

**4.98
kWh**



Installation Manual

SimpliPHI™ 4.9 Battery

SimpliPHI Your Energy Security and Independence

and gain control of your own power.

SimpliPHI helps you manage your power as a personal resource. Anytime. Anywhere. SimpliPHI energy storage optimizes integration of any power generation source – solar, wind, generator – on or off grid, and protects your home and mission-critical business functions from power outages and intermittency. SimpliPHI storage technology reduces operating temperature constraints, the risk of thermal runaway, and eliminates toxic coolants. Safer lithium ferrous phosphate (LFP) chemistry that does not contain cobalt, the rare earth metal that drives thermal runaway.

SimpliPHI's battery technology utilizes the industry's most environmentally benign chemistry (LFP) combined with proprietary architecture and power electronics (BMS) to create a portfolio of high performance, scalable and enduring energy storage solutions that provide power security, resilience and daily cycling for savings on your utility bill.

Briggs & Stratton offers proprietary, commercially available energy storage and management systems that are safer, low-toxicity, reliable, durable, efficient, highly scalable, and economical over the lifetime of the SimpliPHI ESS.

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Safety Information

Important Safety Instructions

SAVE THESE INSTRUCTIONS – This manual contains important instructions that must be read, understood and obeyed during installation of ESS and/or accessories.



WARNING! LOSS OF LIFE. THIS PRODUCT IS NOT INTENDED TO BE USED IN A CRITICAL LIFE SUPPORT APPLICATION. FAILURE TO ADHERE TO THIS WARNING COULD RESULT IN DEATH OR SERIOUS INJURY



DANGER! INDICATES A HAZARDOUS SITUATION WHICH WILL RESULT IN DEATH OR SERIOUS INJURY. THESE CONDITIONS WILL RESULT IN THE TERMS OF THE WARRANTY BEING VIOLATED.



WARNING! WARNINGS IDENTIFY CONDITIONS OR PRACTICES THAT COULD RESULT IN PERSONAL INJURY AND SEVERE DAMAGE TO THE SYSTEM. THESE CONDITIONS WILL RESULT IN THE TERMS OF THE WARRANTY BEING VIOLATED.



CAUTION! CAUTIONS IDENTIFY CONDITIONS OR PRACTICES THAT COULD RESULT IN DAMAGE TO THE UNIT OR OTHER EQUIPMENT CONNECTED. THESE CONDITIONS CAN RESULT IN THE TERMS OF THE WARRANTY BEING VIOLATED.



WARNING! INDICATES AN ELECTRIC SHOCK HAZARD.



CAUTION! BEFORE INSTALLING AND USING BATTERIES, READ ALL INSTRUCTION MANUAL AND CAUTIONARY MARKINGS ON THE BATTERY AND ALL APPROPRIATE SECTIONS OF THIS GUIDE.



CAUTION: THIS MANUAL IS SPECIFIC TO THE SIMPLIPHI BATTERIES THAT FEATURE INTERNAL COMMUNICATIONS WITHIN THE BMS. DO NOT FOLLOW THESE GUIDELINES IF YOU ARE USING THE STANDARD PHI PRODUCT LINE. PLEASE CONSULT THE INSTALLATION MANUAL SPECIFIC FOR YOUR BATTERIES FOUND HERE: [SIMPLIPHI PHI BATTERY INSTALLATION MANUAL LINK](#)



CAUTION: THESE 3 THINGS WILL VIOLATE THE TERMS OF THE WARRANTY & DAMAGE THE BATTERIES. READ IN FULL PRIOR TO BATTERY INSTALLATION

Warranty Statement

The following abbreviated guidelines do NOT encompass all SimpliPHI Battery Warranty details. Failure to adhere to the Warranty and Installation Manual requirements will violate the terms of the Warranty. Read the battery's complete Warranty prior to installation and register the battery according to the form found at the bottom of the same web page address: <https://simpliphipower.com/wp-content/uploads/documentation/SimpliPHI-series/warranty.pdf>

Before using the battery, please read all instructions and cautionary markings on the unit and this manual. Store the manual where it can be accessed easily.

This manual is for qualified personnel. The tasks described in this manual may be performed by qualified personnel only.

CAUTION: The following will result in damage to your PHI batteries and will **violate the terms of the Warranty**:

1. Incorrect battery wiring and/or installation

- a. Verify polarity at all connections with a standard voltmeter if applicable (1) before energizing the system and (2), before switching the built-in circuit breaker to the "ON" position. Reverse polarity at the SimpliPHI Battery terminals will violate the terms of the Warranty and may permanently damage the SimpliPHI Batteries.
- b. SimpliPHI Batteries must be **fully charged before commissioning** (i.e. before connecting loads). Failure to do so will damage the SimpliPHI batteries and violate the terms of the Warranty.
- c. Lugs, washers and lug nuts must be installed according to the Installation Manual. Failure to do so will damage the SimpliPHI Batteries and violate the terms of the Warranty.

2. Pairing the battery with incompatible equipment.

Use of accessories not recommended or sold by the manufacturer may result in a risk of fire, electric shock, or injury to persons and will violate the terms of the Warranty.

- a. Contact Technical Support at (805) 640-6700 x 1 regarding the compatibility of any equipment not explicitly listed in the 'SimpliPHI Integration Guides' section of the Product Documentation web page (<https://simpliphipower.com/product-documentation/>).

3. Incorrect inverter and/or charge controller settings.

Operating the SimpliPHI Battery in conjunction with equipment not programmed to the SimpliPHI Battery's settings will violate the terms of the Warranty.

- a. Refer to the 'SimpliPHI Integration Guides' section of the Product Documentation web page (<https://simpliphipower.com/product-documentation/>) for all inverter and charge controller settings.
- b. Although each SimpliPHI Battery contains an internal Battery Management System (BMS) with circuitry that protects the SimpliPHI Battery cells from over-charge, over-discharge and extreme load amperage, the SimpliPHI Battery must always be installed with appropriate inverter and/or charge controller settings and power electronics to protect the SimpliPHI Battery from open solar photovoltaic (PV) voltage and other high voltage charging sources.
- c. Failure to protect the SimpliPHI batteries from voltages higher than the battery voltage rating (48-56 VDC) will destroy the SimpliPHI batteries, cause electrical fires and violate the terms of the Warranty.

The SimpliPHI Battery Warranty does NOT cover product damage caused by mishandling or improper use per the Installation Manual, Integration Guides and Warranty, exposure to corrosive liquids or solvents, impacts from falling objects or from being dropped, or attempts to repair the battery by any party other than SimpliPhi. The complete list of Warranty Exclusions is included in the SimpliPHI Battery Warranty document: <https://simpliphipower.com/wp-content/uploads/documentation/SimpliPHI-series/warranty.pdf>

1.0 – Introduction

1.1 – Online Resources

The Product Documentation section of our web site (<https://simpliphipower.com/product-documentation/>) includes Specification Sheets, Warranties, Installation & Operator's Manuals, and Integration Guides for all Briggs & Stratton's current and legacy products.

Briggs & Stratton's YouTube channel (https://www.youtube.com/channel/UCcuCaLT_G3Hhumteh-pl5yg/videos) has instructional videos showing various steps of the battery installation process in detail.

1.2 – Technical Support

ESS Technical Support (805-640-6700 x 1, ESSTech@basco.com) is available to take any questions regarding this manual or general installation questions. For assistance with battery system commissioning, Briggs & Stratton asks that a commissioning call be **scheduled ahead of time** with Technical Support.

We encourage you or your installer to contact ESS Tech Support with any questions. We are committed to working with you and your installation team to achieve a safe, reliable storage system that will provide years of maintenance-free service that is covered by our Warranty terms & conditions.

