PHI 3.5™ Battery

INSTALLATION MANUAL

SimpliPhi Power 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 renewable power with the grid and protects your home and mission-critical business functions from power outages and intermittency. SimpliPhi storage technology eliminates operating temperature constraints, toxic coolants and the risk of thermal runaway and fire.

SimpliPhi’s battery technology utilizes the industry’s most environmentally benign chemistry combined with proprietary architecture and power electronics (BMS) that eliminate the need for cooling or ventilation to create products that provide energy security and resiliency.

_SimpliPhi Power offers proprietary, commercially available energy storage and management systems that are safe, non-toxic, reliable, durable, efficient, highly scalable, and economical over the lifetime of the PHI 3.5 Battery._
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Section 1.0 – PHI 3.5 Battery Safety Protocol

Section 1.1 – Safety & Protective Features

1.1.1 – 80A Breaker

All PHI 3.5 Batteries are outfitted with an 80A hydraulic/magnetic circuit breaker which will show a white base when tripped. 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 built-in battery management system (BMS) and creates additional safety, efficiency and functionality to the overall power storage system.

![Figure 1.0 - PHI 3.5 80A Circuit Breaker](image)

**CAUTION:** 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 standards and evaluated by certified electricians, licensed installers, and regional code authorities. Although each PHI 3.5 Battery contains both an 80 Amp circuit breaker and an internal BMS with circuitry that protects the Lithium Ferrous Phosphate cells from overcharge, over-discharge and excessive load amperage, the PHI 3.5 Batteries must always be installed with a charge controller and the appropriate settings to protect the PHI 3.5 from open PV voltage and other high voltage charging sources. The PHI 3.5 Battery Management System (BMS) and internal circuit breaker alone will not protect the PHI batteries from these extreme electrical phenomena. Failure to adhere to installation protocol will void the Warranty.

**CAUTION:** Verify polarity at all connections with a standard volt meter before 1) energizing the system and 2) turning the PHI 3.5 80 Amp breaker “ON/OFF” switch to the “ON” position. **Reverse polarity** at the battery terminals will void the Warranty and destroy the batteries. PHI 3.5 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. Be sure to turn the built-in 80 Amp breaker to the “OFF” position to minimalize the risk of shock or sparks during the
installation and commissioning of the system. Use of insulated gloves, clothing and footwear is always recommended when working in close proximity to electrical devices. Cover, restrain or remove jewelry or conductive objects (metal bracelets, rings, belt buckles, metal snaps, zippers, etc.) when working with any electrical or mechanical device. Cover or restrain long hair and loose clothing when working with any electrical or mechanical device.

PHI 3.5 Batteries do not vent any harmful gasses, and do not require special ventilation or cooling.

PHI 3.5 Batteries are not capable of thermal runaway. If the cells are severely damaged due to physical abuse incurred outside of warranted specifications, which can cause electrolyte leakage and other failures, as with any battery, the electrolyte can be ignited by an open flame. However, unlike other lithium ion batteries (LCO) there are no hazardous or toxic materials in the electrolyte or the material components of PHI 3.5 Batteries. See MSDS for chemical analyses (Appendix A).

**1.1.2 – Charging at Temperatures Below Freezing**

It is important to take necessary steps to determine the temperature of the battery prior to charging the battery, as the battery may otherwise be adversely impacted.

**CAUTION:** Do not attempt to charge the battery below 32 F (0 degrees C). Although cold temperatures do not harm PHI batteries, attempts to charge at subfreezing temperatures can adversely affect SOH and cycle life, and will void the Warranty. If the battery must be charged below 32 F (0 degrees C), the rate of charge must be at no more than 5% of the battery’s rated capacity (C/20).

**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 battery and void the warranty.

**1.1.3 – Battery Management System (BMS)**

PHI 3.5 Batteries are manufactured utilizing Lithium Ferrous Phosphate (LFP) cells, which are produced under exclusive patented licensed technologies, as well as proprietary materials, architecture, assembly methods and battery management system (BMS). This assures the highest grade and quality, longest cycle-life, greatest efficiency and freedom from material impurities, toxicity and hazardous risk.

