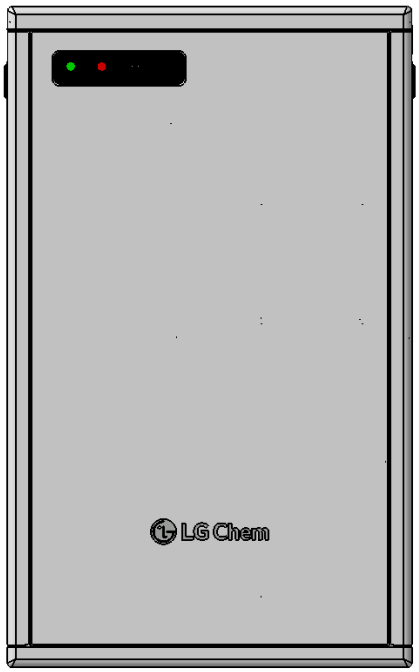
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LG Chem. RESU 6.4EX Battery Pack

Installation Manual (51.8 V)



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Revision History

Date	Revision No.	Prepared by	Remark
2015-02-14	V0.1	Injae Kang	Initiated
2015-02-25	V0.2	Hyeonkyu Kim	Pack design updated & Description modified
2015-02-26	V0.3	Miso Park	Troubleshooting part updated
2015-02-27	V0.4	Sungil Moon	System Overview BPU part updated

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1. Manual Information

This technical description is intended for the installer and aims to assist in correct and safe installation of the Battery Pack system. Information regarding the following subjects can be found in this document:

- Safety — see Section 3 “Safety Instructions”
- Installation — see Section 4 “Installation”
- Troubleshooting — see Section 5 “Troubleshooting”
- Technical Specifications — see Section “Technical data sheet”

1.1 Validity

This product may only be operated within the area of application described in this documentation. Do not use the battery pack for purposes other than those indicated in this description. Use of the battery pack for other purposes can void the warranty as well as damage the unit and the system.

2. LG Chem. RESU 6.4 EX Battery Pack

2.1 General Description

The RESU 6.4 EX Battery Pack comprises four CMA modules and a BPU, housed inside a pack manufactured by LG Chem. This system represents an energy storage device and is intended for operation with a grid connected PV system enabling power backup applications and continued power supply in the event of grid failure. The Battery Pack is suitable for use in combination with inverters.

Each module is made of interconnected Li Ion cells. The BPU is consist of BMS and circuit breaker. Before handling and installation, installers are responsible for familiarizing themselves with the safety precautions and all warnings (see Section 3).

2.2 System Overview

Don’t have defect like a disassembly, a change of color, a scratch, a leakage of liquid, a stain etc. because it may influence that economic value of battery pack.



Figure. 2.1 ISO View of RESU 6.4 EX

Table. 2.1 Nominal Specification

Specification	RESU 6.4 EX
Nominal Voltage / Capacity	51.8V / 126Ah
Configuration	14S4P
Nominal Discharge Current(A)	0.3C
Max. Voltage	58.1V (Range: 45.2V ~ 58.1V)
Dimension (mm) [Width x Height x Depth]	406 x 664 x165
Weight(kg)	60kg
BMS Communication	CAN

