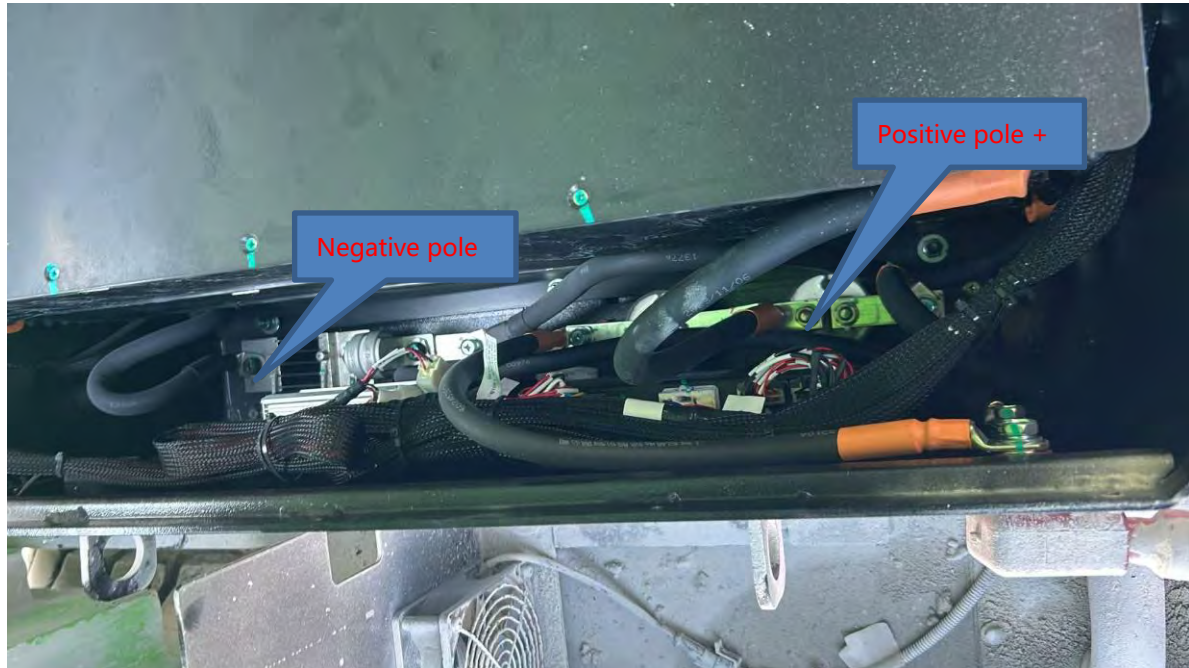
Fault	fault conditions	Fault cause	Troubleshooting	notes
3. Can be charged but cannot be discharged	1. Unable to discharge, the battery can be charged, and the instrument panel lights up when charging;	1. DCDC damage	1. Replace DCDC	
4. Short charging time, short discharge time	1. When charging, the battery quickly fills up, but when discharging, the battery drops quickly	1. Poor module battery cell 2. Poor BMS wiring harness 3. BMS parameter setting error	1. Replace the module 2. Replace BMS wiring harness 3. Change parameter settings or update programs	Short charging time, short discharge time
5. Low charging current	1. When charging, the current value is much smaller than the BMS requested current, and the charger fault light is constantly on	1. Partial module failure of the charger 2. Poor connection of BMS harness	1. Replace the charger module or directly replace the charger 2. Tighten the wiring harness	
	2. When charging, the current of the charger is around 30A, and the battery gauge displays a 09AL fault code (low temperature)	No Fault	This phenomenon is normal. When the cell temperature is between 0 and 5 °C, the charging current is 30A. When the cell temperature rises, the charging current returns to normal and the fault code disappears	
6. When the battery level is greater than the alarm value (15%), a 02AL fault code appears	1. Battery level (SOC) greater than 15%: (e.g. 22%, 60%, etc.) Battery reported 02AL fault (single undervoltage)	1. BMS fault 2. Poor or loose BMS wiring harness 3. Incorrect cell voltage (long-term uncalibration)	1. Replace BMS 2. Replace the wiring harness or reinforce the wiring harness connector 3. Fully charged calibration	