Each PHI 3.5 Battery contains circuitry that protects the Lithium Ferrous Phosphate cells from overcharge, over-discharge and excessive load amperage. If the values specified are exceeded, the protective circuitry will shut down the flow of electricity to/from the PHI 3.5 Batteries. In some cases, this will result in the need to re-initialize an inverter charger. Often, inverter system settings will be saved within the inverter memory storage and will not need to be reset. This is not an absolute standard but is common amongst most inverter chargers and should be anticipated if the PHI 3.5 Batteries go into a state of self-protection and shut down the flow of electricity.
1.1.4 – PHI 3.5 Battery Connection Terminals

The PHI 3.5 Batteries are equipped with two 3/8” threaded studs with a lock washer and nut. The red colored high temperature molded insert connection is for the positive lead. The black colored high temperature insert connection is for the negative lead.

**CAUTION:** Do not attempt to loosen the large brass nut at the base of the terminals.

**CAUTION:** Do not reverse polarity. It will void the warranty. Use a volt meter to check polarity before connecting terminals.

Water Resistant Cable Boots are also included and will be in place when your units arrive. The boots are to be placed over the cable terminations and will stretch to form a water-resistant seal around the base of the molded inserts and terminal connections.

Section 1.2 – Battery Performance Parameters and Sizing Calculations

PHI 3.5 Batteries are designed to operate at a continuous C/2 rate across a large operating temperature range. As long as the batteries are kept within this range during operation, then there is no need to de-rate performance or increase sizing to compensate for the temperature. When used as recommended, no increase in sizing, no special compensations or insulation needs to be considered when determining the size of the energy storage and management system. See specific inverter manufacturer program settings for optimizing system integration.

Table 1.0 - PHI 3.5 Specifications

<table>
<thead>
<tr>
<th>PHI 3.5™</th>
<th>24V</th>
<th>48V</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Voltages - Nominal</td>
<td>25.6</td>
<td>51.2</td>
</tr>
<tr>
<td>Amp Hours</td>
<td>138</td>
<td>69</td>
</tr>
<tr>
<td>Rated kWh Capacity @ C/2</td>
<td>3.5 kWh</td>
<td></td>
</tr>
<tr>
<td>Max Discharge Current</td>
<td>60 Amps (10 mins)</td>
<td></td>
</tr>
<tr>
<td>Max Contin. Disch. Current</td>
<td>45 Amps</td>
<td>34 Amps</td>
</tr>
<tr>
<td>Max Contin. Charge Current</td>
<td>45 Amps</td>
<td>34 Amps</td>
</tr>
<tr>
<td>DC Voltage Range¹</td>
<td>20 to 28.8</td>
<td>40 to 57.6</td>
</tr>
<tr>
<td>Depth of Discharge¹</td>
<td>up to 100%</td>
<td></td>
</tr>
<tr>
<td>Operating Efficiency</td>
<td>98%</td>
<td></td>
</tr>
<tr>
<td>Operating Temp¹</td>
<td>-4° to 140°F (-20° to 60°C)</td>
<td></td>
</tr>
<tr>
<td>Charge Temp¹</td>
<td>32° to 120°F (0° to 49°C)</td>
<td></td>
</tr>
<tr>
<td>Self-Discharge Rate</td>
<td>&lt;1% loss per month</td>
<td></td>
</tr>
<tr>
<td>Cycle Life</td>
<td>10,000+ (@60% DOD)</td>
<td></td>
</tr>
<tr>
<td>Memory Effect</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Warranty Period</td>
<td>10 Years</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>77.5 lbs (35.15 kg)</td>
<td></td>
</tr>
<tr>
<td>Dimensions (W x H x D)</td>
<td>13.5 x 14 x 8 in. (15.5&quot; H w/terminals) / 0.88 ft³ (34.3 x 35.6 x 20.3 cm / 0.025 m³)</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. Max operating conditions. Refer to "Guide for Operating Parameters per Warranty" section.
2. Specifications are typical/nominal.
3. Subject to change without notice.
4. There is less than 1% loss of energy during charging.