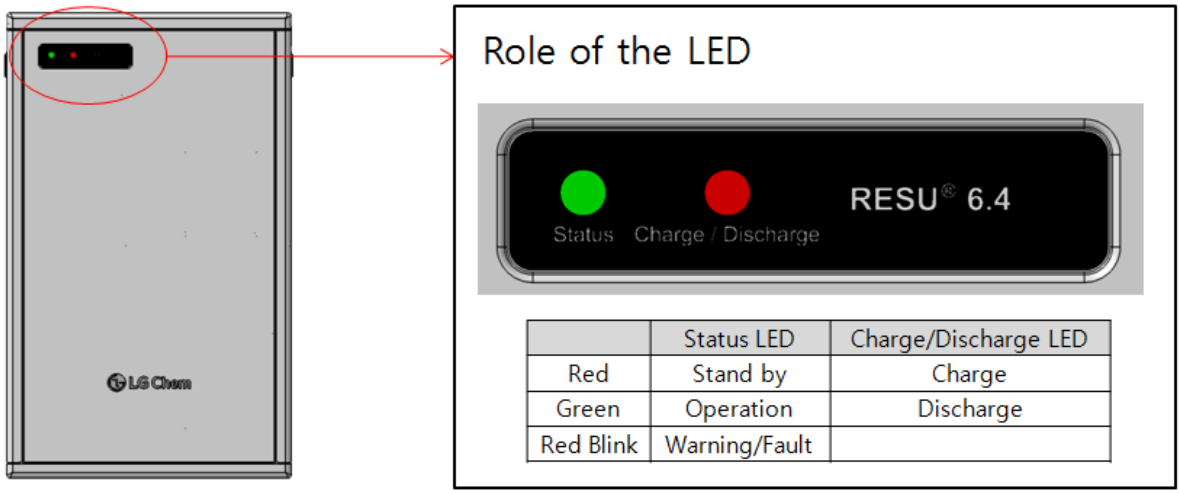


Figure. 2.2 Front view of the RESU 6.4 EX

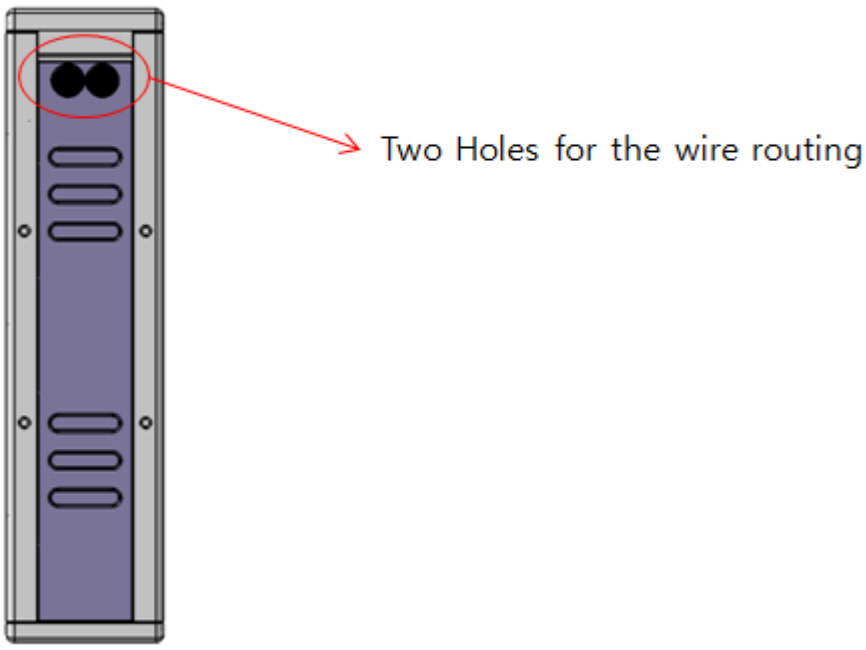


Figure 2.3 Left view of the Battery pack

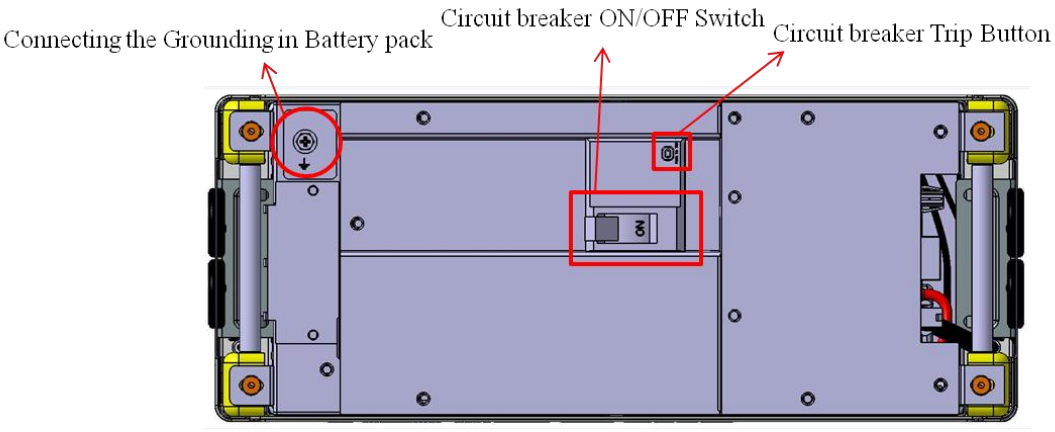


Figure 2.4 Top view of the Battery pack(Open top cover)