1.3 – Product Overview

The SimpliPHI deep-cycle Lithium Ferro Phosphate (LFP) Battery is optimized with proprietary cell architecture, power electronics, Battery Management System (BMS) with communications, manufacturing materials and processes. This assures the highest grade and quality, longest cycle-life, greatest efficiency and freedom from material impurities, toxicity and hazardous risk. The SimpliPHI Battery is modular, lightweight and scalable. It provides power security and seamless integration of renewable and traditional sources of energy in conjunction with or independent of the grid.

1.3.1 – Battery Management System (BMS)

Each SimpliPHI Battery contains circuitry that protects the LFP cells from damaging conditions (overcharge, over-discharge, extreme load amperage, etc.). If pre-programmed BMS values are exceeded, the protective circuitry will shut down the flow of electricity to/from the SimpliPHI Battery. In some cases, the BMS will automatically resume the flow of electricity to/from the SimpliPHI Battery when the battery is no longer in damaging conditions. In other cases, the SimpliPHI Battery's self-protection mechanism will result in the battery's breaker tripping and requiring a manual re-set (refer to Section 6.0 - Troubleshooting of this Manual for manual re-set instructions).

Regardless, once SimpliPHI Battery operation resumes and the connected inverter is back on, SimpliPhi recommends checking that the inverter's settings are still correct. Often, inverter system settings will be saved within the inverter memory storage and will not need to be reset. However, refer to SimpliPhi's SimpliPHI Integration Guides for inverter and/or charge controller settings to verify the set-point values. (<https://simpliphipower.com/product-documentation/>).

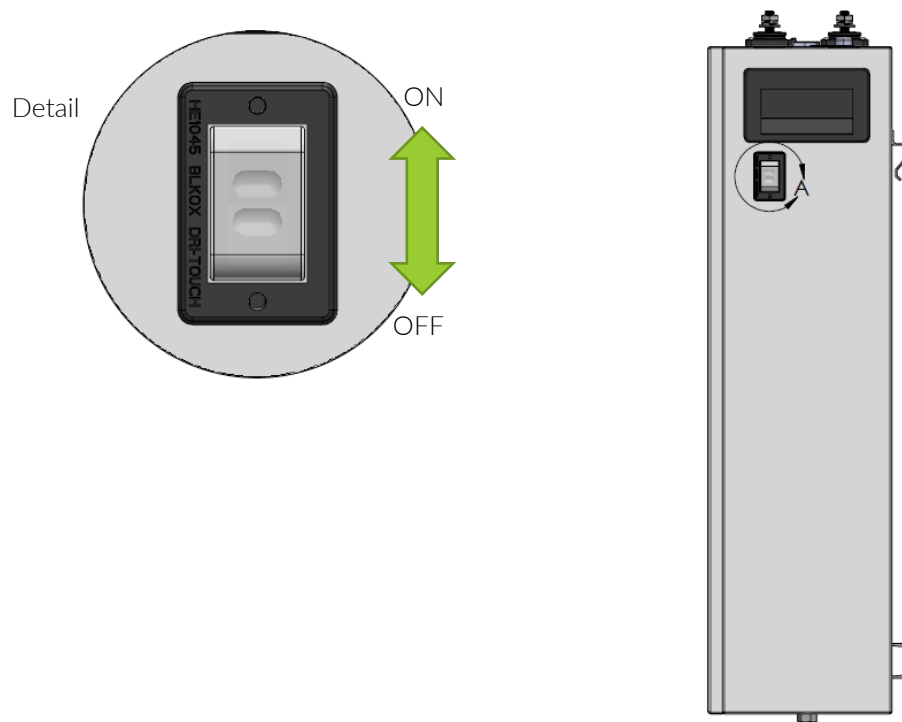


CAUTION: Although each SimpliPHI Battery contains an internal communication based BMS with circuitry that protects the SimpliPHI Battery cells from over-charge, over-discharge and extreme load amperage, the SimpliPHI Batteries must always be installed with appropriate inverter and/or charge controller settings to protect the SimpliPHI Battery from open PV voltage and other high voltage charging sources. Exposure to higher voltage than the SimpliPHI battery rating (48-56 VDC) will violate the terms of the Warranty and may damage the SimpliPHI batteries.

1.3.2 – Built-In Breaker

SimpliPHI batteries are outfitted with a hydraulic/magnetic circuit breaker. This breaker increases safety during shipping and installations and allows the battery to effectively be turned “OFF” or “ON.” The breaker works in conjunction with the battery’s built-in BMS and creates additional safety, efficiency and functionality in the overall power storage system.

Figure 1.0 – SimpliPHI 4.9 Circuit Breaker



NOTE: Circuit breakers, disconnects and fuses should be employed throughout several points of a power storage and generation installation to effectively isolate and protect all components of the system to safeguard against faults, short circuits, polarity reversals or a failure of any component in the overall system. Fuses, breakers, wiring ratings and values should be determined by established electrical codes and standards and evaluated by certified electricians, installers, and regional code authorities.

1.3.3 – Networking Communication Cables & Plugs

Each SimpliPHI battery comes with a 4' CAT5 cable and a terminator plug for networking communication set-up (explained in greater detail in Section 4.7 – Communications Wiring).

1.4 – Specifications

Please review the tables below for SimpliPHI 4.9 battery specifications.

Table 1.0 - SimpliPHI 4.9 Performance Specifications

DC Voltage - Nominal	51.2 VDC
DC Operating Voltage Range	48 VDC to 56 VDC
Amp-Hours	97 Ah
Rated Capacity	4.98 kWh DC at 100% DoD 3.98 kWh DC @ 80%
MAX Surge Discharge Rate (10 minutes)	100 Amps DC (5.1 kW DC)
MAX Continuous Discharge & Charge	48.5 Amps DC (2.5 kW DC)
DC Voltage Range ¹	48 to 56 VDC
Depth of Discharge ¹	up to 100%
Operating Efficiency	96%
Self-Discharge Rate	< 1% per month (when off)
Memory Effect	None
Cycle Life	10,000+ cycles (@ 80% DoD)
Warranty Period	15 Years

Notes:

¹ Max operating ranges. Refer to Warranty for recommended conditions.

Table 1.1 - SimpliPHI 4.9 Mechanical Specifications

Dimensions (W x H x D)	23 x 28.5 x 8.5 in. (30" H w/terminals) / 3.2 ft ³ (584 x 724 x 216 cm / 0.1 m ³)
Weight	160 lbs. (73 kg)
Terminal Size	3/8" (10mm) threaded studs
Minimum Battery Cable Size	4/0 (battery to battery) 2/0 (battery to inverter)

Table 1.2 - SimpliPHI 4.9 Installation Specifications

Maximum Battery Quantity per System	60 batteries (298.8 total kWh @ 100% DoD)
Comms Compatible Inverters	SimpliPHI 6kW, Sol-Ark
Mounting	Wall Mount

Table 1.3 - SimpliPHI 4.9 Environmental Specifications

Charging Temperature	32° to 120° F (0° to 49° C)
Operating Temperature	-4° to 140° F (-20° to 60° C)
Storage Temperature	6 months: 14° to 77° F (-10° to 25° C)
Enclosure	IP 65 with terminal covers

Table 1.4 - SimpliPHI BMS Specifications

SimpliPHI 4.9™ Internal BMS	
Programmed Absorb Voltage	56 VDC
Programmed Float Voltage	54 VDC
Over-Voltage Fault Trip ²	60 VDC
Low-Voltage Fault Trip ²	45 VDC
Programmed Discharge & Charge Rate per Battery ²	48.5 Amps DC (2.5 kW DC)
Charging Low Temperature Fault Trip ²	32° F (0° C)
Discharging Low Temperature Fault Trip ³	-4° F (-20° C)
High Temperature Fault Trip ³	158° F (70° C)
Maximum Quantity of Networked Batteries	60
Networking Cable	CAT5 or greater
Networking Port	RJ45

Notes:

²These SimpliPHI BMS Fault Trip conditions result in the need for the BMS to be re-set **manually** (refer to Section 6.0 - Troubleshooting of this Manual)

³These SimpliPHI BMS Fault Trip conditions result in automatic BMS reconnection when fault conditions are no longer detected. There is no need to re-set the BMS manually in these instances.

