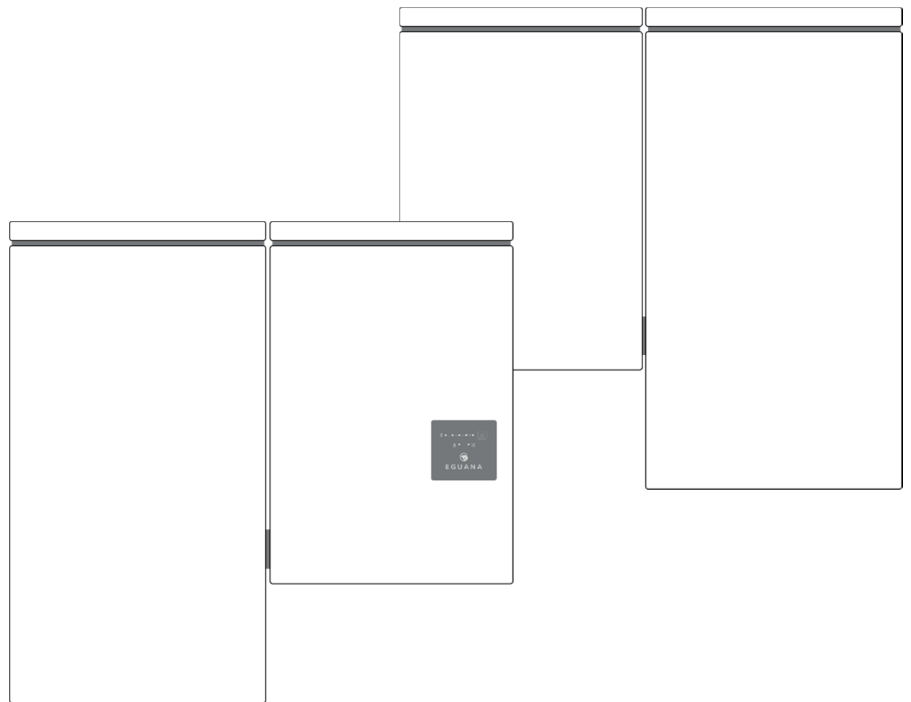




# EGUANA



AC05U-PP / -SP Max & ACB05-PB Max

## Installation & Startup Manual

For use only with battery models

- Pylontech US3000C

Revision	Date	Status	Author	Comments
1.0	26.July.2022	Draft	RWM	Initial release

# IMPORTANT SAFETY INSTRUCTIONS

## SAVE THESE INSTRUCTIONS

The ESS components described within this manual are intended to be used as part of the Evolve LFP Max Energy Storage system and installed per all local building codes and regulations in addition to the National Electrical Code, ANSI/NFPA 70 (for US) and Canadian Electrical Code (for Canada).

The following sub-assembly components are covered within this document:

ACB05U-PP Master PCS system

ACB05U-SP Sync PCS system

Evolve PB Battery system



**CAUTION: Hazardous Voltages! This inverter contains hazardous voltage and energy that may be lethal.** It may only be installed by qualified personnel who have read this manual and are familiar with its operation and hazards. The following safety procedures should be followed:

Only connect the PCS cabinet to a compatible electrical service as defined in the model specifications. The PCS must be connected to a dedicated branch circuit in the main electrical panel.

An external disconnect switch shall be provided in the end installation by others for the AC Grid output circuit.



**CAUTION! This equipment contains high energy lithium batteries.** Qualified and trained personnel should wear protective clothing and equipment when working inside the battery cabinet and/or with battery modules.



**CAUTION! The batteries provided with this system must be charged only by the PCS included as part of the energy storage system.** Do not attempt to charge batteries with any other charger device or connect any devices directly to the DC battery bus.

Ensure proper electrical grounding in accordance with code requirements.

Ensure proper airflow path for active cooling.

Never operate system in a manner not described by this manual.

Only qualified personnel should service this product.

Ensure all covers are securely fastened after installation is complete.

This product must be stored indoors in an environmentally conditioned location prior to installation, protected from rain and exposure to any hazardous chemicals.

Do not attempt to operate this product if there is any physical evidence of damage to any of the cabinets or internal components.



**CAUTION! This equipment is heavy.** Mechanical lifts are recommended for safe installation.

### California Proposition 65



**WARNING!** This product can expose you to chemicals including bis (2-ethylhex-yl)phthalate, which is known to the State of California to cause birth defects or other reproductive harm. For more information go to <https://www.p65warnings.ca.gov/>.

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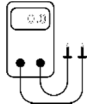





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# 1 Safety

The components described by this manual are intended to be used as part of an energy storage system and installed per all local building codes and regulations in addition to the National Electrical Code, ANSI/NFPA 70 (for US) and Canadian Electrical Code (for Canada).

Throughout this manual, the following symbols will be used to highlight important information and procedures:

Symbol	Definition	Symbol	Definition
	<b>WARNING!</b> A dangerous voltage or other condition exists. Use extreme caution when performing these tasks.		Meter measurement required.
	<b>CAUTION!</b> This information is critical to the safe installation and or operation of the inverter. Follow these instructions closely.		Torque rating critical to operation.
	<b>NOTE:</b> This statement is important. Follow instructions closely.		Login to the remote monitoring system for operating status
	Ground, GND, PE		

## 1.1 In case of emergency

### In all cases:

- If safe to do so, switch off the AC breakers (external to the system).
- Contact the fire department or other required emergency response team.
- Evacuate the area, and if applicable, follow your emergency evacuation plan if others are in proximity to the installed location.

### In case of fire:

- When safe, use a fire extinguisher suitable for use; including A, B, and C dry chemical fire extinguishers or carbon dioxide extinguishers.

### In case of flooding:

- Stay out of water if any part of the system or wiring is submerged.
- Do not attempt to operate batteries that have been submerged in water even after they have been dried.

### In case of unusual noise, smell or smoke:

- If safe to do so, ventilate the area.

## 1.2 Battery module safety precautions

This product is integrated with Pylontech US3000C series battery modules. Refer to the Pylontech product manual for complete safety instructions regarding handling of battery modules.

## 1.3 General safety precautions

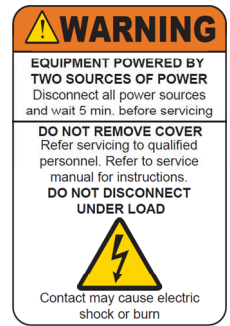


**Important!** Installation, service, and operating personnel must read this document in its entirety, and observe all safety and installation procedures as described in this manual. Never operate system in a manner not described by this manual.

Only qualified personnel should service this product.

Ensure all covers are securely fastened after installation is complete.

Personal Protective Equipment (PPE) in compliance with local work place safety standards must be worn when working inside the cabinet.



### Risks of Fire

Do not expose the system to temperatures exceeding 60 degrees Celsius.

Avoid installation in direct sunlight.

Do not store objects on top of the cabinet.

Do not obstruct the airflow paths of the cabinet air intake.

Do not obstruct the exhaust of cabinet exhaust.

Do not store combustible objects and corrosive chemicals directly adjacent to the system.

### Risks of Shock



**WARNING! Hazardous Voltages. The Inverter contains hazardous voltage and energy that may be lethal.** It may only be installed by qualified personnel who have read this manual and are familiar with its operation and hazards.



Only connect the PCS cabinet to a compatible electrical service as defined in the model specifications. The PCS must be connected to a dedicated branch circuit in the main electrical panel.

Ensure proper electrical grounding in accordance with code requirements.



**CAUTION! Both AC and DC voltage sources are terminated inside this equipment. Each circuit must be individually disconnected before servicing**

### Risks of Damage

The PCS is configured for the Pylontech US3000C battery module only. Do not attempt to connect any other battery to the system.

Do not connect any other loads directly to the battery power bus.

Do not drop, tip, or puncture the cabinet during transport and installation. Visible damage to the cabinet and/or internal components should be reported to the manufacturer immediately.

Do not store this system for periods longer than six months without a battery maintenance charge. This may result in permanent damage to the batteries.

## 1.4 Disposal and Recycling



Do not dispose of the system or any of the components within the cabinet. Batteries, electronics, cables, and metal parts are recyclable. Consult your municipal waste management authority to determine required methods of component recycling.

## 2 Introduction

### 2.1 About this Manual – Target Audience

This manual is intended to be used by qualified service and installation personnel for the purposes of product installation.

This manual contains instructions for the installation of Eguana Evolve™ energy storage components required to assemble the Evolve LFP Max ; including the CB. This product is permanently wired to the home electrical service, and must be installed by a licensed electrician only.

### 2.2 Installation Planning & System Commissioning - Supporting Documents

The Evolve LFP Max energy storage system is operated by the Evolve Hub. Please consult the Evolve Hub Installation Manual for full installation planning details, including conduit layout plans and sample single line diagrams for a complete solar plus storage system installation. The Evolve Hub installation manual also describes in more detail the various operating modes and configurations for AC coupled PV solar plus storage systems.

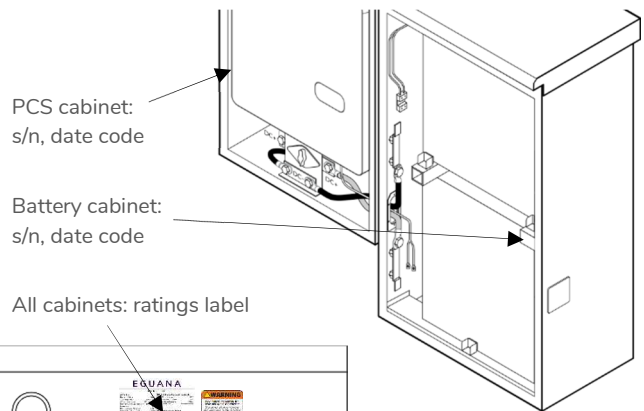
A complete list of Installer resources is available at [www.eguanatech.com](http://www.eguanatech.com) under the Evolve™ product banner.

### 2.3 Glossary

Term	Definition	Term	Definition
AC / DC	Alternating Current / Direct Current	LED	Light Emitting Diode
ARC	Auto Recovery Circuit	NC / NO	Normally Closed / Normally Open
CPU	Central Processing Unit	PCS	Power Control System (Inverter)
EMC	Energy Management Controller	PE	Protective Earth
EMS	Energy Management System	PV	Photo-Voltaic
ESD	Electrostatic Discharge	RF	Radio Frequency
ESS	Energy Storage System	SOC	State Of Charge (Battery)
GND	Ground	SOH	State of Health (Battery)

### 2.4 Product markings

The ratings label is located on the bottom face of each cabinet. The serial number / date code labels for the system are located as shown (right) with the front covers removed.



### 2.5 Special tools & hardware

The following tools are required to complete the installation of the ESS:

- Torque wrench
- 17mm socket wrench (DC- main power connection).
- 10mm socket wrench (battery +/- module power connections).
- 3/8" socket wrench (DC+ main power connection).
- Load bearing hardware for wall bracket mounting. 5/16" (M8)



## 2.6 Initial Inspection of Material List – top level system components

The system components supplied with the system are shown below. Each component should be inspected visually for any damage that may have been caused by shipment. If damage is present, please contact your local distributor.

Item	Eguana P/N	Description
1	ACB05U-PP/SP Max	PCS cabinet (and cover)
2	ACB05-PB Max	Battery Cabinet (and cover)
3*	-----	Wall mount rail – PP model
3*	-----	Wall mount rail – SP model
4	US3000C	4 battery modules
5	LFP Max install kit	Assembly parts kit, cables, and manuals.