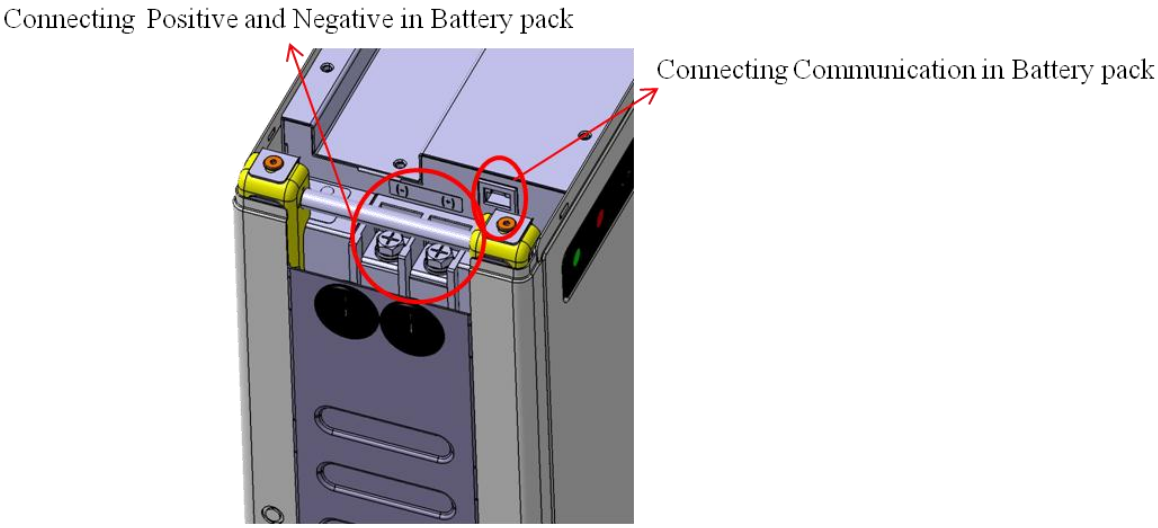


Figure 2.5 Left Top view of the Battery pack(Open top cover)

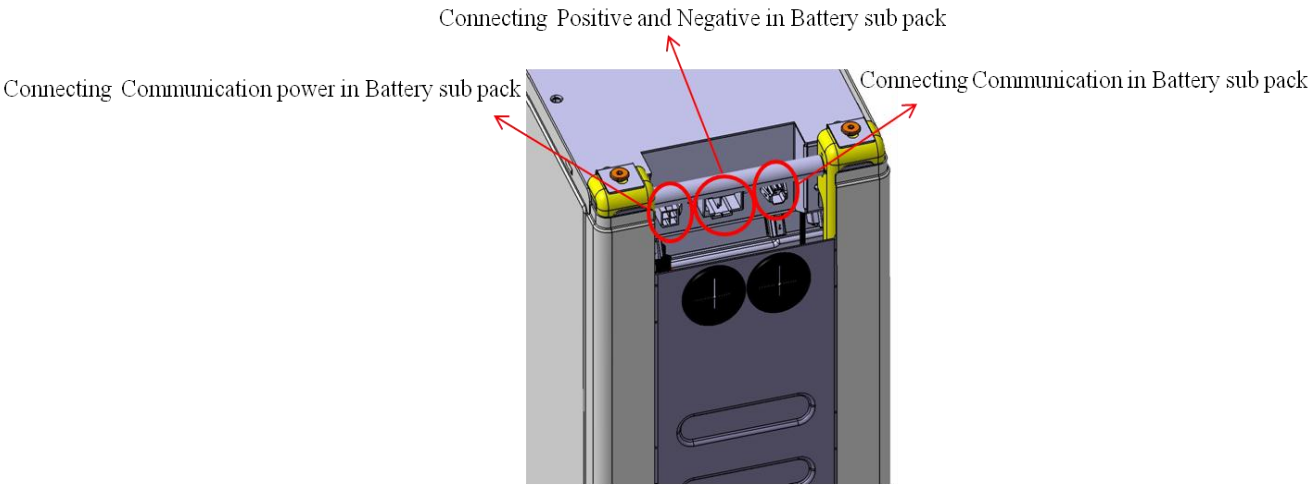


Figure 2.6 Right Top view of the Battery pack(Open top cover)

3. Safety Instructions

For safety reasons, installers are responsible for familiarizing themselves with the contents of this document and all warnings before performing installation.