Specifications are typical/nominal. (Subject to change without notice, refer to most recent edition of Installation Manual and Firmware version information on our website.)

2.0 – Safety

For safety reasons, read all instructions and cautionary markings on the SimpliPHI Batteries, and all appropriate sections of this manual. Failure to follow instructions provided in the Installation Manual, Integration Guides and/or Warranty will violate the terms of the Warranty and damage the batteries.

2.1 – General Safety Instructions

- Do not operate if the SimpliPHI Battery has been damaged in any way during shipping or on-site.
- To reduce the chance of short-circuits, always use insulated tools when installing or working with SimpliPHI batteries or other electrical equipment.
- Remove personal metal items such as rings, bracelets, necklaces, and watches when working with SimpliPHI batteries and electrical equipment. Wear insulated gloves and rubber shoes.
- SimpliPHI Batteries pose some risk of shock or sparking during the installation and initial wiring and connection process. This is consistent with all other battery-based storage formats. To minimize the risk of shock or sparks during the installation and commissioning of the system, make sure the built-in breaker is in the “OFF” position.
- To avoid a risk of fire and electric shock, make sure that existing system wiring is in good condition and that the wire is not undersized. Do not operate the SimpliPHI Battery in conjunction with damaged or substandard wiring or balance of system equipment.

These safety precautions are in addition to the Warnings previously outlined on page 4 of this Manual.

2.2 – Response to Emergency Situations

As with any battery, if the SimpliPHI Battery's cells are severely damaged due to physical abuse, reverse polarity, high voltage, unmitigated current or other electrical phenomenon incurred outside of Warranted installation specifications, it can cause electrolyte leakage and other failures. The electrolyte can be ignited by an open external flame. However, unlike other lithium-ion batteries with cobalt oxides (e.g. LCO, NCM and NCA), the SimpliPHI LFP Batteries' electrolyte and other material components generate a limited amount of heat and do not go into a state of unmitigated thermal runaway with fire propagation. The SimpliPHI UL 1973 Battery Certification verifies "No Thermal Runaway" (see MSDS for chemical analyses). Additional fire safety testing was conducted through UL 9540A protocols which has demonstrated that SimpliPHI batteries do NOT go into unmitigated thermal runaway, fire propagation or deflagration when installed in properly operating systems per this manual.

While SimpliPHI Batteries do not go into thermal runaway with fire propagation, the following protocol should be followed in the event that the SimpliPHI Batteries are subjected to electrical fire caused by other system components or failures:

- Ensure that the system is no longer energized, either from the solar array or the grid (main disconnect).
- Separate any external cables from batteries if present (cut if necessary) using insulated tools.
- Wear a respirator or dust mask to avoid inhaling soot/dust.
- Wear insulating and abrasion-resistant gloves (if permeable, over nitrile or similar gloves).
- Move battery debris into non-conductive bins capable of handling the weight.
- Dispose as regulations require.



CAUTION: While water is an acceptable and effective extinguishing agent for the SimpliPHI Battery model, the Balance of System equipment used in conjunction with the SimpliPHI Batteries may require specialized extinguishers such as FM-200 or CO2 suppression systems.

3.0 – Pre-Installation

3.1 – SimpliPHI Battery Performance

SimpliPHI Batteries do not need to be de-rated unless running continuously at more than 90% capacity. To achieve the greatest cycle life of 10,000 cycles, it is recommended that the SimpliPHI Batteries are operated at 80% maximum Depth of Discharge.

Due to the SimpliPHI Battery's internal self-protection mechanisms, the battery will not charge when internal battery temperatures are below 32° F (0° C), will not discharge when internal temperatures are below -4° F (-20° C), and will not charge or discharge when internal temperatures exceed 158° F (70° C).

All SimpliPHI Batteries are balanced during final production and testing stages. Following proper wiring guidelines **and fully charging the SimpliPHI batteries prior to applying loads** ensures that a system will not require any manual balancing processes.

3.2 – SimpliPHI Battery System Sizing

SimpliPHI Batteries are designed to operate at the continuous ratings specified in Table 1.0 – SimpliPHI Battery Specifications. SimpliPHI Batteries with communications, when paired with an approved inverter will enable proper settings for any size battery bank up to **60 battery modules**. Settings also specified in Table 1.0 will be automatically communicated to the inverter. Battery bank sizes larger than 60 battery modules are not supported since sufficient communications to the inverter and between the batteries cannot be achieved.



CAUTION: An SimpliPHI Battery bank cannot exceed 60 battery modules per bank. Sizing SimpliPHI battery banks larger than 60 battery modules potentially causes damage to the SimpliPHI batteries and violates the terms of the Warranty.

3.2.1 – Sizing for All Systems

SimpliPHI Batteries in DC Coupled or AC Coupled Systems should be sized according to the connected loads' energy (kWh) and power (kW) requirements. While as few as one SimpliPHI Battery may be paired with compatible equipment without voiding the battery warranty, consider that the SimpliPHI Battery is rated according to the specifications listed in Table 1.0 above and that, without a backup AC power source, loads that exceed the battery bank's total capacity or power rating will result in the entire system shutting down.

3.2.2 – Additional Sizing Considerations for AC Coupled Systems

In an AC Coupled system, significantly limiting the solar array's charging power does not work well. In addition, because the solar charging cycle in an AC coupled system will frequently have minimal absorb time, the level of charge achievable with a full absorb is not equivalent to the battery's 100% SoC. This effect is less significant at slower charging rates. Therefore, **it is recommended that the system is sized with a larger battery bank relative to the AC Coupled PV array**. In the below AC Coupling example, the batteries' typical maximum continuous charge rate is multiplied by a de-rate factor of **0.8**.

The charge calculation uses the nomenclature below:

$$\begin{aligned} \text{Battery maximum continuous charge rate (kW}_{\text{DC}}) &= \text{Bat}_{\text{kW}} \text{ (typically @ C/2)} \\ &= (\text{maximum battery charge current} \times \text{battery voltage nominal}) \end{aligned}$$

$$\text{PV charge maximum} = \text{PV}_{\text{kW}}$$

$$\text{Charge Example: } B_{\#PV} \geq \frac{\text{PV}_{\text{kW}}}{0.8 \times \text{Bat}_{\text{kW}}}$$

AC Coupled Solar PV Array is rated at 8 kW

SimpliPHI 4.9 battery has a maximum continuous charge rate of 2.5 kW_{DC}

$$B_{\#PV} \geq \frac{8_{\text{kW}}}{0.8 \times 2.5_{\text{kW}}} = 4$$

A properly sized SimpliPHI battery bank based on the maximum charge from the AC Coupled solar PV array has a minimum of 4 batteries. This helps ensure that the battery bank receives as much charge as possible from the AC Coupled solar PV.



CAUTION: Using fewer than the calculated number of SimpliPHI batteries in this AC Coupled charge calculation may result in limited and ineffective charging from AC coupled PV in Off-Grid or Grid-Outage conditions.

For specific settings related to the inverter's charge and discharge rates in an AC Coupled system, please refer to the inverters integration guide.