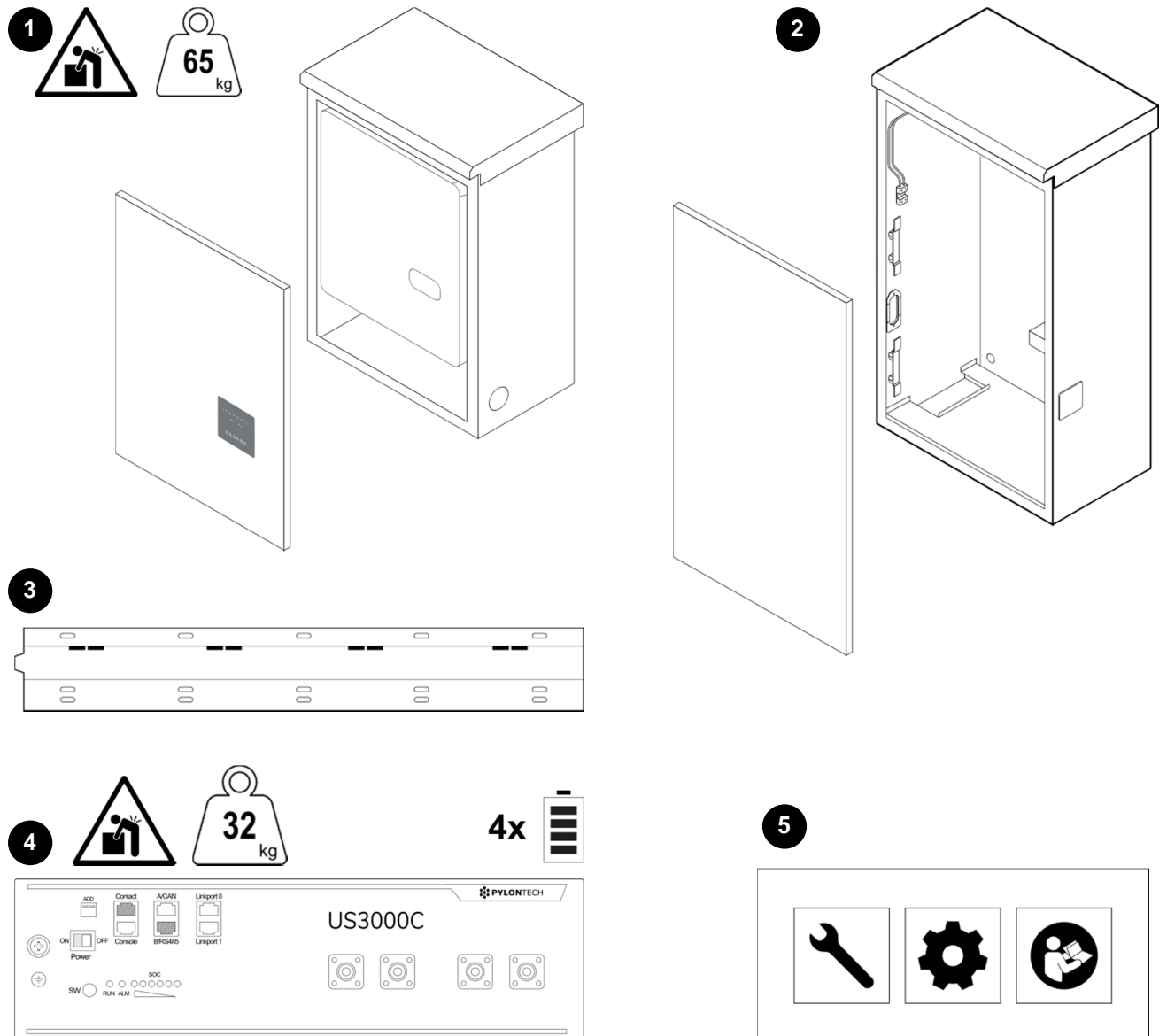


Figure 1: Top level system components.

## 2.6.1 LFP Max install kit – mechanical parts and manuals

Item	Qty	Eguana P/N	Description
<b>Battery Cabinet</b>			
1	1	PB kit	Incl. cabinet coupler assembly, two levelling brackets, and two plugs
2	8	801003244	Adhesive backed battery module pads
3	1	801003757	Battery rack partition bracket (includes attached battery retaining clip 801003044)
<b>PCS Cabinet</b>			
4	1	LP Max kit	Incl. levelling bracket, cabinet coupler end plate, plug, and PCS-BMS communication cable.
-	1	Doc 82013	Evolve LFP Max Installation and Startup Manual
-	1	Doc 58159	Evolve LFP Max System Owner's Manual

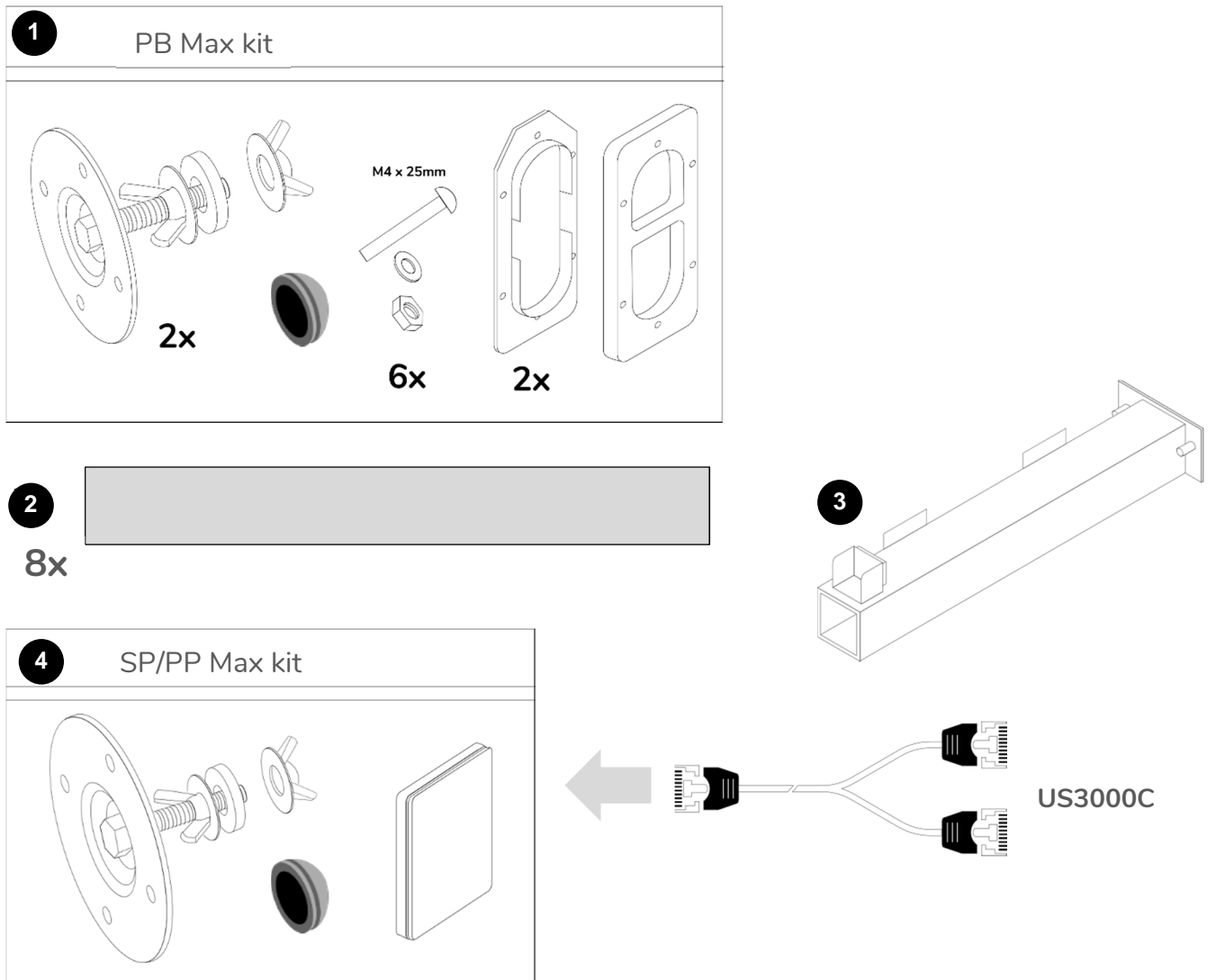


Figure 2: LFP Max install kit - mechanical parts.

## 2.6.2 LFP Max install kit – battery cables

Item	Qty	Eguana P/N	Description	Pylon p/n
1	2	801003792	BMS jumper short 210 mm	WI0SRJ458025
2	1	801003794	BMS jumper long 700 mm	WI0SUS300002
3	4	801003791	Chassis GND cable GRN/YEL 1 m	WI0GUS300001

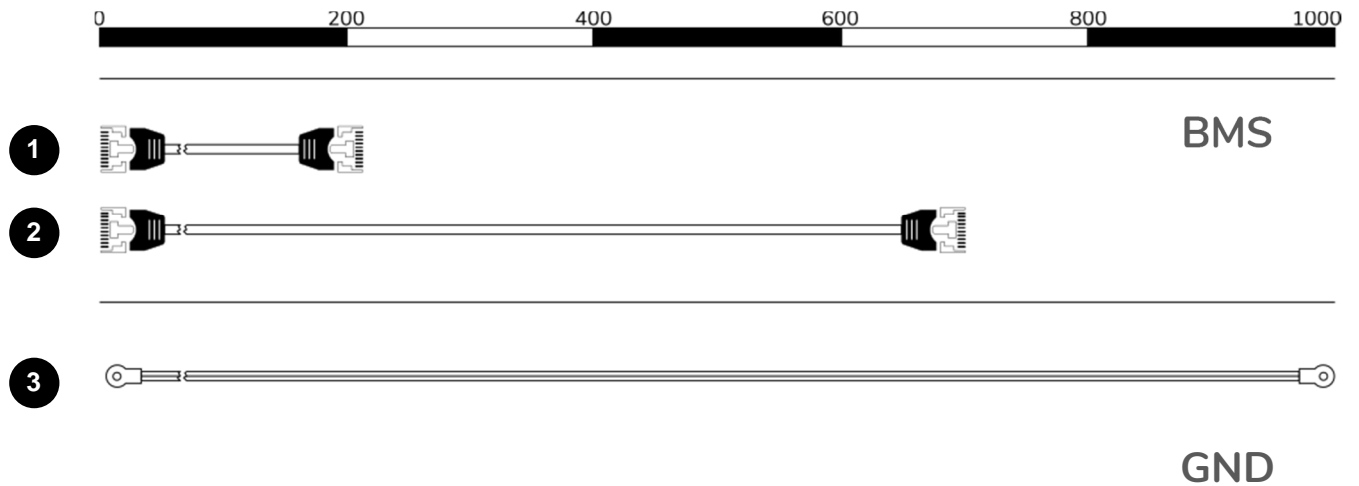


Figure 3: LFP Max install kit - battery cables.

### 3 Installation Site Preparation

Before installing the product, read all instructions and warnings in this manual. This product is wall-mounted only, and can be installed both outdoors (in compliance with NEMA Type 3R installations) and indoors, either attached or detached garages, and indoor locations more than 5 feet from dwelling units. This product is not to be installed in habitable spaces. Consult local building codes for more details.



**CAUTION!** All electrical installation work should be performed in accordance with local building and electrical codes.



**WARNING!** Isolate the PCS from all energy sources prior to electrical installation by means of disconnects, breakers or connectors. Failure to properly isolate either AC or DC sources may result in serious injury or death. This system will generate an AC voltage at the off-grid terminals when DC source is applied.



**CAUTION!** The PCS cabinet weighs up to 145 lbs. (65 kg), and the battery cabinet weighs up to 320 lbs. (145 kg) with four battery modules installed. Handle with care. The wall to which the system is mounted must be load-bearing rated according to the local building code. Mechanical lifts are recommended to position cabinets on the wall bracket.



**NOTE:** All interconnecting cables are limited in length, and designed specifically for adjacent cabinet mounting using the manufactured wall brackets.



**CAUTION!** Do not install in direct sunlight. Battery performance is dependent upon operating ambient temperature. Radiant heat absorbed in direct sunlight will greatly reduce the performance of the battery, and will prematurely cause degradation of the display indicator panel on the PCS cabinet. The battery modules are rated for operating temperature range between -10C to +50C.



**NOTE:** ESS systems installed indoors may require the installation of a smoke alarm or heat detector specific for ESS use. Consult the local building code for more details.



**NOTE:** This product was not evaluated in seismic environments.



**NOTE:** All external wiring must be protected by metallic conduit, and all conduit fittings installed on the ESS cabinets must be rated Type 3R or better.

#### 3.1 Overview of PCS and Battery components

1. The forced air cooling of the PCS cabinet is designed to flow air from bottom to top.
2. Wall mounting hardware not included. The load-bearing wall bracket is provisioned for M8 hardware. Levelling brackets are provisioned for M5 hardware.