Fault	fault conditions	Fault cause	Troubleshooting	notes
7. Intermittent power outage	1. The vehicle loses power during operation and can resume operation after a while, which occurs repeatedly.	1. Poor contact of relay power supply line 2. Poor relay 3. Excessive operating current of the vehicle causes overvoltage protection to cut off the relay	1. Check and reinforce the relay power supply line 2. Replace the relay 3. Repair the vehicle and adjust the BMS parameter settings appropriately	Poor BMS power supply; Excessive battery pressure difference can also cause the same fault

5.3 Force charging

Forced charging operation steps for EIKTO 80v lithium battery

Step 1 Open the maintenance cover of battery, find the positive pole + and negative pole - of the battery. Check voltage with multi-meter, For example 60V.



Step 2

Adjust the cable position. Remove the cable from position 1 to position 2, then fix the nuts

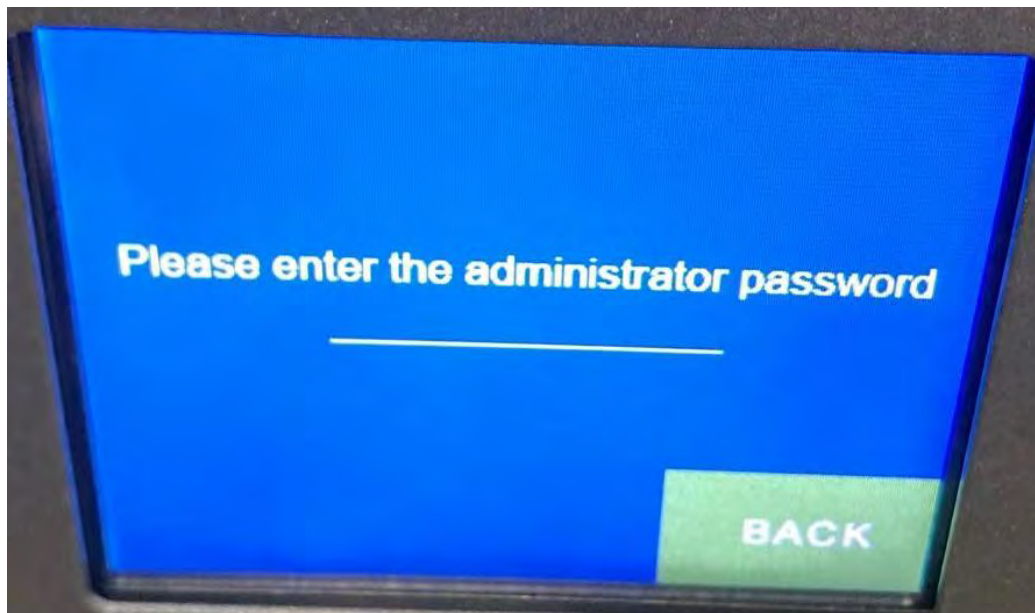




Step 3

Click up-left side of the charger screen, then find Debug mode setting, Input Password 228958.