4.0 – Installation

4.1 – Installation Options

The SimpliPHI 4.9 Batteries are designed to be wall mounted only, with terminals facing up. Do *not* install them upside down, with the terminals facing the floor. This will violate the terms of the Warranty. A maximum of 60 SimpliPHI batteries can be connected together via their communications cables to an approved inverter.

4.2 – Environmental Considerations

4.2.1 – Charging & Discharging at Temperatures Below Freezing and Above 70° C

The SimpliPHI Battery's internal BMS and protective circuitry prevent it from charging below 32° F (0° C) and discharging below -4° F (-20° C). Therefore, install the battery in conditions where ambient temperature does not drop below freezing in order to maintain optimal SimpliPHI battery system operability. Additionally, when connected over CAN to an approved inverter, the charge and discharge rates will automatically curtail when internal battery temperature exceeds recommended values. The charge and discharge rates of the SimpliPHI battery will automatically curtail the charge and discharge current from the inverter based on internal battery temperature based on the chart below:

Table 4.0 – Charge Curtailment at Temperature

Temperature	Charge Current	Discharge Current
Below -20° C	0A	0A
-20° C to -10° C	1A	48.5A
-10° C to 0° C	3A	48.5A
0° C to 7° C	20A	48.5A
7° C to 50° C	48.5A	48.5A
50° C to 70° C	15A	48.5A
Above 70° C	0A	0A

4.2.2 – Explosive Gas Precautions

SimpliPHI Batteries are not ignition protected. To prevent fire or explosion, do not install this product in locations that require ignition-protected equipment. This includes any confined space containing different vented batteries, or flammable chemicals such as, natural gas (NG), liquid petroleum gas (LPG) or gasoline (Benzine/Petrol).

Do not install in a confined space with machinery powered by flammable chemicals, or storage tanks, fittings, or other connections between components of fuel or flammable chemical systems.

SimpliPHI Batteries do not vent any harmful gasses and do not require special ventilation or cooling.

4.2.3 – Anti-Corrosion Protection

Anticorrosive compounds or epoxies are occasionally used in harsh or marine climate installations. Please consult your electrician or qualified installer to determine if this is advisable, and if so, what solution best suits your application. SimpliPHI Batteries are powder-coated steel and may exhibit discoloration when exposed to extreme elements and harsh chemicals. This discoloration will not affect battery performance and is not covered under Warranty. Batteries should be installed in locations in which they are not exposed to saltwater spray or chemicals that may cause discoloration.



CAUTION: Do not combine SimpliPHI Batteries with other brands, chemistries, or models (including the standard PHI model batteries). Do not mix SimpliPHI Batteries from different installations, clients or job sites. Either of these combinations will violate the terms of the Warranty.

4.3 – Mounting Hardware

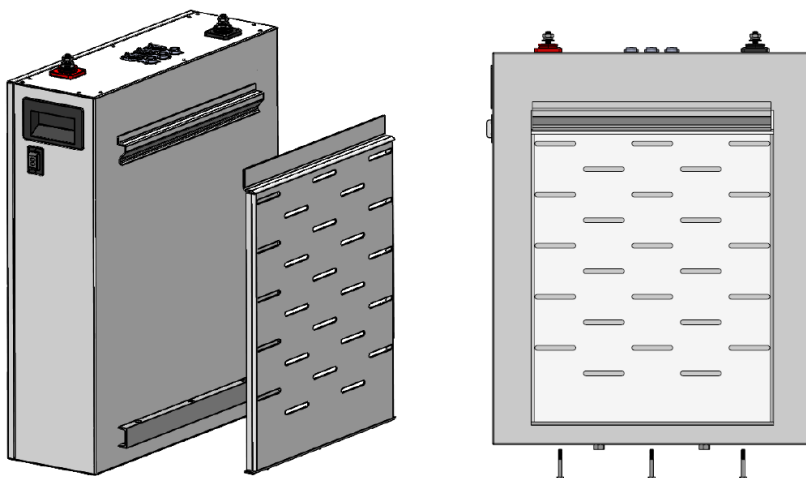
SimpliPHI Battery wall bracket is designed to secure one SimpliPHI 4.9 Battery to a load bearing surface. The brackets can be mounted directly to a wall or can be arranged on strut channels for ease of positioning (mounting hardware other than wall brackets are not included). Mounting brackets should be mounted into load bearing beams, studs, or solid materials with appropriate fasteners. A qualified installer familiar with the appropriate load bearing requirements must accomplish this. Briggs & Stratton is not liable for damage caused by the inappropriate installation of mounting brackets. Refer to Table 2.0 and Figure 2.0 for SimpliPHI Battery and mounting bracket dimensions and weights. Bracket sets are designed to hold only one SimpliPHI 4.9 Module with a weight of 160 pounds.

4.4 – Dimensions and Weight

Table 4.1 – Specifications: SimpliPHI 4.9 Battery w/ Mounting Bracket

SimpliPHI 4.9 Battery w/ Mounting Bracket	
Width	23"
Height	30" (including 1.5" terminal height)
Depth	8.5"
Weight	160 Pounds

Figure 4.0 –SimpliPHI Mounting Bracket Assembly



4.5 – SimpliPHI Battery Connection Terminals

4.5.1 – Batteries with Threaded Studs

The SimpliPHI Battery is equipped with two 3/8" (10 mm) threaded stud terminals with a lock washer and nut. The red connection is for the positive lead. The black connection is for the negative lead.

Black terminal covers are provided and will be installed over the terminals; remove the terminal covers before installation and re-install after attaching battery cables. In order to maintain IP65 rating, outdoor installations will require the Battery Conduit Box [ordered separately] to be installed over the top portion of the battery. Failing to install Battery Conduit Box in outdoor installation will violate the terms of the Warranty.



CAUTION: Do not attempt to loosen the large brass nut at the base of the terminals; doing so will damage the SimpliPHI battery and violate the terms of the Warranty.

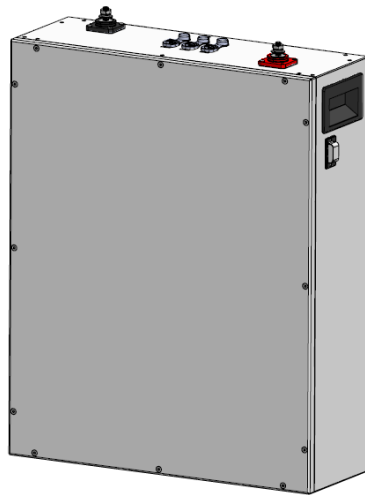
4.5.2 – Torque Batteries with Threaded Studs

SimpliPHI Batteries with threaded stud terminals have a torque specification of 160 in-lbs. (13.3 ft-lbs.). Do not use power tools or impact drivers to tighten the stud terminals. This can result in damage or breakage to the stud terminal and will violate the terms of the Warranty.



CAUTION: Do not tighten the stud terminals beyond their specified torque value of 160 in-lbs. Using an impact driver or power tools on the terminals will violate the terms of the Warranty. Using power tools or impact drivers may damage the terminal even if it doesn't result in breakage.

Figure 4.1



Threaded Studs= 3/8" (10mm)

Torque Value = 160 in lbs

Do NOT use power tools or impact drivers. Doing so will Violate the terms of the Warranty.

4.6 – Electrical Wiring



CAUTION: All SimpliPHI Batteries are designed to serve at fixed voltages and cannot be wired in series to increase the battery bank's voltage. Wiring the SimpliPHI Batteries in series will result in damage to the SimpliPHI Battery's protective circuitry and will violate the terms of the Warranty. SimpliPHI batteries are designed for parallel wiring only to increase the battery bank's storage capacity.