#### 3.2 Installation Area Required to Wall Mount the ESS:

The physical installation of the cabinets requires layout planning and installation of the system components in the available installation space. The recommended installation height is driven by the viewing angle of the display panel on the PCS cabinet.

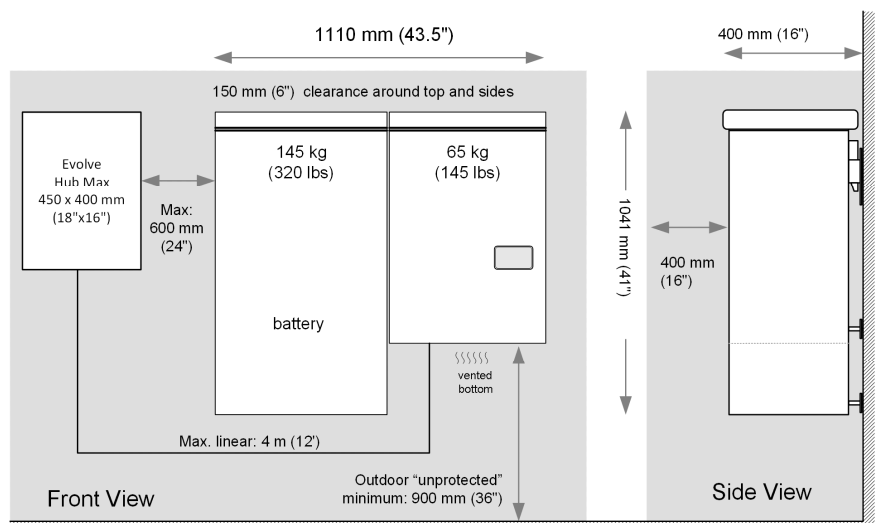


Figure 4: Installation clearances for the Evolve LFP Max energy storage system (ACB05U-PP model shown).

## 4 PCS and Battery Cabinet Wall-Mounting Instructions



Note: The following instructions apply to the -SP model. The -PP model follows the same instruction set with the battery cabinet placed to the left of the PCS cabinet.

1. Mount the wall rail to the wall. Use the available slot pattern to mount to a load-bearing structure rated for the weight of the final system. The slots accommodate a M8 (5/16") bolt diameter.



**IMPORTANT!** Wall-stud mounting: A minimum of three wall studs spanned within the width of the mounting rail are required. A minimum of two mounting bolts are required per stud (top/bottom).

2. (not shown) Remove the battery cabinet from the packaging, and stand the cabinet upright. Remove the front cover.
3. Mount the two leveling brackets to the back side of the cabinet. Each side of the cabinet must have a rubber washer in direct contact with the cabinet wall.
4. Lift the battery cabinet onto the wall mount bracket, aligning the wall hooks at the rear of the cabinet with the slots on the load-bearing face of the bracket.
5. Slide the battery cabinet towards the right end of the bracket to allow for clearance for the PCS cabinet.
6. From the rear side of the cabinet, adjust the outer wingnuts on the levelling brackets until the cabinet is vertically plumb (level) to the wall.

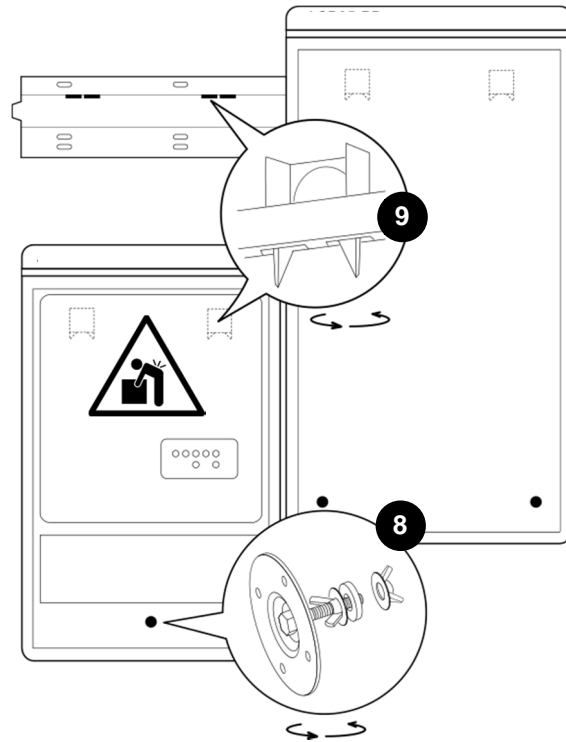
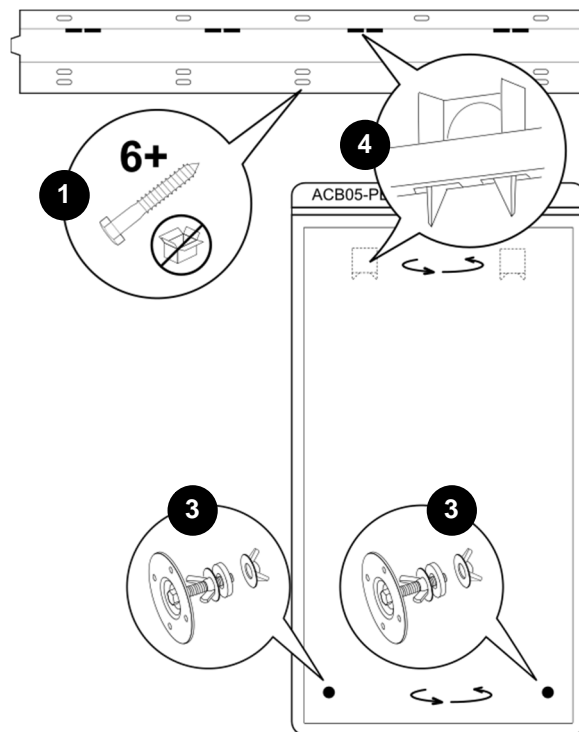
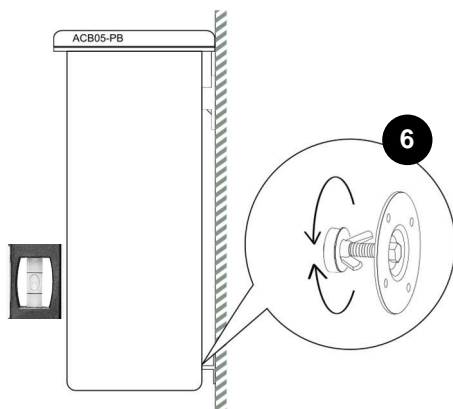


Figure 5: Wall-mounting the cabinets.

7. Remove the PCS cabinet from its packaging and stand upright. (not shown). Remove the front cover.

8. Assemble and mount the single lower-center leveling bracket as shown in steps 3 and 4 above.



**CAUTION!** The PCS cabinet is heavy. Mechanical lift or two persons recommended.

9. Lift the PCS cabinet onto the wall mounting bracket.

10. Slide the PCS cabinet to the left such that it aligns with the alignment tab on the mounting bracket.

11. From the rear side of the cabinet, adjust the outer wingnut on the single leveling bracket until the cabinet is vertically plumb (level) to the wall. (see image – step 6).

12. Insert the PCS cabinet coupling gasket between the two cabinets (lower-front). Slide the battery cabinet towards the left until mating to the gasket.

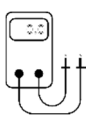
13. Place the coupling plate inside the PCS cabinet and insert the four mounting bolts and washers through to the battery cabinet side.

14. Place star washers on the bolts on the battery side of the cabinet.

15. Mount the battery cabinet side coupling plate, and fasten with the lock nuts. Torque to 10 – 15 in-lbs.



**WARNING!** The mounting bolts of the flange assembly are required to be fully secured, as they provide the chassis grounding for the battery cabinet. Torque nuts as shown in the specification tables provided in this manual.



16. **Continuity test:** Check the continuity between the cabinets using an Ohm meter. The test reading must be zero Ohms at a bare metal point inside each of the PCS and battery cabinets.

17. Install the cabinet coupler end plate (see- LP kit) to seal the hole on the battery cabinet.

18. Optional: (This is not a load bearing anchor – anchored conduit runs to the PCS are satisfactory). Install screws in leveling plates for PCS and battery cabinets by inserting a screwdriver through the hole on the backside of the cabinets.

19. Plug hole on back of cabinet using by inserting the hole plug from the front side.

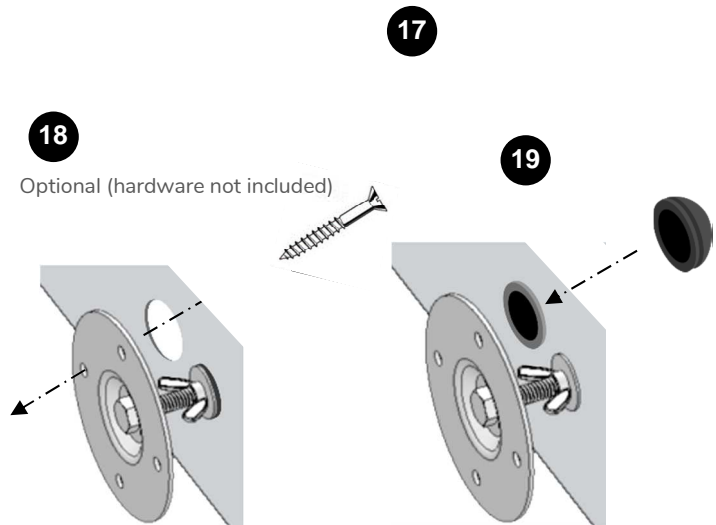
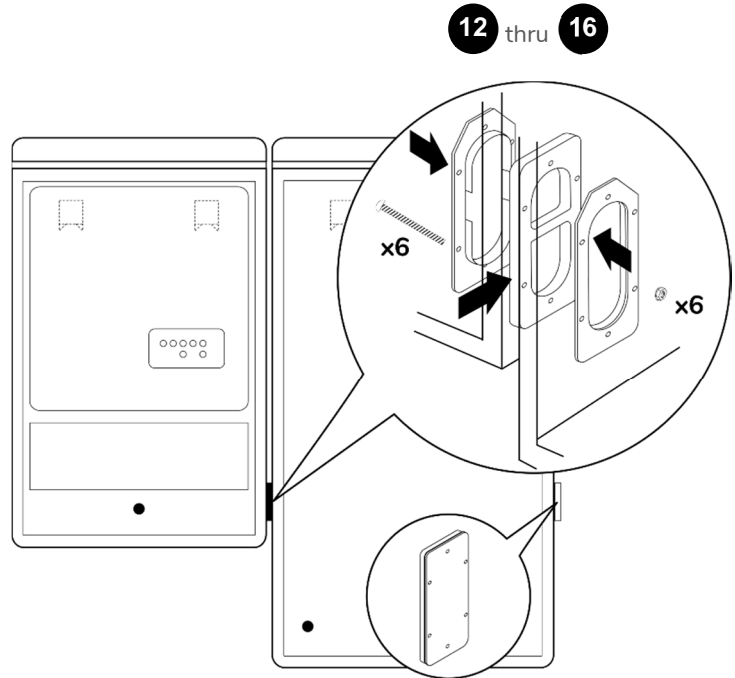
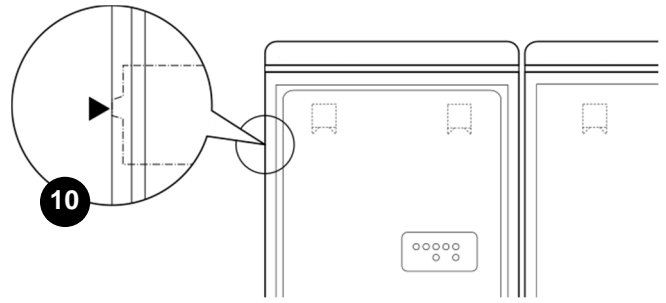


Figure 6: PCS cabinet and inter-cabinet coupler installation.

## 5 Battery Module Assembly

The following instructions include:

- Interconnection of the PCS DC and communication cables to the battery cabinet.
- Preparation and assembly of the battery cabinet modules and internal wiring.



**Note:** Overcurrent protection of the DC source is provided internally as part of the integrated battery system. No external DC disconnect is required.

### 5.1 Battery cabinet ground bus



**CAUTION!** A torque wrench is required to ensure the power cables are terminated to their specifications. Over-torque can damage the DC breaker and/or strip the threads on the copper bus bar posts. Under-torque can result in an arc fault hazard, and risk of fire. Damage as a result of improper termination is not covered by the manufacturer warranty.