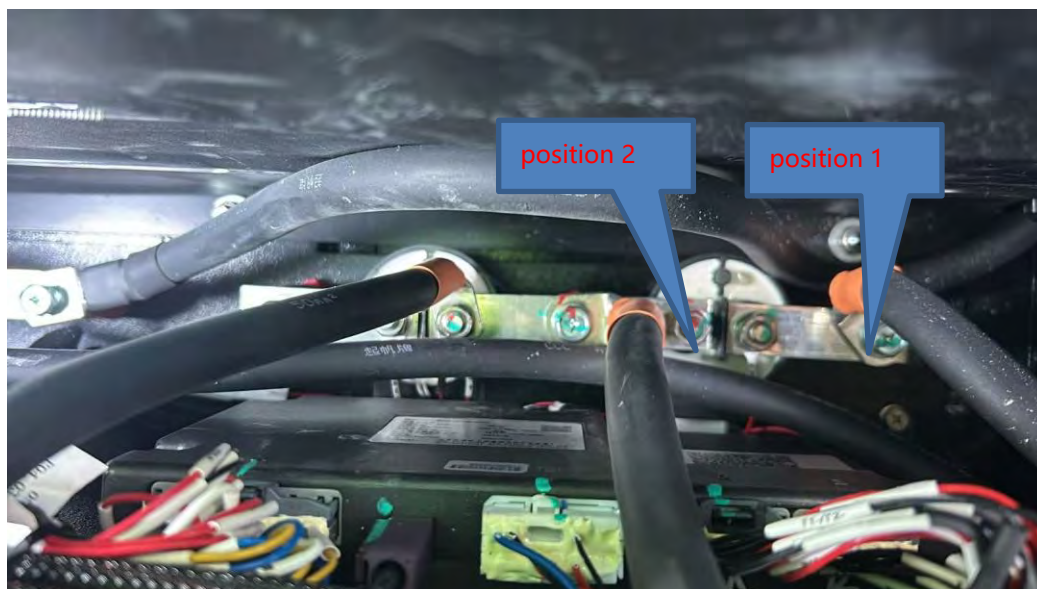
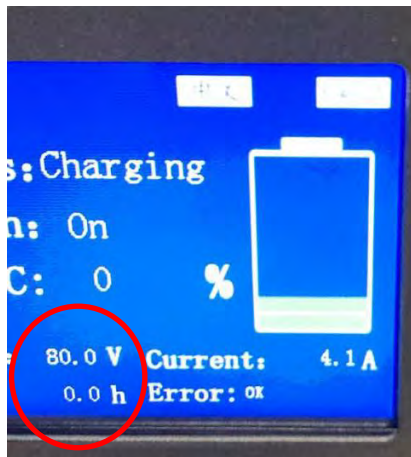


Then input voltage 80V, Current 5A, click the confirm button. the charger starts working.



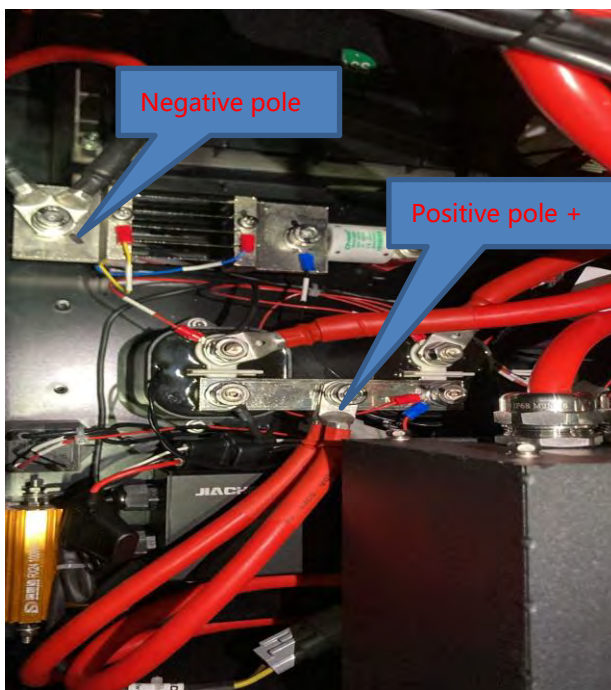
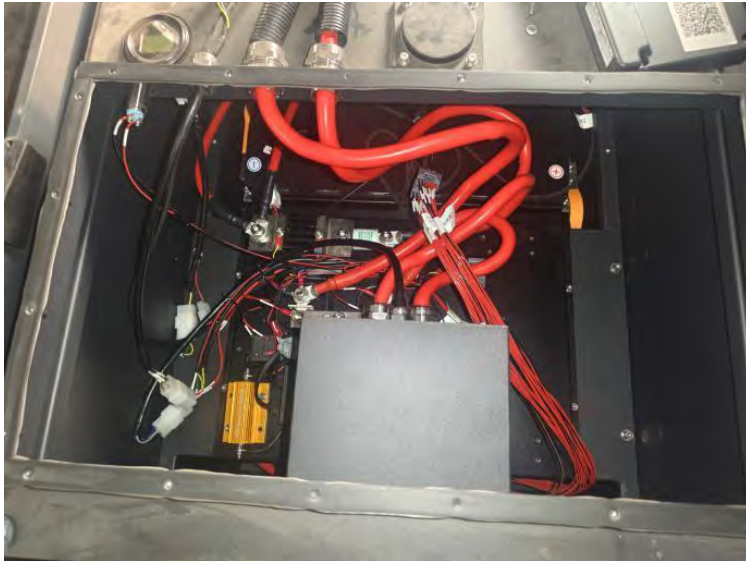
Step 4

Stop charging when the voltage is more than 80 V. Adjust the cable to its initial position. (from position 2 to position 1), Then start charging to 100% SOC.