3.1 General Safety Precautions

Over-voltages or wrong wiring can damage the Battery Pack and cause deflagration, which can be extremely dangerous. Do not install the Battery Pack on flammable construction materials, in areas, where highly inflammable materials are stored, or in potentially explosive environments. Work with the cover removed must be carried out by a qualified electrician. High contact voltages are present in the device. Before removing the cover, the grid, solar array, and battery voltage must be disconnected from the Battery Pack.

The electronics inside the Battery Pack are vulnerable in terms of electrostatic discharge. Be sure to be connected to ground before handling anything within the enclosure of the Battery Pack. Read the label with Warning Symbols and Precautions, which is visibly attached to the Battery Cover (see Section 3.3)

3.2 Battery Handling Guide

Do not expose battery to temperature over 50℃ and open flame.

Do not damage the unit in such ways as dropping, deforming, impacting, cutting or penetrating with a sharp object. It may cause a leakage of electrolyte or fire.

Do not connect anode bolt and cathode bolt with any kind of materials. It may cause severe short circuits.

Do not charge or discharge damaged battery.

Do not place any kind of foreign matters on the cooling path.

Do not put the battery module upside down on the ground.

Hold with insulated gloves when carrying the battery modules.

Do not disconnect, disassemble or repair by unauthorized persons. Services must be made by authorized engineers only.

All types of breakdown of the product may lead to a leakage of electrolyte or flammable gas.

Do not place the product nearby flammables. It may lead to fire or explosion in case of accident.

Keep out of reach of children or animals.

Keep the product away from moisture or liquid. Do not touch or use if liquid is spilled on the product. Store at cool and dry place.