1. Mount the four ground wires provided in the battery module grounding kit into the 4-position ground distribution block.

### 5.2 DC negative & positive power bus terminations

P/N	Description
----	PCS DC- battery disconnect cable
----	PCS DC+ battery disconnect cable



Note; MAX -S model shown. See front view of the MAX-P model below.

2. Route the DC- cable from the DC- bus to the battery disconnect DC- post. Torque the nut to 35 in/lbs.



3. Route the DC+ cable from the DC+ bus to the battery disconnect DC+ post. Torque the nut to 35 in/lbs.

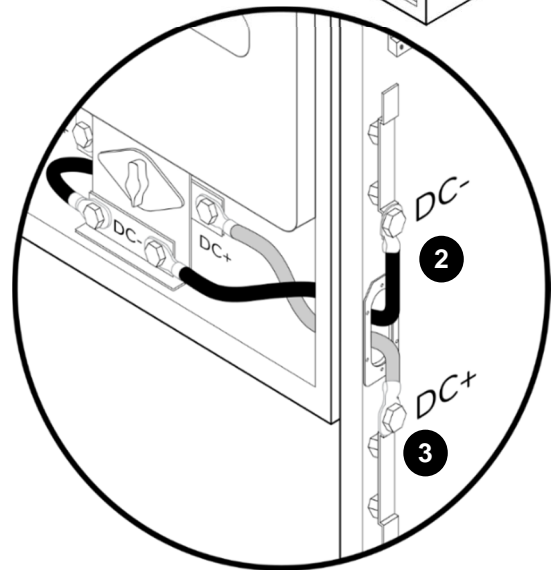
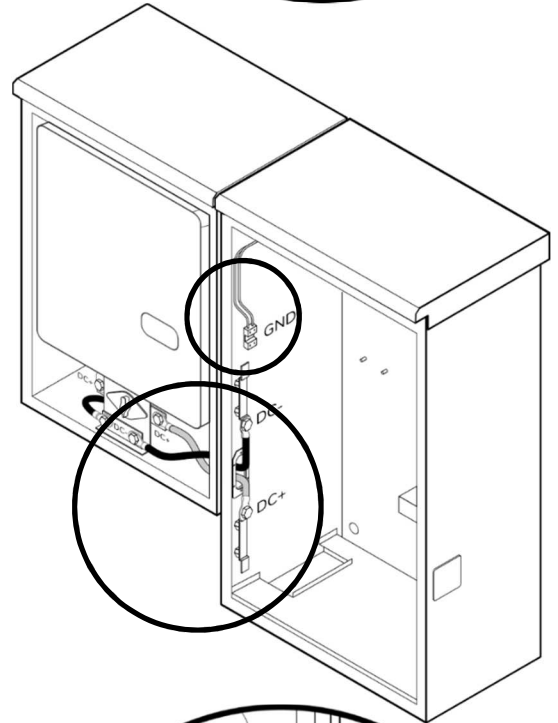
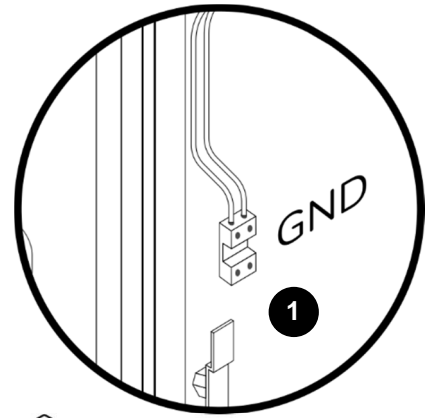
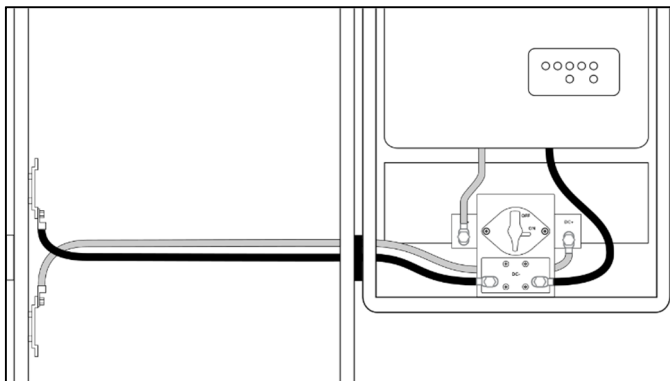


Figure 7: Battery cabinet module grounding wires and DC negative/positive terminations

### 5.3 Preparing battery modules for installation

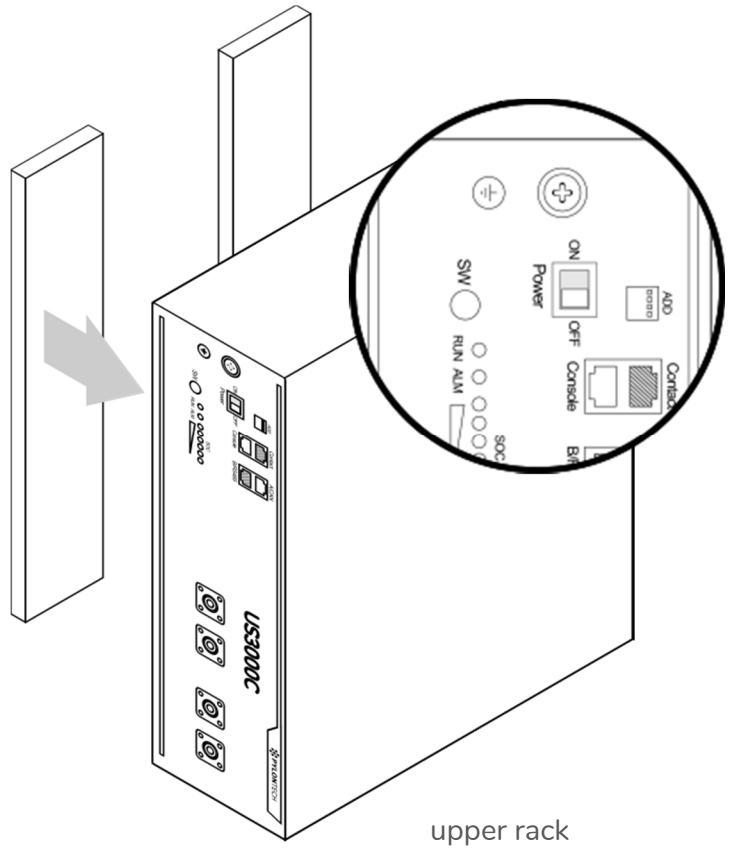
The PCS cabinet is not shown in the following steps.



**CAUTION!** Ensure the battery module power switches are in the OFF position throughout the following procedure.

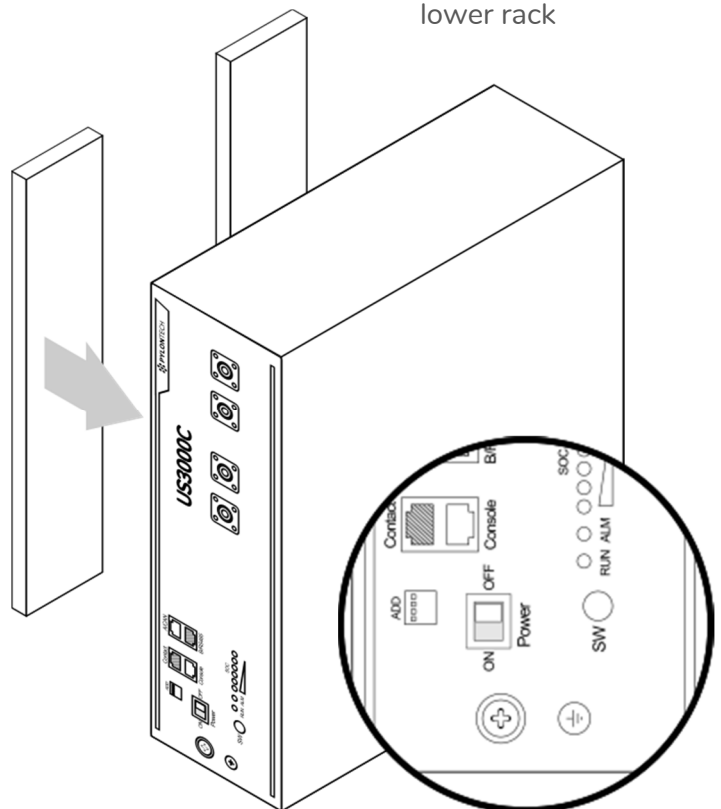


Note: Observe the rotation of the modules on the lower and upper racks. The lower rack is rotated such that the chassis ground terminal is at the bottom of the module, while the upper rack chassis ground terminal is at the top.



upper rack

1. (not shown) Remove a battery from its packaging. Remove the rackmount ears, if supplied with the battery.
2. Attach two adhesive-backed module pads (included in the battery module hardware kit) to the battery modules as shown. For the lower rack of modules, the pads are installed on the top face of the battery. For the upper rack, the pads are installed on the bottom face of the battery.



lower rack

Figure 8: Attaching adhesive pads to the battery modules.



## 5.4 Mounting and grounding the battery modules in the battery cabinet

1. Slide the lower rack battery into the cabinet as shown, and connect the ground cable to the ring terminal ground connector on the battery module as shown.
2. Push the module inward until making contact with the rear face of the cabinet.
3. Repeat steps 1 and 2 above with the 2<sup>nd</sup> lower rack module.
4. Mount the lower rack retaining clip.
5. Install the battery rack partition bracket as shown using the two M5 keps nuts provided.



Note: Remove the retaining clip from the bracket if mounted on the partition bracket before proceeding with the following steps:

6. Repeat steps 1 thru 3 above with the upper level battery rack.
7. Mount the two upper rack retaining clips.

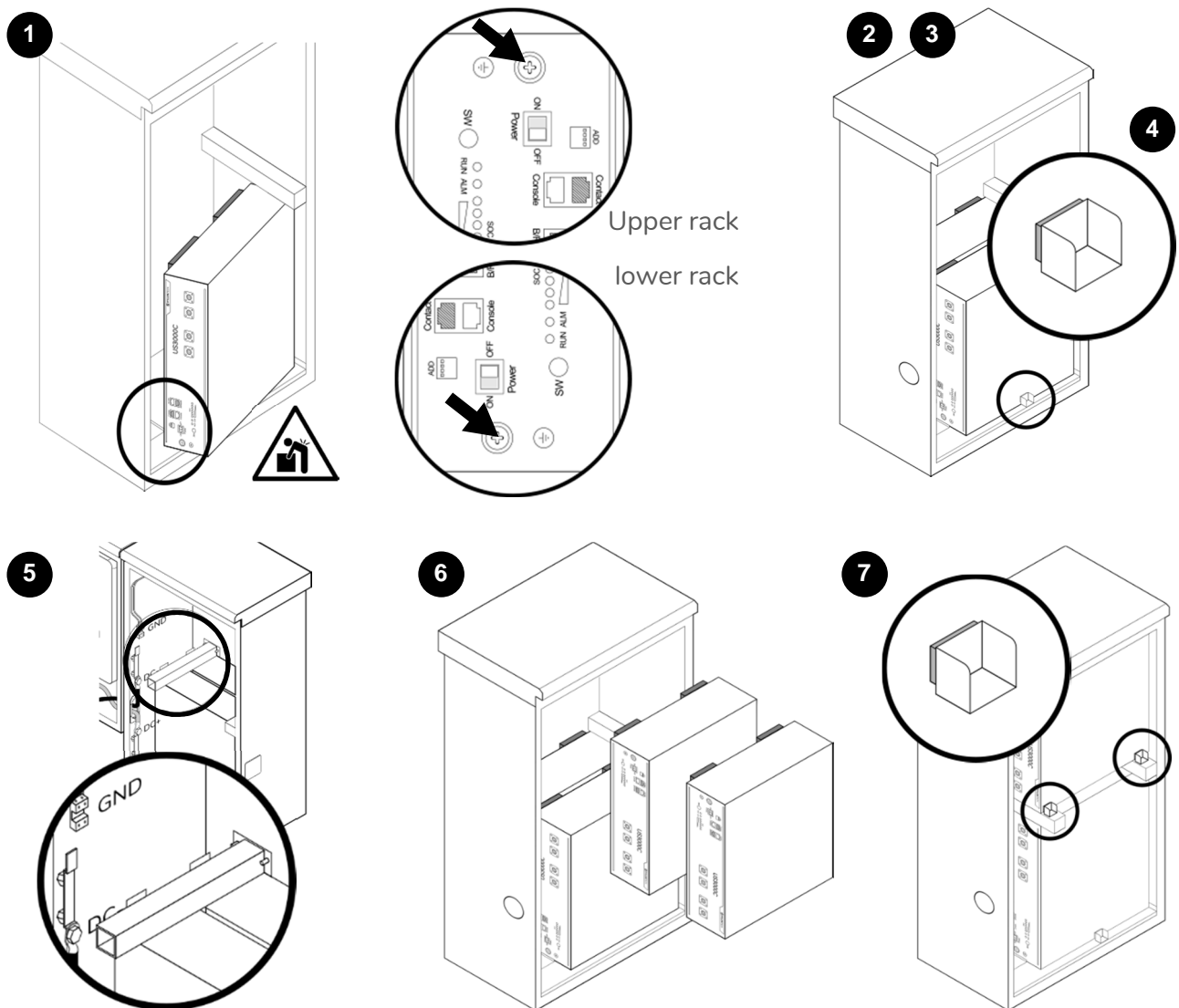


Figure 9: Installing and grounding the battery modules.