4.6.1 – Increasing Storage Capacity via Parallel Wiring

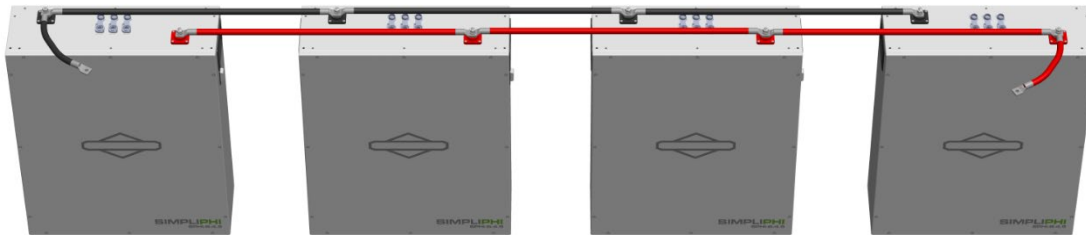
Storage Capacity and total available **Amperage** is increased incrementally with the number of batteries wired in Parallel. For example, two SimpliPHI 4.98 kWh-51.2V_{nominal} (97Ah) Batteries wired in parallel are rated at a combined 9.96 total kWh, 51.2 Volts DC and 194Ah. The two paralleled

PHI 4.9 kWh-51.2V_{nominal} batteries have a combined maximum continuous charge and discharge rate of 97 Amps DC ($2 \times 48.5\text{ADC}$).

4.6.2 –Wiring Batteries with Threaded Studs using Battery Cables

SimpliPHI Batteries can be wired in parallel from terminal to terminal (daisy chained) up to 4 batteries with 4/0 cable. Ensure that all cable lengths within the bank are identical in length and gauge to maintain equal resistance across the string.

Figure 4.2 – Four SimpliPHI Batteries in Parallel

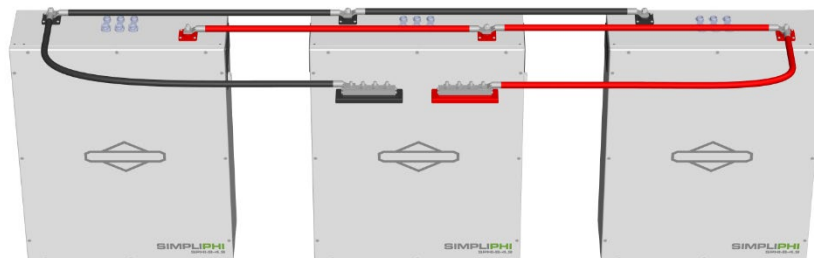


For installations that are larger than 4 batteries, equal sets of batteries not exceeding four batteries per set should be wired to a common busbar or plate. All wire lengths from each SimpliPHI Battery Bank to common busbars or plates should be **identical in length and gauge** in order to balance the load across (all) SimpliPHI Batteries in the installation.



CAUTION: Identical wire lengths and identical wire gauges from each SimpliPHI Battery in an SimpliPHI Battery bank is a critical feature of parallel power storage systems that must be adhered to throughout all parallel wiring instructions. Failure to properly wire the SimpliPHI Batteries in parallel will violate the terms of the Warranty.

Figure 4.3: Three SimpliPHI Battery Banks wired in Parallel to a terminal block. This configuration requires 6 identical lengths of identical gauge copper wire.



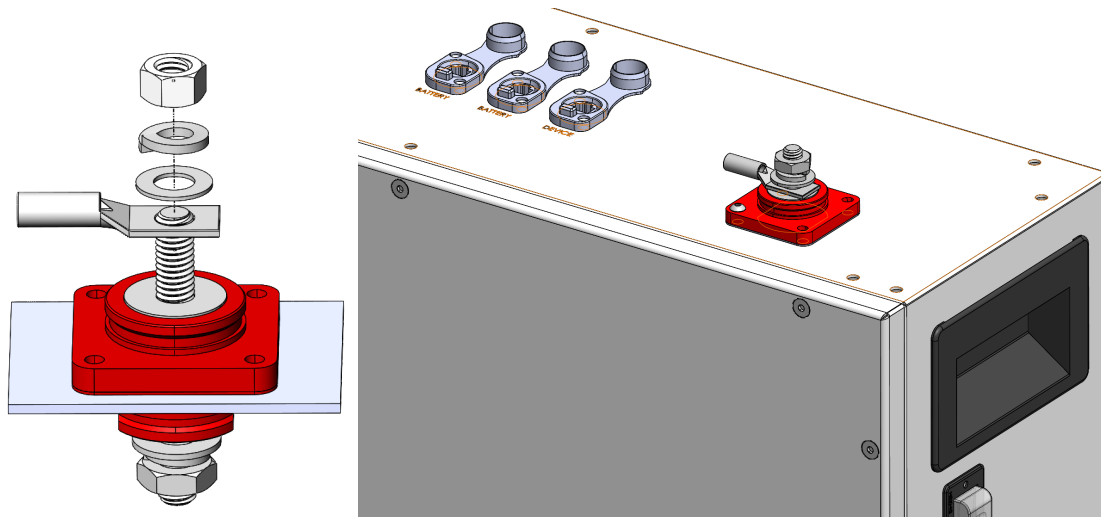
Helpful Tips:

- Power cabling for paralleling SimpliPHI Batteries is not included. All wire should be an appropriate gauge and construction to handle the loads that will be placed upon it. Heavy gauge, high strand copper wire is the industry standard due to its stability, efficiency and overall quality.
- The recommended wire gauge is **2/0 for banks less than 3** and **4/0 for banks 3 or larger**.
- Conductor ampacity can be determined using National Electrical Code tables.
- Depending on the electrical code of the local Authority Having Jurisdiction (AHJ), the SimpliPHI Battery leads' gauge may need to be sized according to the built-in breaker or according to the SimpliPHI Battery's surge rating.
- Battery cables from Spartan Power are flexible and easy to work with: <https://spartanpower.com/product/custom-battery-cables/>. Many of SimpliPhi's distributors also sell battery cables. Refer to the SimpliPhi Wiring Guide for a list of distributors that sell cables.
- Battery cables can be custom ordered to include the **3/8" lugs** that fit on the SimpliPHI Battery's threaded studs.
- Determine the cable length for the SimpliPHI Battery terminal farthest from the common busbar or plate first and use that length for all other batteries in the bank.
- Additional cabling or slack that remains with the shorter distance runs can be coiled and secured with Zip Ties.
- Wire length should be kept as short as practical.
- Positive wire runs should be separated from negative wire runs in separate conduit.
- Energy supplied by the SimpliPHI Battery is reduced as electrical current moves through wire. For lengths of battery cable greater than ~10 feet (3 meters), ensure that the voltage drop is no greater than 3%.
- To take full advantage of the combined SimpliPHI Battery bank's surge rating, the cables that the individual SimpliPHI Batteries are wired to should be rated to match the SimpliPHI Battery bank's total DC surge rating.
- MidNite Solar produces the [MNLB Lithium Battery Combiner](#) (rated at 250 Amps MAX) and the [MNBCB 1000/50 Battery Combiner](#) (rated at 1,000 Amps MAX)



CAUTION: Do not reverse polarity. Positive battery cables must connect to the SimpliPHI Battery's Positive terminal studs (RED) and to Positive DC busbars or plates. Negative battery cables must connect to the SimpliPHI Battery's Negative terminal studs (BLACK) and to Negative DC busbars or plates. Reversing polarity will violate the terms of the Warranty.

Figure 4.4– Cable Lug Wiring onto SimpliPHI Threaded Stud



CAUTION: No material (such as a washer) should be placed between the current carrying terminal and the cable lug or interconnecting busbar. Doing so will violate the terms of the Warranty.