PHI 3.5 Batteries do not need to be de-rated unless running continuously at more than 90% capacity, at temperatures below 0 degrees Celsius, or above 49 degrees Celsius. To achieve higher, warrantied cycles of 10,000+, please refer to operating temperatures and inverter settings in operating parameters per warranty section. Further details are available on request from SimpliPhi Power.

Section 2.0 – Installation Procedure and Diagrams
This section covers system sizing for your installation, basic concepts of system configuration and increasing storage capacity by wiring in parallel. It also provides sample installation diagrams as well as mounting hardware and weight as well as torque value information.

Section 2.1 – System Sizing for Your Installation
The number of PHI 3.5 Batteries should be specified in terms of total storage capacity before the initial installation based on the goals and objectives of the project. All PHI 3.5 Batteries are balanced during final production and testing stages. Following proper wiring guidelines ensures that a system will not require any manual balancing processes.

CAUTION: Do not combine PHI 3.5 Batteries with other brands or chemistries.

CAUTION: Do not mix PHI 3.5 Batteries from different installations, clients or job sites.

Section 2.2 – System Configuration – Basic Concepts
Safe and reliable installation requires trained and certified technicians. The following discussion of PHI Battery configurations is a basic primer. Due to the variety of systems and components in the field, all possible scenarios are not covered. This is not the purpose of this section of the manual. Refer to professional installers regarding your system and its components and specifications. We encourage you or your installer to contact us with any specific questions for technical support. 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.

CAUTION: PHI 3.5 Batteries are designed for parallel operation only – do not arrange in series for increased voltage.

2.2.1 – System Wiring Basics
Refer to published electrical wiring specifications and ratings. 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. A qualified installer should understand this and must adhere to the industry standard and published electrical guidelines.
For all installations:
- Maintain identical wire lengths from each PHI 3.5 Battery terminal to the common bus.
- Use identical wire construction from each PHI 3.5 Battery terminal to the common bus.

All PHI 3.5 Batteries are designed to serve at a fixed voltage range in parallel arrangements for maximum available amperage and storage capacity. PHI 3.5 Batteries are not designed to be arranged in series for increased voltage. Series arrangements can result in damage to the Battery’s protective circuitry and will void the Warranty.

2.2.2 – Increasing Storage Capacity & Simple Parallel Arrangements

Storage Capacity and total available Amperage is increased incrementally with the number of units in Parallel arrangements. The following illustration shows two PHI 3.5 Batteries in Parallel. For example, assume that these are 24V Batteries.

Note the overall Voltage range is not changed. The arrangement remains at 24 Volts, the available AH capacity (ability to provide 24 Volt power over time) has also been doubled with the addition of a 2nd battery. The available amperage from the system has been doubled. The same configuration should be applied to other parallel arrangements, whether they are 24V or 48V. See Figure 1.3.

CAUTION: PHI 3.5 Batteries are designed for parallel operation only. Do not arrange in series for increased voltage. Wiring in series will void warranty.

Figure 2.0 – Two PHI 3.5 Batteries in Parallel

Figure 2.0 represents two PHI 3.5 Batteries in Parallel. Wire lengths from PHI Batteries should be identical in length and gauge in order to balance the load across (all) PHI Batteries in the installation. Identical wiring length is a critical feature of parallel power storage systems that must be adhered to throughout all parallel wiring instructions.
Special attention should be paid for parallel installations. Correct wiring is essential to insure optimum performance and system longevity. All wire “runs” should utilize **identical wiring gauge** and **identical wire lengths** between PHI 3.5 Batteries and the common negative or positive “Bus” or Load. Figure 3.0 depicts four PHI 3.5 Batteries that have been wired in Parallel. This configuration requires **8 identical lengths of appropriately heavy gauge copper wire**.