3.3 Warning Label and Symbols

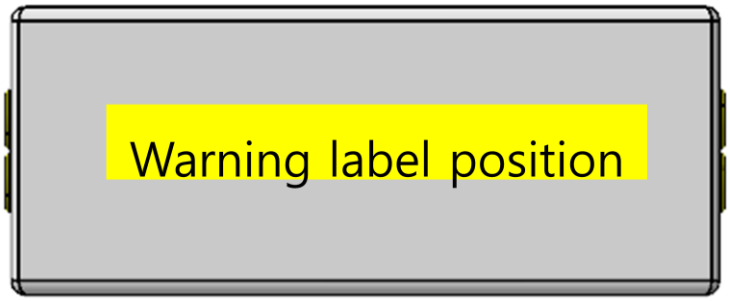


Figure 3.1 LG Chem's warning label position

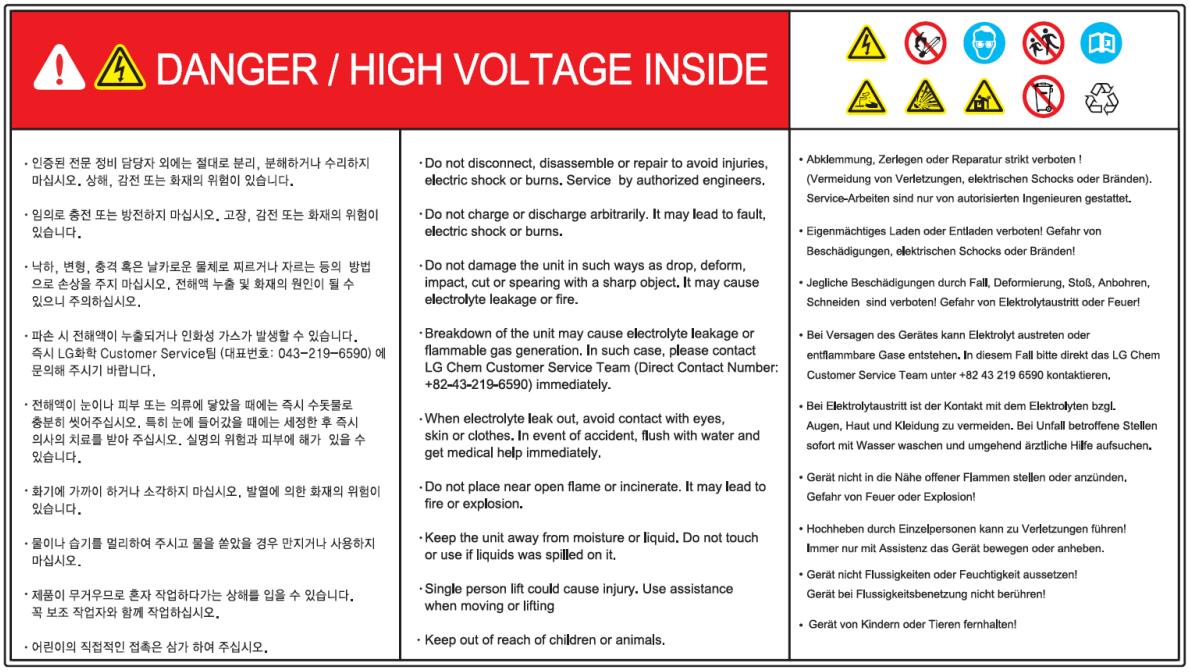


Figure 3.2 Warning Label on the Battery Pack (Top Position) – **to be revised**

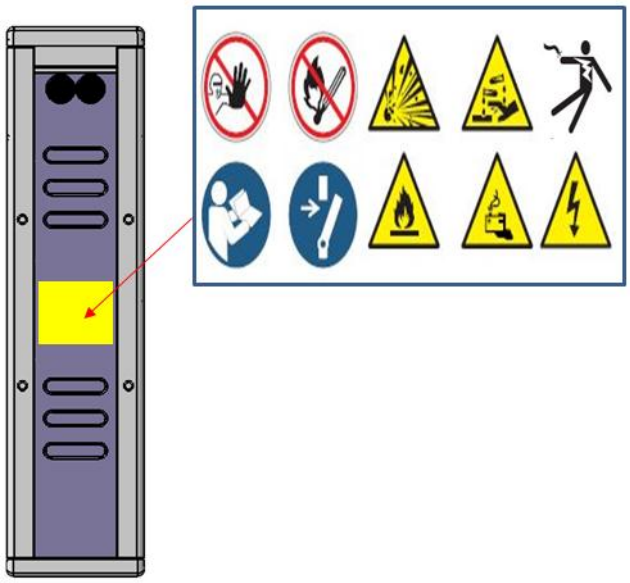


Figure 3.3 Warning Label on the Battery Pack (Right Position)

3.4 Response to Emergency Situations

- If a user is exposed to internal materials of the battery cell due to damage on the outer casing, the following actions are recommended

Inhalation: Leave the contaminated area immediately and seek medical attention.

Eye contact: Rinse eyes with water for 15 minutes and seek medical attention.

Contact with skin: Wash the contacted area with soap thoroughly and seek medical attention.

Ingestion: Induce vomiting and seek medical attention.

- Fire Extinguishing Media

Respirator is not required during normal operations. Use of SCBA is required in the event of fire.

Use FM-200® or CO_2 extinguisher for battery fire.

Use an ABC fire extinguisher, if the fire is not from battery and not spread to it yet.

- Fire Fighting Instructions

If fire occurs during charging batteries, shut off the power to charger (Shut off the circuit breaker). Remove batteries from the fire fighting area. When batteries are heated above 150°C, there may be a possible explosion. Water is effective to cool down the batteries and the scene of the fire.

- Fire Fighting Equipment

Use Personal Protective Equipment Directive (89/686/EEC) complied full-face SCBA (Self-Contained Breathing Apparatus) with full protective gear. Hazardous fumes including carbon monoxide, carbon dioxide, and/or various hydrocarbons can be generated during a fire.

- Effective ways to deal with Accidents:

On land: Place damaged battery into a segregated place and call local fire department or service engineer.

In water: If a battery is flooded, first, cut off power supply to battery system. Ex) Switch off AC circuit breaker connected to battery inverter and PV system. Wait until floodwaters subside and do not approach near battery. If, inevitably, someone have to go into the flooded water, insulated full-length rubber boots and gloves are necessary. Do not use flooded battery again and contact to service engineer.

3.5 How to deal with the battery module (Dropping situation happened)

In case of battery module drop or event happened during assembly working, do following step.

[Step 1] : Visual inspection.