CAUTION: Sparks may be present when connecting wires to SimpliPHI Battery terminals. Be sure the battery's built-in circuit breaker is in the OFF position to minimize the risk of shock or sparks during system installation.

4.6.3 – Parallel Wiring Batteries with Threaded Studs using Interconnecting 4/0 Cables

SimpliPHI Batteries can be paralleled by directly attaching 4/0 cables to the batteries' terminals. Up to 4 batteries can be connected by daisy chaining positive to positive and negative to negative terminals. It is recommended that 4/0 cable is used for installations of 3 or 4 batteries. For installations of less than 3 batteries, 2/0 cable can be used. This installation method should only be used for indoor applications. Outdoor applications will require conduit and conduit boxes (available from SimpliPhi). Please refer to Section 4.8 for outdoor installations.



CAUTION: Again, no material (such as a washer) should be placed between the current carrying terminal and the interconnecting busbars. The interconnecting busbars are placed on the SimpliPHI Batteries' terminals first, then the flat washer, lock washer, and nut are secured to the terminal posts.

Helpful Tips:

- The interconnecting cable ratings must match or exceed the SimpliPHI Battery bank's total surge rating.
- Cables for paralleling more than two SimpliPHI Batteries can be sourced from outside suppliers or custom ordered from SimpliPhi.
- Best practice involves wiring the battery leads to opposite ends of the battery bank.
- Size the battery cables leading from the interconnecting cables to the Balance of System equipment using the National Electrical Code's Conductor Ampacity tables.



CAUTION: Do not reverse polarity. **Use a voltmeter to check polarity before making connections to the battery terminals.** Reversing polarity will violate the terms of the Warranty.

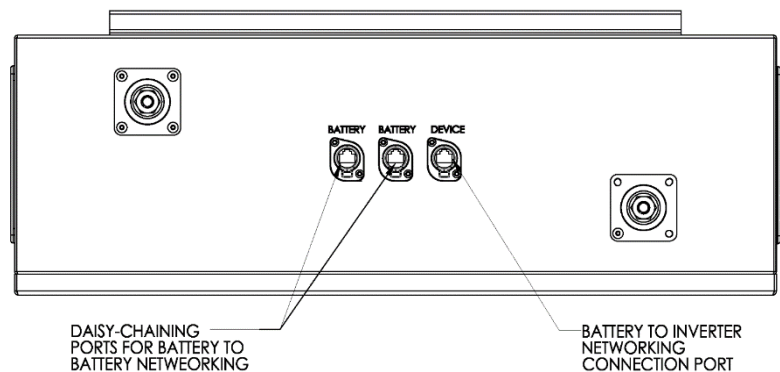
4.7 – Communications Wiring



CAUTION: The maximum number of SimpliPHI batteries that can be installed within a single bank is 60.

Each SimpliPHI battery includes three RJ45 ports, compatible with CAT5 (or greater) cable. Two of these ports are used for connecting between the SimpliPHI batteries in a battery bank (“daisy-chaining”). These two “daisy-chaining” ports are labeled as “BATTERY”. The third port is used for the communication connection between the SimpliPHI battery bank and the inverter or gateway and is labeled “DEVICE”. **Only one of the SimpliPHI batteries within the battery bank will utilize the “DEVICE” port (either the battery at the head or the tail of the daisy-chain).** SimpliPHI batteries with un-utilized third ports may plug those ports using the RJ45 dust caps provided with the battery.

Figure 4.5 – SimpliPHI Networking Connection Ports



In a string of batteries, the two batteries at the ends of the communication chain will have a cable occupying only one of the “daisy-chaining” ports in the SimpliPHI battery. On each of these two batteries, the communication port not occupied by a cable will need a 120 Ohm terminator plug installed in the open port (see photo). One terminator plug is included per SimpliPHI battery.

Figure 4.6 – SimpliPHI Batteries Networked Together in A Daisy-Chain

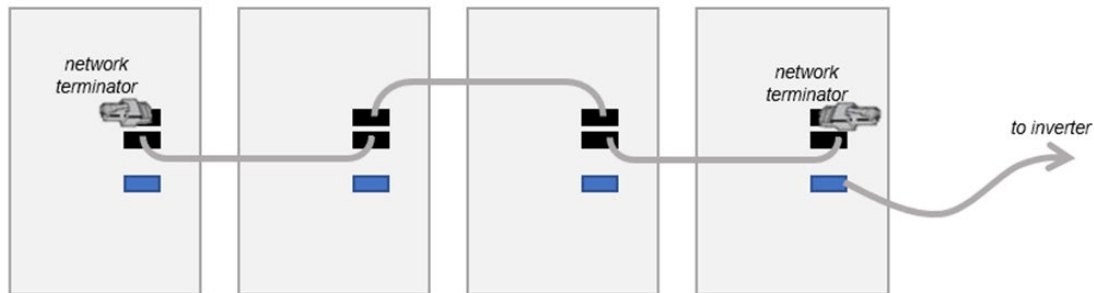
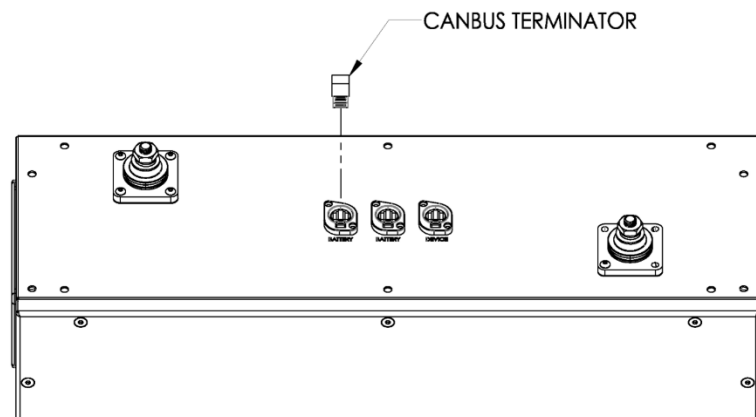


Figure 4.7 – SimpliPHI Battery's Terminator Plug



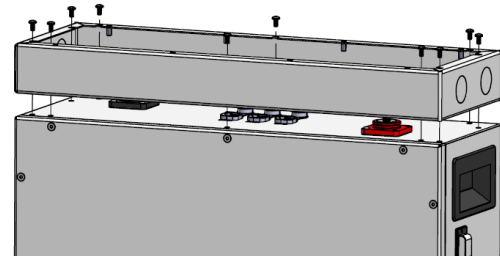
The maximum number of SimpliPHI batteries that can be connected in a single system is 60, with a maximum total connected distance of 40m (131 feet) from the first SimpliPHI battery module to the last SimpliPHI battery module. While one 4' CAT5 networking cable is provided per SimpliPHI battery, shorter networking cable for daisy-chaining the batteries may be used.

Utilizing the last/closest battery to the inverter, create the closed loop communications bridge between the SimpliPHI Battery and the Communication Input Port in compatible equipment utilizing CAT5 or greater cable. The cable length from the last SimpliPHI Battery to the Inverter cannot exceed 40m (131 feet).

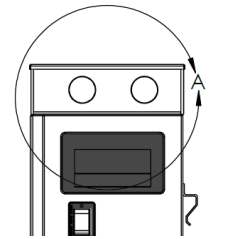
4.8 – Conduit Box Installation (Outdoor Installations)

An optional conduit box is available (purchased separately) for outdoor installations where conduit is required for all cabling. During installation, leave more than 6 inches available between the battery and any wiring gutter to allow a screwdriver access to the top cover plate.