## 5.5 Wiring the battery modules

Follow the battery module power and communication jumper wiring below.

Ref	P/N	Description	Pylon p/n label
C1	#3792	BMS jumper short 210 mm	WI0SRJ458025
C2	#3794	BMS jumper long 700 mm	WI0SUS300002

### 5.5.1 Battery module DC +/- jumper cable wiring

The battery cables are factory terminated at the DC- and DC+ bus. All cables are the same length. Connect each module (push-to-click) connector as shown (right).

### 5.5.2 BMS communication jumper cable wiring

Install the cables in the following sequence.



**IMPORTANT!** All module interconnecting BMS jumpers terminate at the [Linkport] terminals. Note the Linkport reference, 0 and 1, for each port connection.

1. Terminate the BMS jumper cable C2 between batteries #2 - 3.
2. Terminate the BMS jumper cables C1 between batteries #1-2 and #3-4.

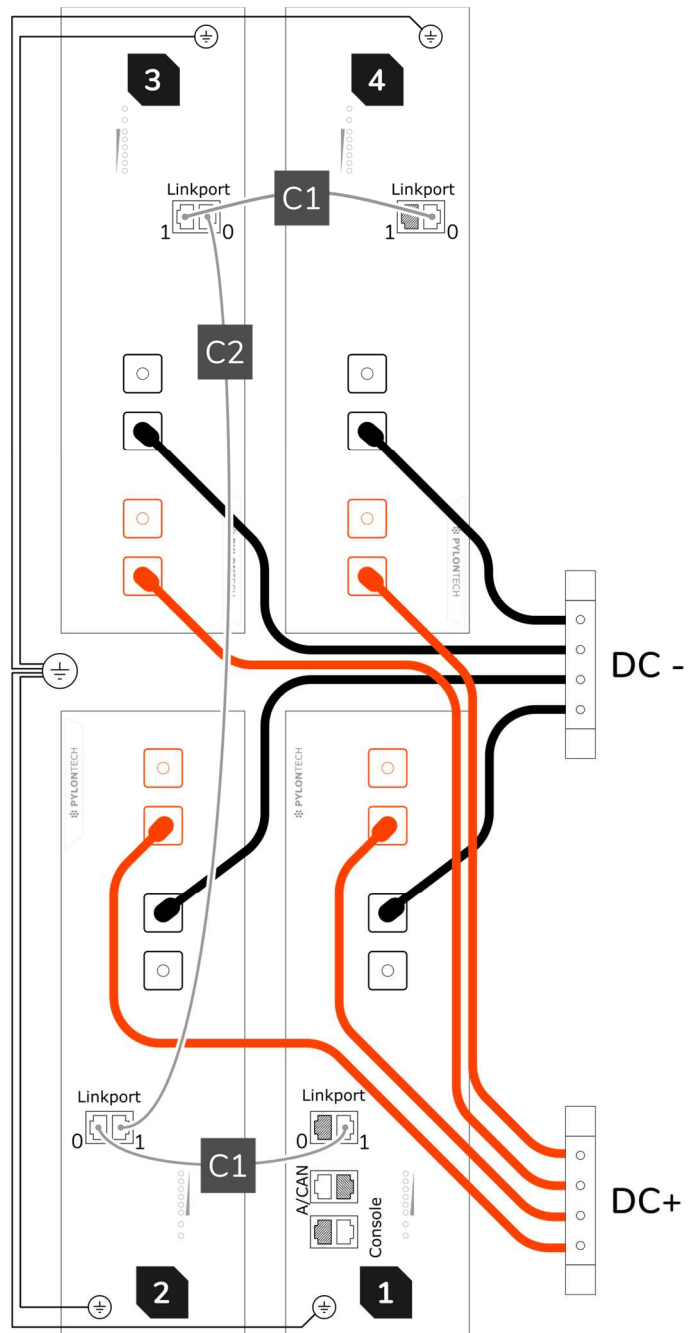


Figure 10: Installing the battery jumper cables.

### 5.5.3 PCS to BMS communication cable

This cable is specific to the battery model. Refer to the instruction that applies only to the battery module supplied.

Terminate the PCS-BMS cable in battery #1 as shown below. This battery is herein referred to as the “Master” battery module. All other modules sync to the master.

1. Terminate the PCS – BMS / Console Y cable jumper in the [A/CAN] and [Console] ports of battery #1.
2. Route the other end of the cable through the PCS port hole and terminate in the cable in the [BMS OUT] port.

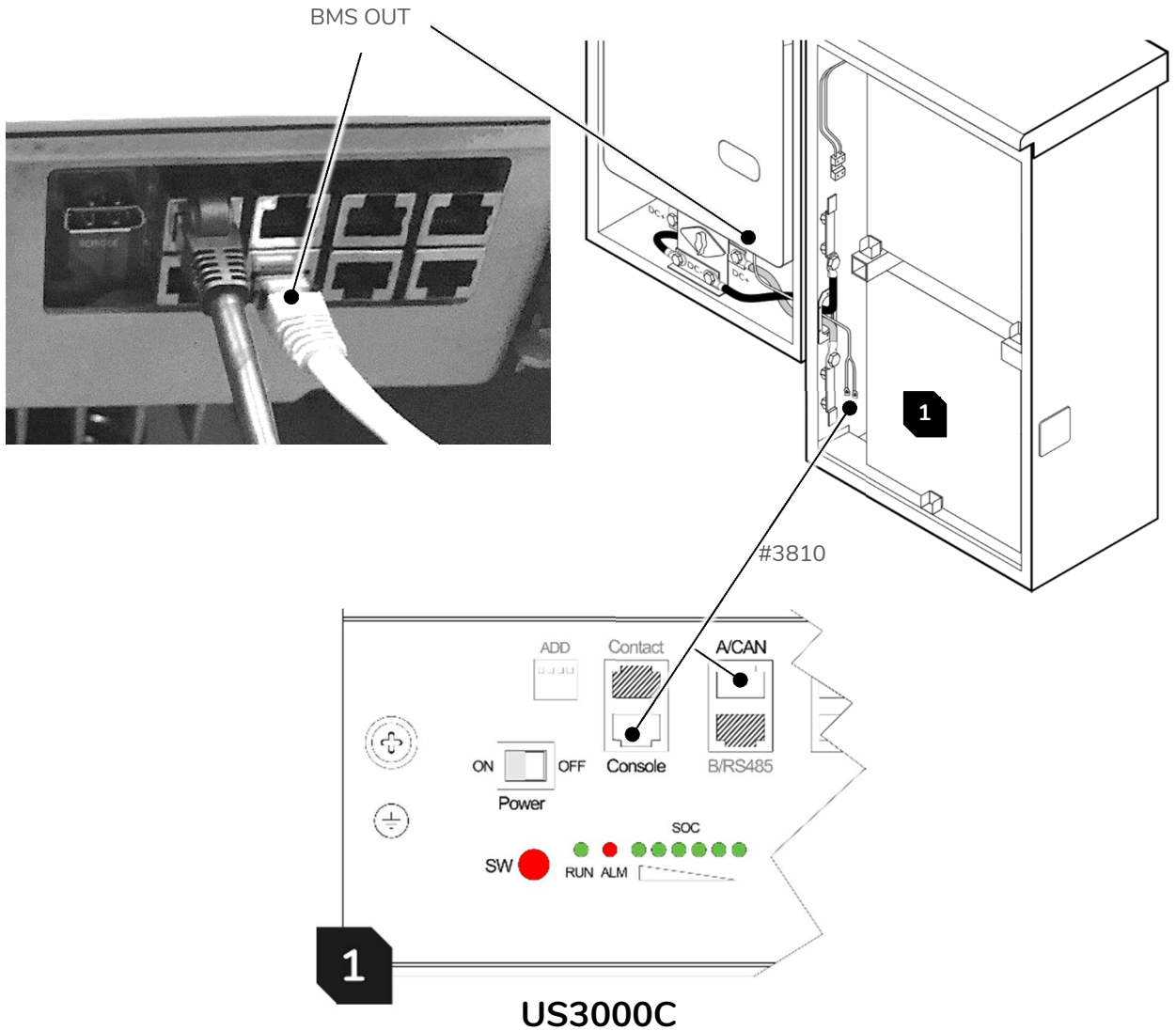


Figure 11: PCS to BMS communication cable connection.

## 6 System Electrical Wiring



**Note:** This product is capable of providing utility interactive and islanded back up power, and can be AC coupled to a utility interactive photovoltaic inverter. Wiring methods must be in accordance with local electrical codes. The installer is responsible for ensuring that over-current protection is installed and sized appropriately for the AC grid and off-grid output circuits, in accordance with the National Electrical Code, ANSI/NFPA 70, Canadian Electrical Code and local codes.

All field wiring connections to the battery system are at the PCS cabinet only. The knockout locations for conduit entry into the PCS are categorized as AC power and signal level circuits.



**IMPORTANT! Drilling holes anywhere in the battery or PCS cabinet renders the warranty null and void.** Use the knockouts provided at the bottom face of the PCS cabinet only! Do not drill holes anywhere in the battery system. Use conduit fitting reducers, if applicable.

### 6.1 AC power connections



**Note:** The PCS provides galvanic separation between AC and DC Sources.



**CAUTION!** To reduce the risk of fire, connect only to a dedicated circuit provided with appropriate branch circuit over-current protection in accordance with local electrical codes.



**WARNING!** Improper connection of the wiring panel may result in equipment damage and cause personal injury. Disconnect all AC and DC Sources prior to installation.



**Note:** The AC output's Neutral terminal is not bonded to ground. The Neutral is connected to ground when operating in backup (stand-alone) mode.

#### AC Grid Port:

1. Terminate the AC grid connection wires as follows:  
L = Line  
N = Neutral  
PE = Ground.

PCS cabinet – bottom view

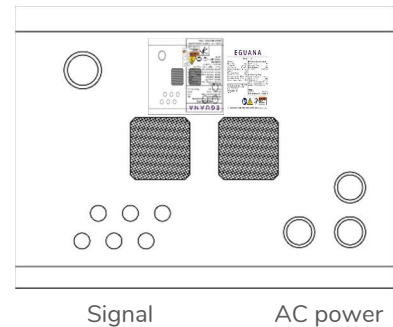


Figure 12: PCS knockout detail.

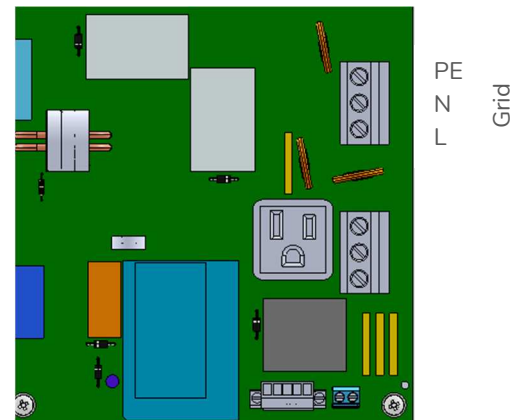


Figure 13: AC power connections.