![Figure 3.0 - Four PHI 3.5 Batteries in Parallel](image)

**Helpful Tips:**
- Use identical length and gauge wire to balance the load across the batteries.
- Determine the cable length for the battery terminal farthest from the bus.
- Make all Battery cables a matching length.
- Additional cabling or slack that remains with the shorter distance runs can be coiled and secured with Zip Ties.

**Wiring Methods:**
1. For 1 to 8 units: Wire directly to inverter & charge controller equipment.
2. For 6 to 20 units: Use a DC combiner or panelboard.
3. For 20+ units: Connect the battery terminals directly to a common bus.

**Section 2.3 – Torque Values**
For the DC terminals on the PHI 3.5, torque bolts to 160-in lbs (13.3 ft-lb).

**Section 2.4 – Mounting Hardware**
The SimpliPhi Power Mounting Brackets (sold separately) are designed to secure one PHI 3.5 Battery to a load bearing surface. SimpliPhi Power Batteries can be mounted in practically any orientation (Terminals Up or on any Side), with no impact to the performance of the battery. Do not install them upside down. The brackets can be mounted directly to a wall or can be arranged on strut channels for...
ease of positioning (mounting hardware not included). A qualified installer should be familiar with
accomplishing this with the appropriate load bearing requirements.

For ease of measuring, arranging and mounting your PHI Battery array, a drawing of the PHI 3.5
Mounting Brackets with dimensions is provided (Figure 4.0).

During mechanical testing, individual PHI 3.5 Mounting Brackets were exposed to 200 pounds each of
downward pressure along the bracket’s outer edge. During this test, a deflection of approximately 30
thousandths of an inch was measured. Combined bracket sets can easily bear weights in excess of 400
pounds. Bracket sets are designed to hold one PHI 3.5 Module, with a weight of 77.5 pounds.

**Section 2.5 – Battery Weight**

PHI 3.5 Batteries weigh 77.5 pounds. The Wall Mount Bracket Assemblies weigh 8 Pounds. The
SimpliPhi Power Mounting Brackets should be mounted into load bearing beams, studs or solid materials
with appropriate fasteners. SimpliPhi Power is not liable for damage caused by inappropriate installation
mounting of brackets.

**Section 2.6 – Battery Wall Mount + Bracket Dimensions**

<table>
<thead>
<tr>
<th></th>
<th>PHI 3.5 Battery</th>
<th>PHI 3.5 Battery w/ Mounting Bracket</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Width</strong></td>
<td>13.5”</td>
<td>13.7”</td>
</tr>
<tr>
<td><strong>Height</strong></td>
<td>15.5” (including 1.5” terminal height)</td>
<td>15.5” (including 1.5” terminal height)</td>
</tr>
<tr>
<td><strong>Depth</strong></td>
<td>8”</td>
<td>9.16”</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>77.5 Pounds</td>
<td>85.5 pounds</td>
</tr>
</tbody>
</table>
Figure 4.0 – Mounting Bracket Assembly
Section 3.0 – PHI 3.5 Battery Wiring Methods

Section 3.1 – Connecting Cable Leads to the PHI 3.5 Batteries

Before connecting the cable leads to the PHI 3.5 battery, please be aware of the following information concerning power cabling, considerations for power cable terminations as well as installation environments.

**CAUTION:** Spark may be present when connecting wires to PHI 3.5 terminals.

**CAUTION:** Do not reverse polarity. It will void the warranty. Use a volt meter to check polarity before connecting terminals.

A brief small spark is often present when connecting the second of two leads to a battery. Example: If the Positive has been connected, a small spark will likely be present when connecting the Negative lead. **This is a normal occurrence.** Complete all connections in a clean, ventilated, well-lit area. To avoid any spark or electrical event when connecting the terminal leads on the PHI 3.5 Battery, turn the 80 Amp breaker “ON/OFF” switch to “OFF” position.