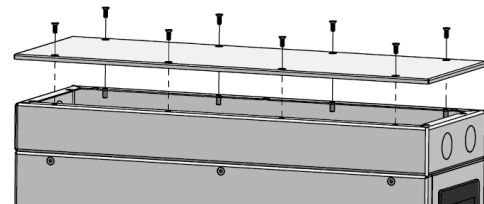
Step 1: Line up the screw holes in the conduit box with the mounting holes on the top side of the battery case. Secure the conduit box with the provided 10/32 pan head screws using a #2 Phillips screwdriver.



Step 2: Complete all wiring connections for battery terminals and communications cables. Use 1" conduit to route 4/0 battery cables and battery communications cables using 1" U.S. trade size knockouts on both sides of the conduit box. **Positive cables and negative cables are to be run in separate conduit.** It is acceptable to run communication cables in either conduit along with battery cable.



Step 3: Secure the conduit box cover with provided 10/32 flat head flush style screws using a #2 Phillips head screwdriver.



4.9 – Battery System Commissioning



WARNING! SimpliPhi Batteries should be installed, wired and commissioned by a qualified installer or professional electrician who is familiar with general electrical safety precautions and specific regional code requirements.

If the SimpliPhi Battery's voltage has dropped (during an extended period in storage) to a voltage below the inverter's minimum starting voltage requirement, then the battery will need to be charged using a plug-in / external charger. SimpliPhi's batteries have a very low self-discharge rate and typically do not require ancillary charging. If the SimpliPhi Battery's voltage has dropped due to over-discharge, try the steps outlined in Section 6.0 – Troubleshooting prior to using ancillary charging equipment.



CAUTION: Only use a SimpliPhi approved LFP charger if ancillary charging is required before installation, testing or troubleshooting. Failure to use a SimpliPhi approved LFP charger will damage the SimpliPhi Batteries and violate the terms of the Warranty.

Before installing the SimpliPHI Battery, inspect the battery for any signs of damage. Do not install or operate the battery if it has been damaged during shipping.

1. Prepare the battery module for installation by removing its plastic terminal covers, 11/16" stainless steel hex nuts and 3/8" lock washers from the battery terminals and set aside.



CAUTION: Do not attempt to loosen the large brass nut at the base of the terminals; doing so will damage the SimpliPHI battery and violate the terms of the Warranty.

2. Before installing the SimpliPHI Battery, test its voltage by turning its built-in breaker to the ON (I) position.
3. Measure the SimpliPHI Battery's voltage with a multimeter. Batteries *typically* ship at ~52 VDC. When installing more than one SimpliPHI Battery, check that the batteries' voltage readings are similar. Batteries with a voltage variance greater than 1 Volt DC should be isolated and charged separately.
4. After testing the SimpliPHI Battery's voltage, turn the battery's built-in circuit breaker back to the OFF (O) position.
5. Wire the SimpliPHI Battery bank with all the included SimpliPHI Batteries' built-in breakers in the OFF (O) position. All electrical wiring must be in accordance with Section 4.6 – Electrical Wiring and all communications wiring must be in accordance with Section 4.7 – Communications Wiring.



CAUTION: All Briggs & Stratton Battery products are designed to work exclusively in parallel. Never connect in series to achieve higher voltages. Wiring in series will destroy the batteries and violate the terms of the Warranty.

Verify polarity at all connections before energizing system. Reverse polarity at the SimpliPHI Battery terminals will destroy the SimpliPHI batteries and violate the terms of the Warranty.

6. Confirm all loads are turned OFF. Disconnect the inverter's AC Output breaker or turn off the breaker at the top of your loads' breaker panel.
7. The main DC disconnect in the inverter's power panel should still be in the OFF position.
8. Turn all battery circuit breaker switches to the ON (I) position and wait 20 seconds for the BMS to re-boot.
9. Turn the main DC disconnect in the inverter's power panel ON.
10. At this point, the inverter may come on automatically in standby mode, or the inverter might need to be manually turned on. Check the inverter user manual to determine functionality.
11. Activate the SimpliPHI Battery's networking connection within the Inverter.
12. Then program the equipment for those settings that are not automatically communicated by the SimpliPHI to the BoS equipment. SimpliPhi's settings are specified in the relevant SimpliPHI Integration Guides specific to the inverter you are utilizing. (<https://simpliphipower.com/product-documentation/>) and are generally outlined in Section 5.0 – Programming of this Manual.



CAUTION: SimpliPhi Batteries must operate in conjunction with properly programmed Balance of System equipment. Operating the batteries with equipment that has not been programmed to SimpliPhi's specified parameters will damage the SimpliPhi batteries and violate the terms of the Warranty.



CAUTION: Charge the batteries fully. When first commissioning the battery system, the batteries must be charged fully before connecting any loads. Neglecting to charge the batteries fully when first commissioning the battery system will violate the terms of the Warranty.



CAUTION: Remember that charging the batteries in sub-freezing conditions will violate the terms of the Warranty.

14. Battery charging may be accomplished via the inverter/charger using an AC power source such as the grid or a generator, or via a charge controller or integrated MPPT using power from a connected solar PV array.
15. The batteries will bulk charge to 56 VDC, will Absorb for approximately 0.5 hours (at slower rates of charge, less absorb time may be observed), and will then rest at approximately 53.3 VDC. This condition would be considered fully charged.
16. Once the batteries are fully charged, turn on the inverter's AC Output breaker and/or the breaker at the top of your loads' breaker panel.

4.10 – Battery Bank Expansion

New SimpliPhi Batteries that are added to an existing SimpliPhi battery bank must be of the same nameplate voltage, form factor, and model.



CAUTION: Do not combine PHI Batteries with other brands or chemistries. This will violate the terms of the Warranty.

The following are instructions for expanding upon a SimpliPhi battery bank using SimpliPhi batteries.

In addition to adhering to all other Installation Manual instructions, refer to the following guidelines when expanding upon an existing SimpliPhi battery bank:

1. Charge the existing battery bank ("Bank A") according to normal charging procedure (SimpliPhi batteries charge to 56V and "rest" at approximately 52.5 - 53.5V after being taken off a charge).
2. Disconnect Bank A from the system, by either
3. Disconnecting all battery cables leading from Bank A's batteries to the battery combiner box, panelboard, or inverter's power panel, OR
4. Turning off the built-in breakers included in each of Bank A's batteries

5. Connect the additional batteries (Bank B) to the system, following all sizing, wiring instructions and torque specifications outlined in previous sections of segment 4.0 in this manual.
6. Check that the connected Balance of System (BoS) equipment settings (including charge rate) are altered as a result of being networked to Bank B.
7. Charge Bank B fully, making sure all loads are disconnected at the time of initial charge.
8. Wire all Bank A batteries and Bank B batteries in parallel, adhering to the wiring methods outlined in Sections 4.6 and 4.7 above.
9. Ensure that DC Positive common bus and DC Negative common bus ratings are appropriate for the new larger quantity of batteries in the bank.
10. Remember to re-orient the networking connections as one long “daisy-chain” for the expanded battery bank. This will involve unplugging the last terminator plug in the chain and reposition to the end of the “daisy-chain” and reconnecting the battery-to-inverter communications cable and reviewing all Inverter settings for accuracy.
11. Review all Inverter settings for accuracy; new values for certain settings should automatically appear as reflective of the larger, expanded battery bank.

5.0 – Programming

5.1 – Operating Parameters per Warranty

To maintain SimpliPhi Battery health and to comply with the Warranty, adhere to the operating parameters outlined in Tables 5.0 and 5.1 below. Refer to the manufacturer-specific Integration Guide from SimpliPhi’s Product Documentation web page for a complete list of settings specific for the inverter that you are pairing with: <https://simpliphipower.com/product-documentation/>.