### 6.2 External AC Circuit Protection Device

An external AC circuit protection device, either breaker or fused disconnect, that isolates all ungrounded conductors, shall be provided by others for the AC Grid output circuit. For outdoor wall mount installations, the disconnect must be rated for outdoor use and include fuse protection of ungrounded conductors (2 pole). The maximum fuse / breaker rating for the external disconnect is determined by the use application of the ESS:

Grid interactive only operation (without backup): 50 Amp

Grid interactive & backup operation: 60 Amp

## 6.3 Chassis Grounding

In this section, “Chassis Ground” is referred to as “ground” or “grounding” unless otherwise mentioned. The AC and DC grounding are intended to provide a low impedance signal path at all frequencies.

DC Ground Wiring Installation: The PCS cabinet is shipped with ungrounded DC power terminals within the inverter. However, the default setting for DC grounding is set for DC negative to ground. This is to indicate that the DC negative terminal of the inverter is grounded within the PCS system. The DC negative ground is completed once terminated in the master battery cabinet.

AC Ground Wiring Installation: The AC power grounding is achieved through the PE terminals of the AC grid connectors on the AC Filter Board, as shown in section 6.1.



**Note:** The field ground wire rating applies to the AC circuit only. The DC source loop is internal to the battery cabinet, and is rated accordingly.

Lightning Grounding: The inverter has built-in lightning protection. In order for the lightning protection to be effective, the grounding for lightning currents must be provided via low impedance path from AC Filter Board to System Ground and further to the building Ground/Earthing point.

## 7 Battery module BMS definitions and operating states

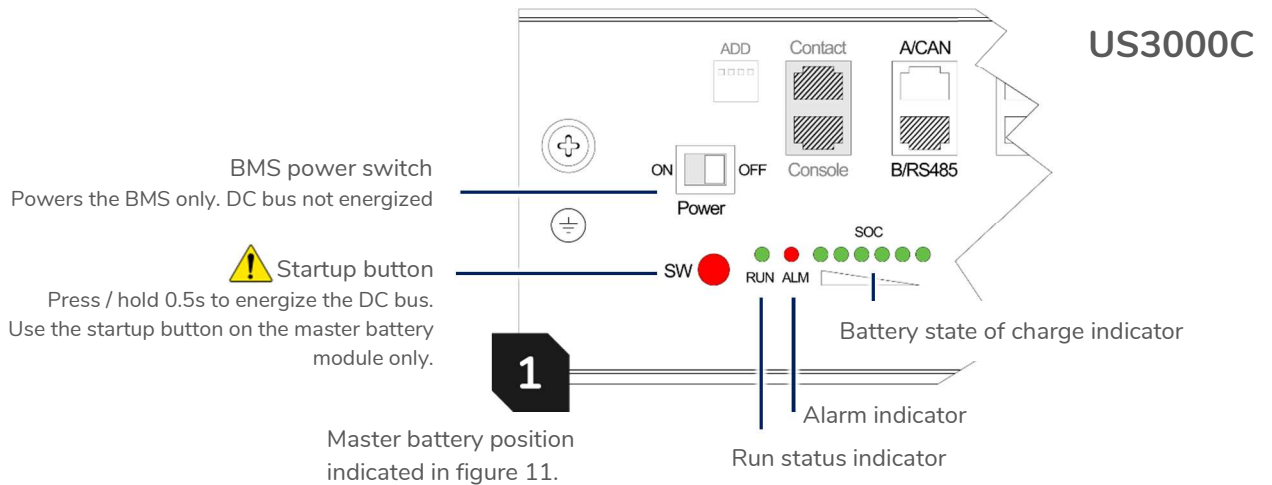
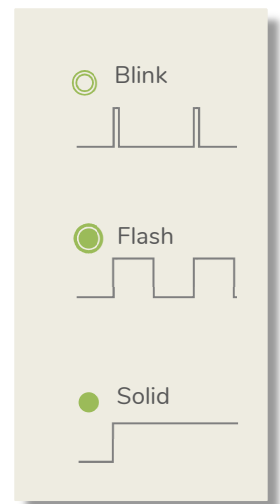


Figure 14: Pylontech US3000C BMS face plate.

Condition	RUN	ALM	SOC.	Each LED represents 16.7% SOC
Power ON	●	●	● ● ● ● ● ● ● ●	Initializing after BMS power switch ON
Idle / Normal	○	●	● ● ● ● ● ● ● ●	
Charge	●	●	● ● ● ● ● ● ● ●	Highest SOC flashes. ex) 50%.
Discharge	○	●	● ● ● ● ● ● ● ●	Show SOC. ex) 33%.
Alarm		●		All other LEDs as per operating condition.
System error/ Protect mode	●	●	● ● ● ● ● ● ● ●	DC bus not energized.



## 8 ESS startup procedure



**CAUTION!** Powering the ESS requires a specific start-up procedure. Please follow the steps below.

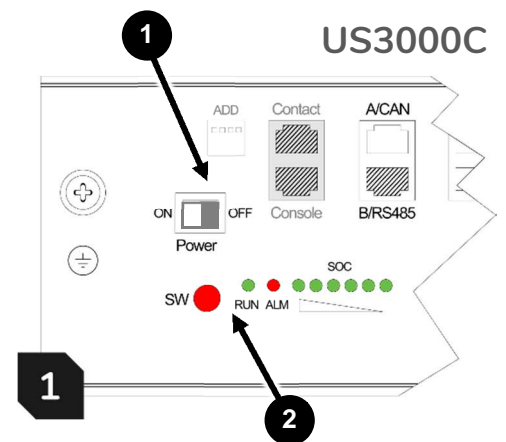


**CAUTION!** If the battery disconnect has been placed in the OFF position at any time during operation, wait one minute before returning to the ON position. Rapid cycling (less than one minute) of the battery disconnect can cause damage to the pre-charge circuit.



**CAUTION!** During the first start-up sequence after installation, the battery modules may require a battery maintenance cycle to balance the SOC. This maintenance cycle requires a grid connection so that the PCS can be commanded to charge the batteries. The PCS battery SOC alarm light will flash yellow if maintenance and/or other battery faults are present. This procedure may take from a few minutes to a few hours, depending on the difference in battery module SOC.

1. Turn ON the BMS power switch to all battery modules in the cabinet.
2. Press and hold the Start button on the master battery module for 0.5 seconds. The master battery is the lower-front module in the battery cabinet. Wait for the battery module to initialize to the normal/idle state. See also figure 11, module position 1 for reference.
3. Turn ON the battery disconnect.
4. Turn ON the external AC source disconnect .



### 8.1 System operation



The ESS is fully automated. The EMC will be programmed to connect the system to the grid after AC and DC sources are applied. The operating states can also be viewed on the PCS display panel. For more details on system operation, refer to the Evolve ESS Owner's Manual. The EMC communicates with the PCS via TCP/IP.

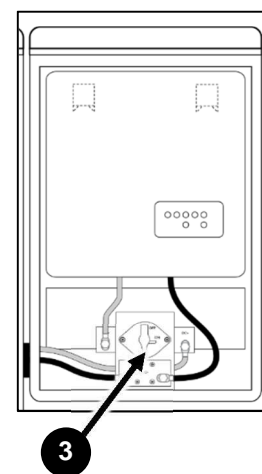


Figure 15: ESS startup procedure.

## 9 PCS Display Panel

### 9.1 LED Display Indicators














The PCS cabinet is equipped with a display panel that provides indication of the following:

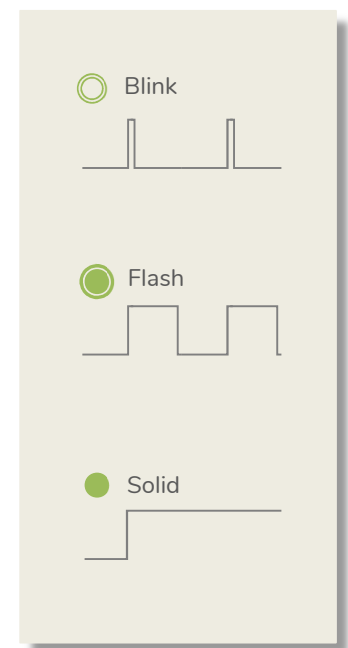
- Battery Operating State
- PCS Operating State
- (out of) Service Indicator

Refer to section 9.2 for a complete definition of indicator states.

To conserve energy, the LEDs will turn off after 5 minutes from being activated. They can be re-activated by pressing the service button.

### 9.2 PCS display panel indicator summary

LED	Mode	Definition
		State of charge. Each LED represents 20% SOC. Solid = battery idle.
		Charge = flash right. Discharge = flash left.
		Low battery.
		Sleep / Standby mode.
		Grid timing mode.
		Grid synchronization mode. Ten second test before grid connect mode.
		Grid connected mode.
		System OK.
		System out of service.
		User initiated service mode.



### 9.3 Service Button

The service button can be used to wake the LED display, and either place the system into or out of service mode, as well as cycle through various operating modes. If the system has gone into service mode, the user can attempt to bring the system back into normal operation using the service button.



**Note:** It is recommended to login to the EMC via web browser and retrieve the service code from the system prior to attempting to clear the service mode.

Observed state	Action	Service button command
All panel lights off	Wake panel display	Press and release
Service light on	Exit service mode	Press and hold 5 seconds

Refer to section 11 – Troubleshooting if the service button does not perform the action requested.

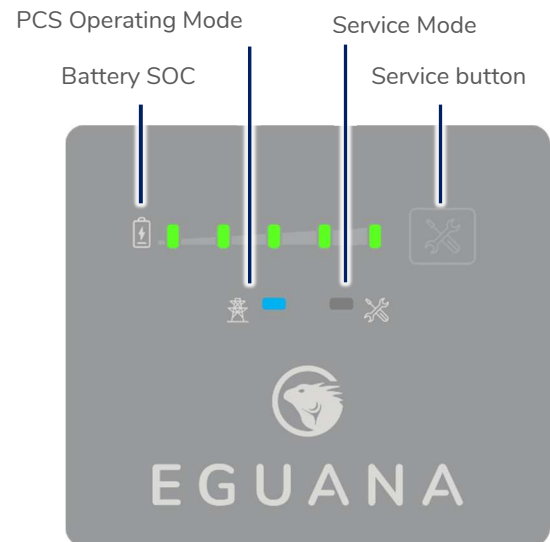




Figure 16: PCS display panel.


## 9.4 Backup Power Operation


This system will provide backup power to dedicated electrical circuits within the home via a permanently wired electrical sub-panel, referred to as the backup panel. Backup power is limited in rating and duration, both of which are dependent on the nature of the loads connected to the system, and the availability of the solar PV supply. This system is designed to reliably provide power to a refrigerator, home lighting, home electronics, and small appliances.

 **NOTE:** This product is not an uninterruptible power source (UPS). Following a utility outage, a four second power interruption will occur before the backup power source commences. As a result of this interruption, a desktop or portable UPS is recommended if continuous operation is desired for any electronic devices.




 **IMPORTANT!** Surge rated loads, i.e. power tools, portable air conditioners, may cause an overload shutdown. Equipment of this type that is connected to the backup panel should be inspected and tested regularly as per manufacturer suggested schedules. Permanent damage to the battery system and/or your equipment may occur if exposed to chronic overloading cycles.

 **IMPORTANT!** Portable extension cords connected to a backup circuit should be limited to 10 meters.

 **IMPORTANT!** This product does not support automatic gas generator integration. Do not attempt to connect a gas generator to the battery system. If generator support is required, consult your installer regarding a separate manual transfer to your backup electrical panel.

 **NOTE:** The power output / surge rating will be further limited when the battery is below 10% SOC.

### 9.4.1 Backup Power Display Modes

Display	Definition
	Battery status LEDs indicate the following: <ul style="list-style-type: none"> <li>• Charge = flash right. Discharge = flash left.</li> <li>• PCS and service lights off.</li> </ul>
	Low SOC shutdown in backup mode. See section 9.5 to restart the system.
	Low SOC shutdown initiated while out of service. See troubleshooting – section 7, “service light on in backup mode”.



## 9.5 Restarting the battery system after low battery shutdown

The system will shut down when the battery reaches a critically low-level during backup operation.