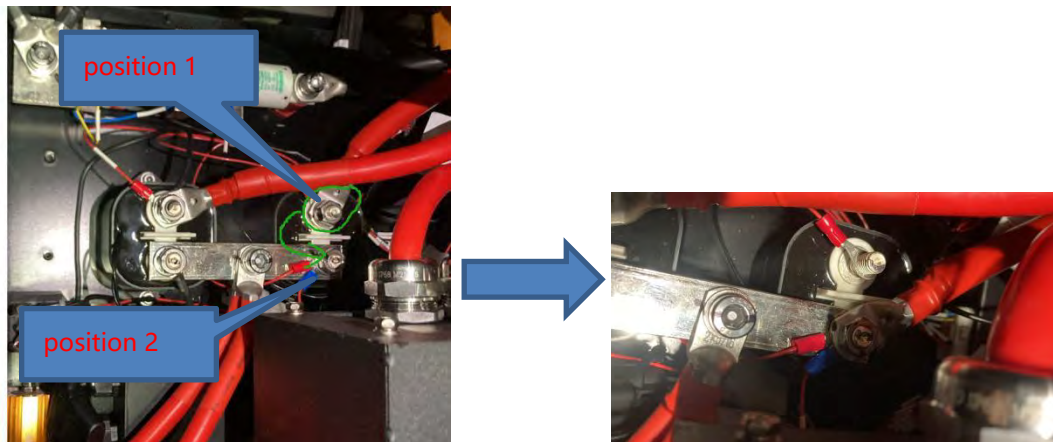
Forced charging operation steps for Houju Lithium battery

Step 1 Open the maintenance cover of battery, find the positive pole + and negative pole - of the battery. Check voltage with multi-meter, For example 60V.



Step 2

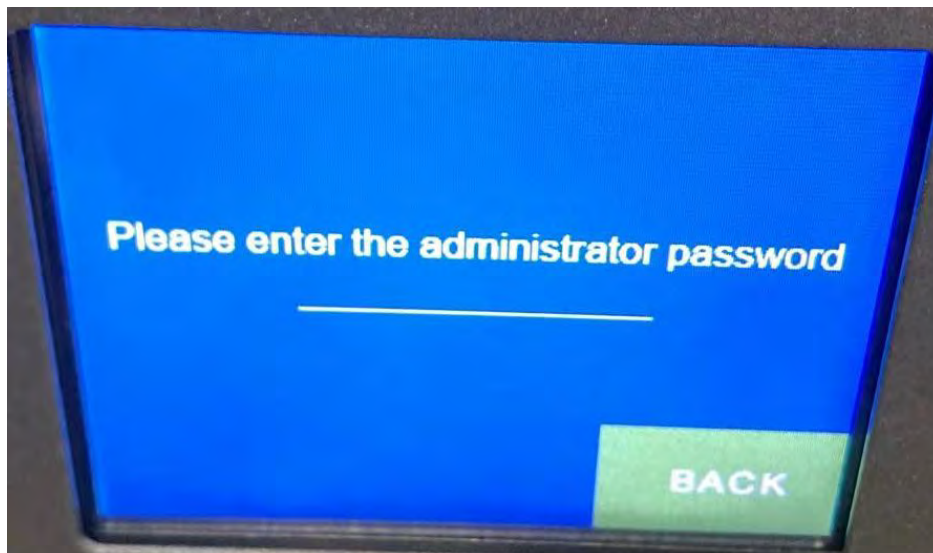
Adjust the cable position. Loosen 2 nuts and remove the cable from position 1 to position 2, then fix the nuts