Table 5.0 – Operation Parameters

Recommended Operating Conditions for 10 Year Warranty			
Depth of Discharge (DoD)	80% (~10,000 cycles)	90% (~5,000 cycles)	100% (~3,500 cycles)
Operating Temperature °F (°C)	32 to 120 (0 to 49)		
Low Battery Cut-Off Voltage (V) ³	50.2	49.6	48
Absorb / High Cut-Off Voltage (V)	56		
Absorb Time	0.5 Hours		
Absorb End Amps (if applicable)	2% of the PHI Battery bank’s total Ah capacity		

Table 5.1 – Operating Limitations

Notes / Operating Limitations for PHI Batteries	
	SimpliPhi 4.9
Limitations by Model	48V
Continuous Discharge Rate (ADC)	48.5
Surge Discharge Rate (ADC) – 10 minutes maximum	100
Continuous Charge Rate (ADC)	48.5

- Levels are typically @ 25°C and may need adjusting at temperature extremes.
- When performing rapid deep charge/discharge cycles, the PHI Battery should be allowed to “rest” 15 mins in between.



CAUTION: When commissioning the system, the appropriate controller and inverter settings must be programmed per the manufacturer's recommendations. Consult the manufacturer's manuals and/or the Integration Guides listed on [Briggs & Stratton's Product Documentation web page](#). Failing to do so will damage the SimpliPhi batteries and will violate the terms of the Warranty.

6.0 – Troubleshooting

Certain SimpliPhi BMS fault trip conditions (outlined in Section 1.3.1 and Table 1.0 of this Manual) result in the need for a manual re-set of your SimpliPhi Battery's internal BMS. If a fault has occurred, consult SimpliPhi Technical Support (ESSTech@basco.com) to ensure that your SimpliPhi Battery bank has been sized correctly and inhabits operational conditions.

Once the fault's cause has been addressed with Support, take the following steps to re-set the BMS:

The PHI batteries are reading extremely low or no voltage:

1. If the breakers are not all off already, turn off each of the built-in breakers in all of the SimpliPhi Batteries in the battery bank.
2. Turn off the main DC disconnect located in the inverter's power panel, between the battery bank and the inverter.
3. Turn off the main breaker at the top of the inverter's AC distribution panel or sub-panel.
4. Wait 5 minutes, for the BMS in each battery to re-set itself.
5. Use a multi meter to take voltage measurements of each SimpliPhi battery in the battery bank, to make sure the voltage increased to the minimum voltage necessary for the inverter to turn on.

To measure a single battery's voltage within a battery bank, only the battery being measured has its built-in breaker in the ON (I) position; all other batteries in the bank must have their built-in breakers OFF (O).

6. Turn on each of the built-in breakers in all of the SimpliPhi Batteries in the battery bank and wait 20 seconds for the BMS to re-boot.
7. Turn on the main DC disconnect located in the inverter's power panel.
8. Check that all parameters in the Balance of System equipment are programmed according to the relevant SimpliPhi Integration Guide. Failure to do so will damage the PHI batteries and violate the terms of the Warranty.
9. To charge the batteries quickly, we recommend using an AC power source to immediately charge the PHI battery bank via the inverter's charger. However, the SimpliPhi batteries will not incur any damage if they are charged using a connected solar PV array via the charge controller. The important aspect of this step is that the batteries re-charge as soon as the BMS has re-set.
10. Turn on the inverter's AC Input breaker and turn on the inverter.
11. The inverter should automatically self-initiate a battery charge. However, a Force Charge may need to be initiated in the inverter.

Appendix A – SimpliPHI Battery Safety & Green Attributes, Certifications

This Appendix section covers the SimpliPHI Battery safety attributes and certifications, UN DOT certification and UL compliance and certification. It also covers the SimpliPHI Battery's green attributes – from products to materials to disposal, as well as relevant environmental and ecological considerations.

A.1 – Safety Attributes and Certifications

A.1.1 – Intrinsically Safe Operation and Installation

The SimpliPHI Lithium Ferrous Phosphate (LFP) battery cell component is made with an intrinsically safe cathode material (iron phosphate). This creates a strong molecular bond, which withstands extreme conditions, prolongs cycle life, and maintains integrity with little or no maintenance over extended periods of time. No venting or cooling is required. No special precautions or structural considerations beyond what is in the manual are necessary when installing SimpliPHI Batteries.

A.1.2 – No Safety Hazards due to Off-Gassing

SimpliPHI Batteries do not vent dangerous gasses during normal operation, such as hydrogen and oxygen, because chemicals contained in Lithium Ferro Phosphate cells' electrolyte do not electrolyze to any appreciable extent within the SimpliPHI Battery's operating voltage range.

A.1.3 – SimpliPHI Battery Control and Protective Circuitry

SimpliPHI batteries utilize balancing, voltage regulation, thermal and current controls, as well as other protective measures in its SimpliPHI Battery Management System (BMS). This protective circuitry is embedded in the architecture of each SimpliPHI Battery.

A.1.4 – UN DOT Certified Cells

The Lithium Ferrous Phosphate (LFP) cells are independently certified to withstand the UN DOT 38.3 testing guidelines with no special circuitry added. These tests include short circuit, over-voltage, overcharging, extreme temperature, high altitudes, shock and extreme vibration testing.

A.1.5 – UL Compliance

The Lithium Ferrous Phosphate cells within the SimpliPHI Batteries fully comply with the safety testing parameters of UL 1642. Batteries have been tested to UL 9540A and are certified to UL 1973.

A.1.6 – RoHS Compliant

SimpliPHI 4.9 Batteries are RoHS compliant. Any RoHS compliant component is tested for the presence of Lead (Pb), Cadmium (Cd), Mercury (Hg), Hexavalent chromium (Hex-Cr), Polybrominated biphenyls (PBB), and Polybrominated diphenyl ethers (PBDE). For Cadmium and Hexavalent chromium, there must be less than 0.01% of the substance by weight at raw homogeneous materials levels. For Lead, PBB, and PBDE, there must be no more than 0.1% of the material, when calculated by weight at raw homogeneous materials. Any RoHS compliant component must have 100 ppm or less of mercury and the mercury must not have been intentionally added to the component. In the EU, some military and medical equipment are exempt from RoHS compliance.

A.2 – Green Attributes, Environmental & Ecological Considerations

A.2.1 – Materials

The primary materials (lithium, iron, phosphate) that make up SimpliPHI Batteries are environmentally benign and pose very few polluting or environmentally degrading by-products in the harvesting and refinement processes.

A.2.2 – By Products

There are no hazardous by-products associated with the use of SimpliPHI Batteries, such as off-gassing, sulfuric acid spillage, lead contamination, or explosive chemicals.

A.2.3 – Operation

There is no need for maintenance, such as adding water or chemicals. Once installed, SimpliPHI Batteries are maintenance free as long as all the Installation Manual, Integration Guidelines and Warranty requirements are adhered to.

A.2.4– Life Cycles

SimpliPHI Batteries are designed for thousands of cycles while maintaining 70 percent or more of their initial capacity. To achieve this, it is critical to follow the operating conditions outlined in our manuals.

A.2.5 – Disposal

The outer casing and brackets contain steel, aluminum, copper, cardboard, and recyclable plastic. Lithium Ferrous Phosphate (LFP) materials can also be recycled through established battery centers if desired.

A.2.6 – Summary

The Lithium Ferrous Phosphate (LFP) cells utilized throughout the entire SimpliPHI, PHI and LibertyPak product lines are classified as non-hazardous by OSHA and WHMIS. Lithium easily combines into harmless compounds when disposed of properly. Designed and Manufactured in the USA Using Exclusive American Patented Technologies.