Power Cabling for the PHI 3.5 Battery is not included. Your qualified installer or application specifications will determine the wire gauge for your system. Connection to the battery terminal should only be made using appropriately sized ring terminals for your battery cables.

High amperage rated ring terminals can be found for these and other common wire gauges. Your installer can source these.

3.1.1 – Considerations for Power Cable Terminations

Please factor in the below information for power cable terminations:

- PHI 3.5 Battery Mounting Stud Size: 3/8”
- Power Cable Wire Gauge: Generally anywhere from 6 AWG to 2/0 AWG or larger

3.1.2 – Protection from the Environment

Anticorrosive compounds or epoxies are occasionally used in harsh or marine climate installations. Please contact your Electrician or Qualified Installer to determine if this is advisable, and if so, what solution best suits your application.

Section 3.2 – Final Connection of the Installation

Final installation and operation guidelines will be dictated by your Electrician and Installer based on the overall properties of and procedures for the equipment in your installation and any code requirements that apply to your region. SimpliPhi Power, Inc. technicians and sales staff are available to provide any additional information on the PHI 3.5 Battery as needed. Please contact SimpliPhi Power for any technical support at your convenience. SimpliPhi Power, Inc. is committed to providing safe, reliable energy storage and management that is maintenance free, non-toxic and long-lasting. This commitment extends to our customers, valued installers, partners, and to the community at large. Please be aware of the potential electrical hazards before interacting with any and all electrical or mechanical devices. Please take all necessary precautions in your projects and installations. Please refer to page 4 for safety guidelines.
PHI Batteries feature a Low Battery Voltage Cut Off (LBCO). This is a self-protection mechanism that prevents over discharge. The LBCO will cause the battery to turn off once batteries approach Zero Capacity or 100% Depth of Discharge.

Most, if not all, inverters have related features. These features are often referred to as “Load Disconnect”, “Load Shedding” or similar. These features are there to protect the battery bank from excessive discharge. In instances of low battery voltage, when there is no incoming energy to recharge the battery bank, the inverter will disconnect the load and remain in standby until the battery bank is recharged.

For Off Grid installations, where charge energy is only provided by PV arrays, Inverter “Load Disconnects” are generally set at a value that will allow a system to remain online and in standby for at least 24 hours (10% at top of charge and 10% at bottom of charge). This allows a system to stay online until at least one full day of sun can recharge the battery bank.

In any application, off-grid or grid-tied, if your PHI 3.5 battery bank is reaching the LBCO, load disconnects or load shedding set points may need to be adjusted. Refer to (Operating Parameters per Warranty).

In case of LBCO, cycle the DC Battery Disconnect (inverter), in order to reset the system. Only complete this procedure when there is a charge source available, otherwise, the system will simply reach LBCO in a short time period and shut down again.

Section 4.0 – Operating Parameters Per Warranty

Although SimpliPhi batteries are capable of performing at very high rates and depths of discharge within a very wide temperature range, in order to achieve extended life cycles and to comply with the Warranty, the Warranty conditions the recommended operating parameters, indicated in Tables 3.0 and 4.0 below, must be adhered to.

<table>
<thead>
<tr>
<th>Table 3.0 – Warranty Operation Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Recommended Operating Conditions for 10 Year Warranty</strong></td>
</tr>
<tr>
<td><strong>Equivalent to 80% Retained Capacity</strong></td>
</tr>
<tr>
<td><strong>Discharge/Charge Rate</strong></td>
</tr>
<tr>
<td><strong>DoD</strong></td>
</tr>
<tr>
<td><strong>Operating Temperature °F (°C)</strong></td>
</tr>
<tr>
<td><strong>Programming Settings for Ancillary Equipment</strong></td>
</tr>
<tr>
<td><strong>Absorb / High Cut-Off Voltage (V)</strong></td>
</tr>
<tr>
<td><strong>Recharge / Low Cut-Off Voltage (V)</strong></td>
</tr>
</tbody>
</table>
Table 4.0 – Operating Limitations