To restart the system:



**IMPORTANT! Ensure there is adequate sunlight for the solar PV system to charge the battery before restarting the system.** If the battery system is installed without a PV system connected to the backup panel, do not attempt to restart the system. Wait for the utility power to return.

1. Press and hold the service button for 5 seconds.



The backup power will restart, allowing the PV system to reconnect\* and begin charging the battery. The system will continue to operate if the battery charges to its minimal normal operating range. If the battery does not charge within 15 minutes of restart, the system will shut down to preserve the battery.

\*PV system reconnect time is approximately 5 minutes.



Note: If necessary, the load circuits can be shut off inside the backup panel to increase the battery charge rate. Do not shut off the PV circuit.

## 10 Maintenance & Service

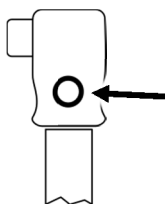
This is a maintenance free product. Regularly scheduled inspection of the airflow path for the active cooling fans on the bottom side of the PCS cabinet is all that is required. This inspection should occur on an annual basis, or coincide with PV inspection.

If the fan ventilation holes are obstructed with dust / debris, a soft-bristled brush can be used to wipe them clean. For heavy soiling use a soft, dry brush. Do not use any solvents, scouring, or corrosive materials to clean the unit. Never remove or unplug connections or plugs during cleaning.

Please contact Eguana technical support @ 1-800-6478 for any service related inquiries.

## 11 Serviceable Parts – Battery module removal/replacement

The battery modules within the battery cabinet are removable and/or replaceable. To replace or remove the battery modules, follow the reverse instructions in section 5 of this manual.



DC module jumper cables

Press & hold the lock button to release the cable from the battery terminal.

## 12 Troubleshooting

System faults are reported and logged in the monitoring system. All fault logs are also accessible remotely by your installer.



**IMPORTANT!** Contact an Eguana service representative as recommended below only after any of the following conditions are present on the front display of the inverter panel, and the recommended actions do not resolve the issue.

Condition	Definition
Service light ON in grid mode	System is prevented from normal operation due to internal fault. Notify service personnel.
Service light ON in backup mode	If the system faults into service in backup operating mode, there may be an overload condition which prevents the system from operating safely. If the battery charge level is greater than 20% (one or more Green LEDs), reduce the load by shutting off circuits in the backup electrical panel, then press and hold the service button 5 seconds to resume backup power operation. If the battery low SOC shutdown mode is displayed, shut off all load circuits (keep PV ON) in the backup panel, and do not attempt to resume backup operation until adequate sunlight is present to provide a solar charge of the battery.
All panel lights flashing	System is attempting to communicate with the battery modules. Notify service personnel if this condition persists more than 30 minutes.
All panel lights OFF after service button wake command	This indicates loss of both AC and DC power sources to the PCS. Check the circuit breaker in the main electrical panel for the energy storage system.
Online monitoring system not accessible	Check the internet connection. If connection is via wi-fi, reboot the wireless router, and make sure the login user and password have not been changed since time of original installation. Check power to the energy management system via the orange indicator light on the right side of the panel. Note: the energy management system may lose power after an extended utility outage where there is not enough solar generation to maintain battery system power. Note: monitoring system servers may occasionally be down for service. If first attempts are not successfully, try again the following day before contacting your installer.

## 13 Decommissioning the ESS

1. Shut OFF the external AC disconnect that feeds the ESS AC grid supply port.



**WARNING!** The AC circuit on the ESS side of the external AC disconnect will remain energized with the ESS operating in backup mode once the disconnect is in the OFF position. The following instructions below must be performed by licensed service personnel only.

2. Remove the PCS cover.
3. Turn the Battery DC Disconnect to the OFF position.
4. Remove the battery cabinet cover.
5. Shut OFF the power switches to each individual battery module in the cabinet.



**WARNING!** If the ESS installation is configured as part of a backup solar plus storage installation using the Evolve Hub Max and a dedicated backup panel, refer also to the Evolve Hub Installation Manual to de-energize the entire system prior to removal of the ESS.

To remove the ESS, follow the assembly instructions in reverse order (refer to sections 6 through 4).

# 14 Specifications

Table 1: PCS Electrical / Mechanical Ratings

Model	ACB05U-PP Max & ACB05U-SP Max (contained in Evolve LFP Max)		
	Grid : Charging	Grid : Discharging	Off Grid
Maximum DC Voltage	80 V DC		
Operating DC Voltage Range	40 to 80 V DC		
Operating DC Voltage Range at 100% Output Power	40 to 80 V DC		
Maximum DC Current	100 A	125 A	125 A
AC Power Factor*	0.8 lagging to 0.8 leading, adjustable		N/A
Operating Voltage Range (default)	105.6 to 132 V AC		N/A
Operating Voltage Range (with ride-through)	60.0 to 132 V AC		N/A
Operating Frequency Range (default)	59.3 – 60.5 Hz		N/A
Operating Frequency Range (with ride-through)	50.0 – 66.0 Hz		N/A
Nominal Output Voltage / Frequency* / phases	120 V AC / 60 Hz / single phase		
Maximum Continuous Output Current / power (total)	41.6 A / 5000 W		
Maximum Allowed Overload Condition (as percentage of maximum continuous current)	100%	100%	100-120 % - 30 minutes 120-170 % - 5 seconds
Maximum Output Overcurrent Protection	60 A		
Short circuit current withstand rating	10 kA		
Maximum AC Short-circuit Current	404 Apk-pk (< 5 ms), 8.0 Arms		
Maximum Synchronization In-rush Current	1.7 Arms		
Protective Class (I, II, or III)	Class I		
Over-Voltage Category (OVC I, II, III, or IV)	OVC III		
Pollution Degree	3		
Lightning protection	IEEE 62.41.2, location category B, low exposure		
Normal Operation Temperature Range / Humidity	-40 to +50 °C (limited by battery, see below)		
Normal Operation Humidity	Max 95% (non-condensing)		
Maximum Full Power Operating Ambient	40 °C	50 °C	
Enclosure Rating	Type 3R		
Dimensions / Weight	20.8"W x 30.8"H x 15.6"D (529 x 783 x 397 mm) / 145 lbs (65 kg)		
Battery BMS	UL60730-1 compliant		
EMS communication port / protocol compliance	TCP/IP / IEEE2030.5 compliant		
PCS (inverter) control	UL1998 compliant		
Default Trip Limits: UL1741 (IEEE 1547.1)			
Low Volt Trip (adj.), Volts	Default	105.6 V AC	N/A
	Min/Max	0 – 105.6 V AC	N/A
Low Volt Trip (adj.), time	Default	1257 cycles (21 Sec.)	N/A
	Min/Max	1257 – 2997cycles (49.95 Sec.)	N/A
High Volt Trip (adj.), Volts	Default	132 V AC	N/A
	Min/Max	132 - 144 V AC	N/A
High Volt Trip (adj.) time	Default	57 cycles (0.95 Sec.)	N/A
	Min/Max	57 – 777 cycles (0.95 – 12.95 sec)	N/A
Undervoltage: (Very Low) Trip Limit	< 60 V AC		N/A
Undervoltage: (Very Low) Trip Time	≤ 117 cycles (1.95 Sec)		N/A
Overvoltage: (Very High) Trip Limit	> 144 V AC		N/A
Overvoltage: (Very High) Trip Time	≤ 10 cycles (0.16 Sec)		N/A
Under Frequency Trip Limits (Adjustable)	Min	50 Hz	N/A
	Default	58.5 Hz	N/A
	Max	59.0 Hz	N/A
Over Frequency Trip Limits (Adjustable)	Min	61.0 Hz	N/A
	Default	61.2 Hz	N/A
	Max	66.0 Hz	N/A
Frequency Trip Limit Accuracy	0.1 Hz		N/A
Frequency Trip Time Accuracy	0.1 Sec		N/A
Voltage Trip Limit Accuracy	2%		N/A
Voltage Trip Time Accuracy	0.043 Sec		N/A
Compliance			
Safety	UL1741, UL 1741SA, UL 1998, UL 9540		

Refer to section 14.1 for operating characteristics in compliance with the UL 1741 SA standard.

**Table 2: PCS Field Wiring Ratings – AWG / Torque**

Field Wiring	Use Copper Wire Only, 90°C or higher rated		
Terminal	Minimum Wire Size mm <sup>2</sup> (AWG)	Maximum Wire Size mm <sup>2</sup> (AWG)	Tightening Torque, Nm (in. lbs)
Ground Lug	16 mm <sup>2</sup> (6 AWG)	16 mm <sup>2</sup> (6 AWG)	5.0 (45)
AC Grid Terminals	10 mm <sup>2</sup> (8 AWG)	16 mm <sup>2</sup> (6 AWG)	5.0 (45)

**Table 3: Battery Cabinet Electrical / Mechanical Ratings**

Model	Battery Cabinet
	Evolve –BP Max (contained in Evolve LFP Max)
Battery Mfr / model / chemistry	Pylontech / US3000C / Lithium Iron Phosphate
Maximum DC Voltage (Cabinet)	80 V DC
Operating DC Voltage Range (Cabinet)	0 to 80 V DC
DC Voltage Range at 100% Output Power	44.5 to 53.5 Vdc
Max DC current rating / Recommended DC current rating	125 A
Max wire size of main DC	70 mm <sup>2</sup> (AWG 2/0)
Disconnect switch, positive pole	500 A
Min DC interrupt capacity	1540 A
Max wire gauge of branch circuit, DC positive cable	70 mm <sup>2</sup> (AWG 2/0)
Grounding terminal, DC negative grounded	70 mm <sup>2</sup> (AWG 2/0)
Max battery module capacity / Usable capacity (x8 modules)	3.55 kWh / 3.2 kWh (28.4/ 25.6 kWh)
Maximum Continuous Output Power (total)	5000 W
Normal Operation Temperature Range	0 to +50 °C charge / -10 to +50 °C charge
Maximum Full Power Operating Ambient	50 °C
Storage Temperature Range (	-20 to +60 °C
Enclosure Rating	Type 3R
Dimensions	22.5"W x 41.0"H x 15.6"D (572 x 1041 x 397 mm)
Weight (including 4 battery modules)	320 lbs (145 kg)
<b>Compliance</b>	
Safety	UL 9540, UL 1973

**Table 4: Battery Cabinet Field Wiring Ratings – AWG / Torque**

Field Wiring	Use Copper Wire Only, 90°C or higher rated		
Terminal	Minimum Wire Size mm <sup>2</sup> (AWG)	Maximum Wire Size mm <sup>2</sup> (AWG)	Tightening Torque, Nm (in- lbs)
Ground Lug (internal)	-	10 AWG home run per module	1.7 (15)
PCS DC+ breaker terminal	-	70 mm <sup>2</sup> ( 2/0) included	1.7 (15)
PCS DC- / field ground	-	70 mm <sup>2</sup> ( 2/0) included	4.0 (35)
Battery Cabinet DC+ Bus	-	70 mm <sup>2</sup> ( 2/0) included	4.0 (35)
Battery Cabinet DC- Bus	-	70 mm <sup>2</sup> ( 2/0) included	4.0 (35)
Battery Cabinet DC+ Module cable	-	21 mm <sup>2</sup> ( 4) included	2.1 (18.5)
Battery Cabinet DC- Module cable	-	21 mm <sup>2</sup> ( 4) included	2.1 (18.5)

## 14.1 UL 1741 SA Grid Support Utility Interactive Inverter Specifications

The PCS within this integrated storage product complies with the UL 1741 SA standard for grid support utility interactive inverters. These functions are intended to be either enabled or disabled in accordance with local utility interconnection requirements. The UL1741SA grid support functions are compliant to the following standards:

- CA Rule 21 (2020 edition)
- IEEE 1547 (2003 edition)
- IEEE 1547.1 (2005 edition)

**Table 5: UL1741 SA grid support functions.**

Grid Support Function Tested	Test Standard
Anti-islanding protection – unintentional islanding with grid support functions enabled	UL 1741 SA 8
Low/high voltage ride through	UL 1741 SA 9
Low/high frequency ride through	UL 1741 SA 10
Ramp rates	UL 1741 SA 11
Reconnect by “Soft Start”	UL 1741 SA 11
Specified power factor	UL 1741 SA 12
Dynamic Volt/VAR operations	UL 1741 SA 13
Frequency-Watt	UL 1741 SA 14
Volt-Watt	UL 1741 SA 15

**Table 6: SA9 Low and high voltage ride through settings.**

SA9 Low and High Voltage Ride Through – CA Rule 21				
Region	Voltage Range [%Vnom]	RideThrough Duration [s]	Maximum Trip Time [s]	Operating Mode During Ride Through
High Voltage 2 (HV2)	$V > 120\%$	N/A	0.16	N/A
High Voltage 1 (HV1)	$110\% < V \leq 120\%$	12	13	Momentary Cessation (zero power)
Near Nominal (NN)	$88\% \leq V \leq 110\%$	Indefinite	N/A	Continuous Operation
Low Voltage 1 (LV1)	$70\% \leq V < 88\%$	20	21	Mandatory Operation
Low Voltage 2 (LV2)	$50\% \leq V < 70\%$	10	11	Mandatory Operation
Low Voltage 3 (LV3)	$V < 50\%$	1	1.5	Momentary Cessation (zero power)
Value for CA Rule 21				
Parameter	Value for CA Rule 21			
Nominal AC voltage [V]	120			
AC voltage accuracy [%Vnom or V]	2%, 2.4V			
Voltage trip time accuracy [s]	0.043			
Minimum under-voltage [%Vnom]	50.0%			
Maximum over-voltage [%Vnom]	120.0%			
Default function status	Enabled			

Table 7: SA10 Low and high frequency ride through settings.