When the Battery drops to floor, make sure if smoke, smell, heat generation occurs to battery. Installer should observe dropped battery at least 20 min. If there is no event, do the step 2. If event occurs, do chapter 4 Emergency response .

[Step 2] : Voltage check.

Before battery voltage check, installer should carefully do not touch metal parts such as base plate assy. Check the voltage between power terminal (Negative position) and base plate to make sure insulation damage happen to battery or not. If voltage is measured during voltage check, installer should be careful not to touch metal part to hand. So insulation gloves are preferred during voltage check. After checking battery module voltage, repack the battery to packing box.
(To distinguish insulation damaged battery, if voltage is measured, do the mark “V” at top of packing box.)

[Step 3] : Recovery the battery pack.

Both case whether outer battery pack is damaged or not, battery module should be recovered at Customer’s service center when battery is dropped. To check, inner battery module parts have been damaged or not, do disassemble the battery module by authorized LG Chem's engineer.

4. Installation

The Battery Pack must be installed indoors with the required ambient temperature in a range of 0 to 40 °C. The assembled system weights approximately 60kg, therefore, the weight must be carefully considered when the installation site and method are chosen. For selecting the installation site, please ensure there is enough space for heat to dissipate

4.1 List of safety gears and Tools

Table 4.1 Required Tools for Installation

Tool list	Qty	Remarks
Screwdriver(+)	1	
Hex Socket wrench set	1	Used to assemble bolts (M5)



Figure 4.1 Safety Gear

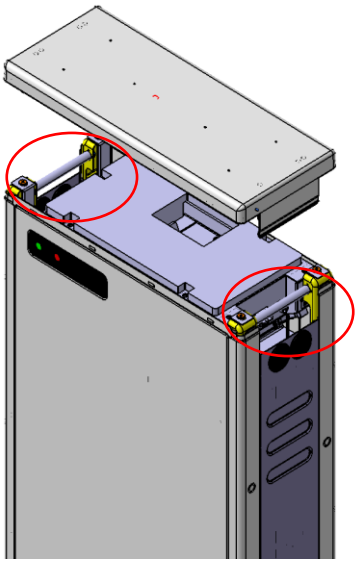
4.2 Cautions

Use Insulated Tools: The grips of tools must be insulated & the exposed portion of metal part of tools must be minimized. Secure insulated safety gears to prevent workers from electric current. Do not put off insulated safety gears during installation.

Any metallic materials except the components tightening battery modules must not be placed at the Installation site. Assure the switch of Circuit Breaker is in “off” position.

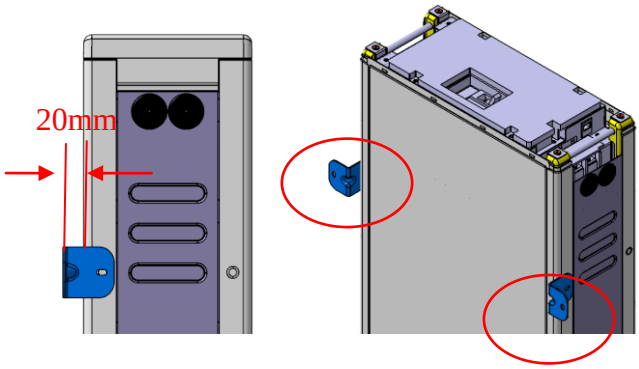
4.3. Installation Procedure

[Step 1]



1) Lift up the Top cover holding on the hands
(Handle : Marked red circles)
2) Move the Battery pack to the installation place.

[Step 2]

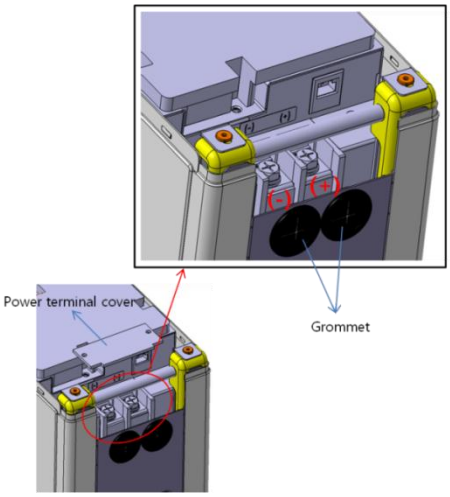


1) Install on Flat Surface

2) Cutting the Design Cover
(Using the Cutter or Nipper)