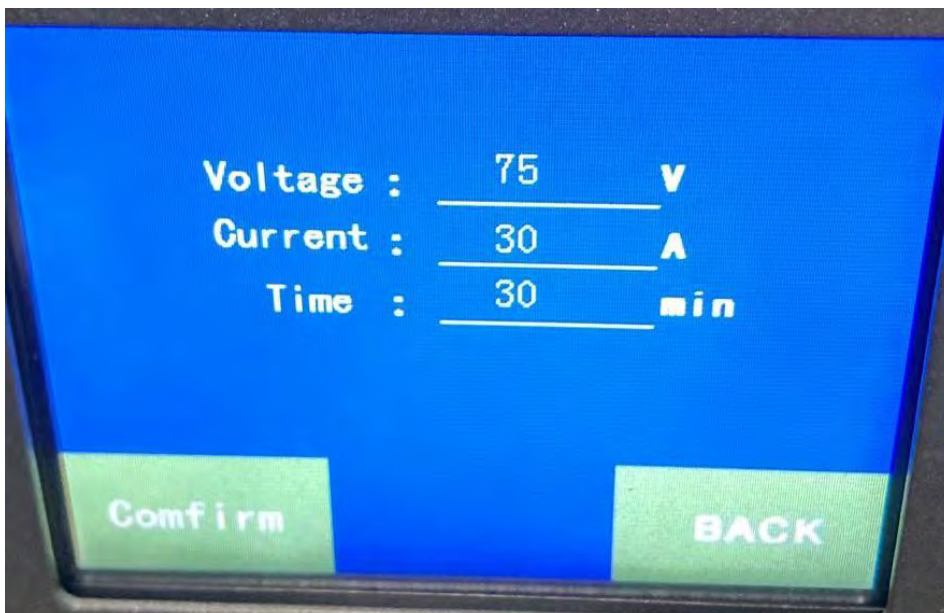
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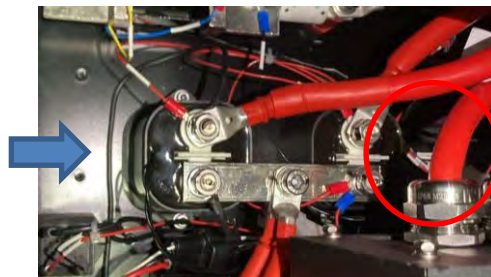
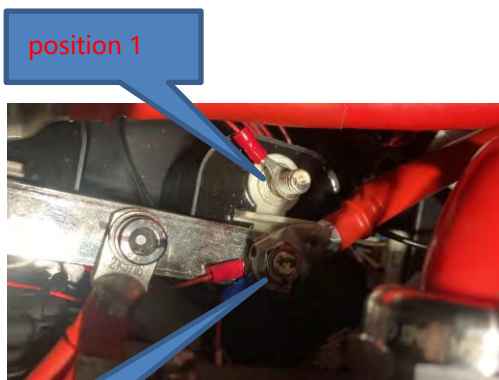
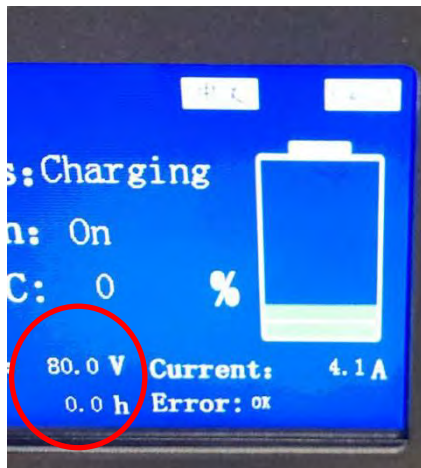


Then input voltage 80V, Current 5A, click the confirm button. the charger starts working.



Step 4

Stop charging when the voltage is more than 80 V. Adjust the wire to its initial position. (from position 2 to position 1), Then start charging to 100% SOC.



CAUTION NOTE:

When performing any work inside the battery, be extremely cautious for the possibility of short circuits.

Work carefully and use insulated electrical tools as far possible to prevent damage to internal battery hardware.

Be aware of costly damage, fire and personal injury that can be caused by incompetence and neglect to adhere to safe working conditions and cautions.

END