SA10 Low and High Frequency Ride Through – CA Rule 21				
Region	Frequency Range [Hz]	RideThrough Duration [s]	Maximum Trip Time [s]	Operating Mode During Ride Through
High Frequency 2 (HF2)	$f > 62.0$	N/A	0.16	N/A
High Frequency 1 (HF1)	$60.5 < f \leq 62.0$	299	300	Mandatory Operation (FW)
Near Nominal (NN)	$58.5 \leq f \leq 60.5$	Indefinite	Indefinite	Continuous Operation
Low Frequency 1 (LF1)	$57.0 \leq f < 58.5$	299	300	Mandatory Operation
Low Frequency 2 (LF2)	$f < 57.0$	N/A	0.16	N/A
Parameter		Value for CA Rule 21		
Nominal frequency [Hz]		60		
AC frequency measurement accuracy [Hz]		0.02		
Frequency trip time accuracy [s]		0.1		
Minimum under-frequency [Hz]		53.0		
Maximum over-frequency [Hz]		64.0		
Maximum trip time [s]		1000.0		
Default function status		Enabled		

Table 8: SA11 Ramp rate settings.

SA11 Ramp Rates	
Parameter	Value for CA Rule 21
Output current rating for function [A]	41.6
Minimum normal ramp up rate [%I <sub>rated</sub> /sec]	1.0%
Maximum normal ramp up rate [%I <sub>rated</sub> /sec]	100.0%
Minimum output current [A]	0
Ramp rate accuracy [%I <sub>rated</sub> /sec]	N/A
Minimum soft start ramp up rate [%I <sub>rated</sub> /sec]	0.1%
Maximum soft start ramp up rate [%I <sub>rated</sub> /sec]	100.0%
Default normal ramp up rate [%I <sub>rated</sub> /sec]	100.0%
Default soft start ramp function status	Enabled
Default soft start ramp up rate [%I <sub>rated</sub> /sec]	2.0%

Table 9: SA12 Specified power factor settings.

SA12 Specified Power Factor	
Parameter	Value for CA Rule 21
Apparent power rating for function [VA]	5000
Output power rating for function [W]	5000
DC input voltage range with function enabled [V]	40.0 - 80.0
Nominal AC voltage [V]	120
AC voltage range with function enabled [V]	105.6 - 132.0
AC voltage accuracy [%Vnom or V]	2%, 2.4V
DC voltage measurement accuracy [V]	0.05
Active power range of function [W]	1000 - 5000
Power Factor Accuracy	0.03
Power Factor settling time [sec]	5
Minimum inductive power factor	-0.9
Minimum capacitive power factor	0.9
Mid inductive power factor	-0.9
Mid capacitive power factor	0.9
Default function status	Disabled
Power factor default	-0.95

Table 10: SA13 Volt VAR Mode

SA13 Volt-VAr Mode	
Parameter	Value for CA Rule 21
Apparent power rating for function [VA]	5000
Output power rating for function [W]	5000
EUT input voltage range with function enabled [V]	40.0 - 80.0
Nominal AC EPS voltage [V]	120
AC EPS voltage range with function enabled [V]	96.0 - 144.0
Reactive power accuracy [%Prated, VAr]	8%, 400VAr
Maximum ramp rate [VAr/s]	500
Maximum rated reactive power production (capacitive, overexcited) [VAr]	2200
Maximum rated reactive power production (inductive, underexcited) [VAr]	-2200
Minimum rated reactive power production (capacitive, overexcited) [VAr]	250
Minimum rated reactive power production (inductive, underexcited) [VAr]	-250
Maximum slope [VAr/V]	611
Deadband range [V]	4.8 - 18.0
Time accuracy [s], related Tr-vv	2
Settling time [s]	3
Default function status	Enabled
Default response time, ramp to Qmax,ind [s]	10
Default power prioritization	Q
Default Voltage at Q1 [V]	114.6
Default max reactive power production setting [VAr], Q1	1500
Default voltage at Q2 [V]	117.06
Default reactive power setting at lower voltage deadband limit [VAr], Q2	0
Default voltage at Q3 [V]	122.4
Default reactive power setting at upper voltage deadband limit [VAr], Q3	0
Default voltage at Q4 [V]	125.4
Default max reactive power absorption setting [VAr], Q4	-1500

\* Volt-VAr mode can function with active or reactive power priority. When an inverter is set in Volt-VAr mode with reactive power priority and the inverter's apparent power kVA limit is reached, active power is reduced to maintain reactive power production. When an inverter is set in Volt-VAr mode with active power priority and the inverter's apparent power kVA limit is reached, the reactive power is reduced to maximize active power production.



Table 11: SA14 Frequency-Watt settings.

SA14 Frequency Watt	
Parameter	Value for CA Rule 21
Output power rating for function [W]	5000
AC frequency range with function enabled [Hz]	50.0 - 66.0
AC frequency measurement accuracy [Hz]	0.02
P(f) accuracy [%Prated or W]	5%, 250W
Settling time [sec]	3
Adjustment range of response time [s]	0.5 - 5.0
Adjustment range of the start of frequency droop [Hz]	59.964 – 63.0
Maximum slope of frequency droop [%Prated/Hz]	100.0%
Minimum slope of frequency droop [%Prated/Hz]	50%
Default function status	Enabled
Default response time, ramp to 10% Prated [s]	0.5
Default start frequency [Hz]	60.5 – 63.0
Default slope of frequency droop [%Prated/Hz]	50.0%
Default use of hysteresis (symmetric recovery)	Enabled
Under-frequency response function status	Enabled
Default under-frequency start [Hz]	59.964
Default slope of under-frequency droop [%Prated/Hz]	50.0%

Table 12: SA15 Volt-Watt Settings.

SA15 Voltage Watt	
Parameter	Value for CA Rule 21
Output power rating for function [W]	5000
AC voltage range with function enabled [V]	120.0 - 132.0
Nominal AC voltage [V]	120
AC voltage accuracy [%Vnom or V]	2%, 2.4V
Output power accuracy [%Prated or W]	10%, 1000W
Time accuracy [s]	2
Settling time [sec]	3
Adjustment range of the start of active power reduction [V]	122.4 – 127.2
Adjustment range of the stop of the curtailment function [V]	121.2 – 129.6
Maximum Slope of active power reduction [%Prated/V]	33.3%
Minimum slope of active power reduction [%Prated/V]	21.0%
Range of adjustment of a delay before return to normal operation [sec]	1.0 – 60.0
Adjustment range of the rate of return to normal operation [%Prated/sec]	10.0 - 100.0%
Default function status	Disabled
Power duration reference	Pre-disturbance
Default response time, ramp to 10% Prated [s]	1
Default start voltage [V]	127.2
Default stop voltage [V]	126.0
Default active power slope [%Prated/V]	20.8%
Default use of hysteresis (symmetric recovery)	Disabled
Default delay before return to normal operation [s]	1
Default active power rate of return to normal operation [%Prated/s]	100

## 14.2 Thermal performance: Charge / Discharge Curves

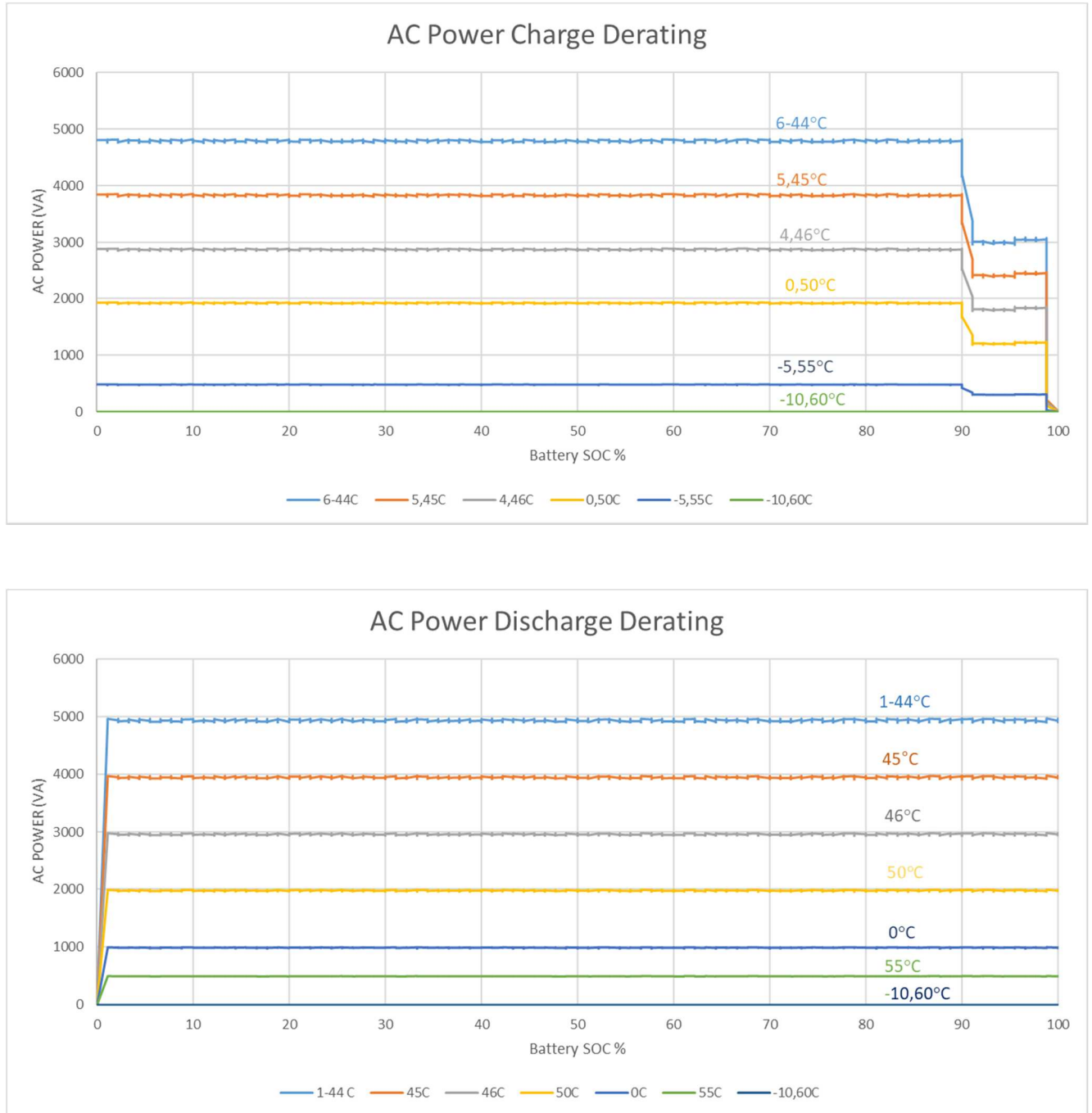


Figure 17: Energy storage system thermal derated charge and discharge curves with base battery cabinet including four Pylontech US3000C modules.

# INSTALLATION NOTES