3) Anchoring the Battery pack to the wall using MTG Brackets
→ Using the M5 Bolt, fix the 2points on the side of the battery pack. And then fix the 2 points on the wall.
(MTG Bracket : Marked red circles)

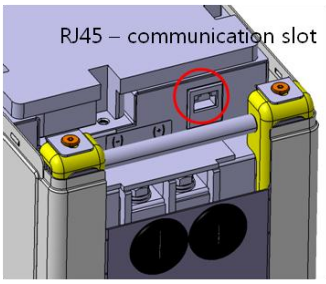
[Step 3]

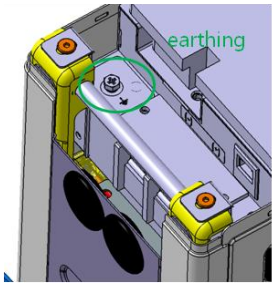


Right side of batteyr pack

1) Remove the Power terminal Cover
(Using the Screwdriver)
2) Cutting the grommets for the power cable before cable routing from inverter side
→ Connect cable interconnection between battery pack and inverter using power cables. Connecting direction of the power terminals are marked on the BPU.

[Step 4]

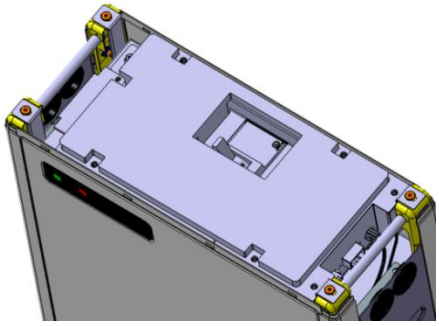




Left side of batteyr pack

1) Connect the communication cable between battery pack and inverter.
2) If using the earthing cable, connect the wire on the earthing point.
(Earthing point : Marked green circle at left side of BPU)

[Step 5]



Right side of batteyr pack

1) Switch on the circuit breaker.

[Step 6]



1) Restore the top cover.
2) Fix the top cover hooks to handles.

5. Troubleshooting

If any malfunction or disturbance occurs during installation or operation, first of all, check BMS power & circuit breaker lever operation. Depending on status of CB & BMS, refer to the corresponding category and chapters.

In addition, LG Chem provides additional pack status monitoring S/W and corresponding manual. Therefore, LG Chem strongly recommends for installer or service engineer to prepare monitoring S/W and requested equipments, commented in monitoring S/W manual, to analyze malfunction status.

- **CAT 1 : Circuit Breaker Fail**
  - CAT 1-1 : On/Off Lever Switching Fail …….....5.1.1
  - CAT 1-2 : Trip Operation Fail…….....5.1.2
- **CAT 2 : BMS Power Fail**
  - CAT 1-1 : Battery Over-Discharge…….5.2.1
  - CAT 1-2 : BMS H/W Error……..……..5.2.2
- **CAT 3 : Others**
  - CAT 3-1 : BMS Status LED (Green) Fail...…….5.3.1
  - CAT 3-2 : Inverter Warning & Malfunction Message……...5.3.2
  - CAT 3-3 : CB Auto Trip……5.3.3

5.1 Circuit Breaker Fail

This category covers mechanical damage of CB. The normal operation status of On/Off lever and trip functionality can be checked.

5.1.1 On/Off Lever Switching Fail

Precondition

The following preconditions have to be confirmed.

- Battery Inverter has to be powered off.
- BMS has to be powered off, put toggle switch downward.

Method

- Put CB lever to On position.
- Check the lever is fixed in On position.

Note. If the lever is in trip state, between On and Off position, switch to Off position first, then switch to On.

Symptom

- Lever cannot be fixed in, and switched off by itself.

Action

- Contact to service center.

5.1.2 Trip Operation Fail

Precondition

The following preconditions have to be confirmed.

- Battery Inverter has to be powered off.

Method

- Put CB lever to On position.
- Push TRIP button on the CB.
- Check the lever is moved to trip position.

Note. TRIP button is the red square push button, located left side of lever.

Symptom

- CB lever is not moved to trip position, between On and Off position.

Action

- Contact to service center.

5.2 BMS Power Fail

This category covers power fail cases. In case of battery pack over discharge and BMS H/W error, BMS cannot be powered on normally.

5.2.1 Battery Over-Discharge

Precondition

The following preconditions have to be confirmed.

- Battery Inverter has to be powered off.
- CB has to be in Off or TRIP state.

Method (Refer to Chapter 4.3 Step 5)

- Turn On CB

Symptom

- BMS Status LED (Orange → Green) is not turned on.

Action

- Contact to service center.
- or measure pack voltage.

Warning. Measuring pack voltage has to be performed by qualified engineer.
Do not charge battery in case of BMS power fail caused by over discharge.

Note. To power on BMS normally, pack voltage has to be over than 37V

5.2.2 BMS H/W Error

Precondition

- Same as 5.2.1.

Method

- Same as 5.2.1.
- Check the pack voltage.

Symptom

- BMS Status LED (Orange → Green) is not turned on.
- Pack voltage is over than 37V

Action

- Contact to service center.

5.3 Others

This category covers cases that CB is in normal state and BMS is normally powered on. BMS initiation fail and warning & fault messages, caused by BMS diagnosis result, that can be seen in Battery Inverter are representative cases. In these cases, monitoring S/W shows more detailed information about symptoms.

5.3.1 BMS Status LED (Green) Fail

Method (Refer to Chapter 4.3. Step 5)

- Turn On the CB
- Check the BMS Status LED (Orange-Init).
- Check the BMS Status LED color changing. (Green-Normal Run)

Symptom

- BMS Status LED does not change the color (Orange → Green).
- Switch lever is moved to trip position if the Status LED remains more than 5 minutes to orange color.

Note. In normal operation, BMS Status LED changes the color. If Status LED does not Change the color, it means that BMS initiation is failed.

Action

- Contact to service center.

5.3.2 Inverter Warning & Malfunction (Fault) Message

After power on & normal initiation, BMS periodically monitors various current battery states. And if any abnormal cases occur, BMS sends warning or fault messages to Battery Inverter. In these cases, BMS Status LED (Green/Orange) is turned on and blinks.

If a warning message is sent to Battery Inverter, it records a message internally and takes no reaction. However, in case of a fault (malfunction) message, Battery Inverter stops its operation immediately and shows corresponding fault message on its Display Panel.

The following table lists warning and fault messages that can be caused by BMS.

Table 5.3 Warning & Fault Messages

Description
Battery Over Voltage
Battery Under Voltage
Battery Over Temperature
Battery Under Temperature
Battery Discharge Over Current
Battery Charge Over Current
BMS Internal Communication
Battery Cell Voltage Imbalance

5.3.3 CB Auto Trip

In addition to warning & fault message, if more serious fault conditions occur, BMS can trip CB intentionally to cut the DC power lines from Battery Inverter. And in some cases, after CB trip, BMS turns off its power by itself. In these cases, by using monitoring S/W, the cause of automatic BMS power off can be checked.

More detailed information about CB Auto Trip can be found in monitoring S/W manual.

Appendix

Technical data sheet

	RESU 6.4 EX(14S4P)
Nominal Voltage (V)/ Voltage rang (V)	51.8 / 45.2 ~ 58.1
Nominal Capacity(Ah) CC/CV Mode(Cutoff : 0.05C)	126Ah (0.3C)
Nominal Energy (kWh)	6.4kWh (0.3C)
Dimension (mm) [Width x Height x Depth]	406 x 664 x165
Weight (kg)	60kg
Max Discharge Current (A)	110A (TBD)
Nominal Discharge Current (A)	0.3C
Nominal Charge Current (A)	0.3C
Peak Power (W) (25℃/77°F)	5kW
Faradic Charge Efficiency (25℃/77°F)	99%
Battery Roundtrip Efficiency (C/3, 25℃/77°F)	95%
Expected Lifetime at +25℃(+77°F)	>10y
Cycle life (90% DOD; +25℃/+77°F)	6000 cycle (EOL 60%)
Available Operating Temperature	0~40℃ As the degradation of battery product is accelerated in high temperature, it is not recommended to store battery modules over 40℃
Optimal Operating Temperature	15~30℃
Storage Temperature	-30~50℃
Cooling	Natural Convection
Interface	CAN Communication
Cell Safety	IEC 62133
Pack Safety (Certification)	CE, IEC62619
United Nation Class	UN 3481
Hazard Classification	Class 9
Transportation Regulation Compliance	UN 38.3
Protection Class	IP 21