<table>
<thead>
<tr>
<th>Notes / Operating Limitations for PHI 3.5 Batteries</th>
</tr>
</thead>
<tbody>
<tr>
<td>² Limitations by Model</td>
</tr>
<tr>
<td>Continuous Discharge Rate (A)</td>
</tr>
<tr>
<td>Continuous Charge Rate (A)</td>
</tr>
</tbody>
</table>

² 60A Discharge/Charge Rate (10 minutes maximum)
³ Levels are typically @ 25°C and may need adjusting at temperature extremes.
⁴ When performing rapid deep charge/discharge cycles, the battery should be allowed to "rest" 15 mins in between.

⚠️ CAUTION: Verify polarity at all connections before energizing system. Reverse polarity at the battery terminals will void the Warranty and destroy the batteries.

⚠️ CAUTION: Before commissioning the system the appropriate controller and inverter settings must be programmed per the manufacturer’s recommendations. Consult the manufacturer’s manuals and/or access technical support (Schneider, SMA, Magnum, Outback, etc.). The following Charge Controller Integration tables are for general reference only.

⚠️ CAUTION: All SimpliPhi Power products are designed to work exclusively in parallel. Never connect in series to achieve higher voltages.

Section 5.0 – PHI 3.5 Battery Safety & Green Attributes, Certifications

This section covers the PHI 3.5 battery safety attributes and certifications, such as the lack of thermal runaway and off-gassing, UN DOT certification and UL compliance. It also covers the PHI 3.5 battery’s green attributes – from products to materials to disposal, as well as relevant environmental and ecological considerations.

Section 5.1 – Safety Attributes and Certifications

5.1.1 – Intrinsically Safe Operation and Installation

The PHI 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. There is virtually no danger of Thermal Runaway, as there may be with Lead Acid, NiCd, and Lithium Cobalt type batteries. No venting or cooling is required. No precautions or special structural considerations are necessary when installing PHI 3.5 Batteries.
5.1.2 – No Safety Hazards due to Off-Gassing, Acids, Thermal Runaway
PHI 3.5 Batteries do not vent dangerous gasses, such as hydrogen and oxygen, because there are no chemicals used in the creation of the electrical energy, in contrast to Lead Acid and other battery chemistries. There are no dangers of exposure to sulfuric acid because PHI 3.5 Batteries do not have caustic electrolytes. Thermal runaway is not an issue with PHI products due to the basic nature of Lithium Ferro Phosphate cell chemistry utilized in all our power storage products.

5.1.3 – PHI 3.5 Battery Control and Protective Circuitry
SimpliPhi Power Inc. utilizes balancing, voltage regulation, thermal, current controls, as well as other protective measures, in its PHI 3.5 Battery Management System (BMS). This protective circuitry is embedded in the architecture of each PHI 3.5 Battery.

5.1.4 – UN DOT Certified Cells
The Lithium Ferrous Phosphate (LFP) cells are independently certified to withstand the UN DOT T1-T8 testing guidelines with no special circuitry added. These tests include short circuit, over-voltage, overcharging, extreme temperature, high altitudes, shock and extreme vibration testing.

5.1.5 – UL Compliance
The Lithium Ferrous Phosphate cells within the PHI 3.5 Batteries fully comply with the safety testing parameters of UL 1642.

5.1.5 – RoHS Compliant
SimpliPhi Power 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.

Section 5.2 – Green Attributes, Environmental and Ecological Considerations

5.2.1 – Materials
The primary materials (lithium, iron, phosphate) that make up PHI 3.5 Batteries are environmentally benign and pose very few polluting or environmentally degrading by-products in the harvesting and refinement processes. This is especially true when compared to those of lead acid, NiCad, and NiMH batteries.

5.2.2 – By Products
There are no toxic by-products associated with the assembly or use of PHI 3.5 Batteries, such as off-gassing hydrogen, sulfuric acid spillage, lead contamination, or explosive chemicals.
5.2.3 – Operation
There is no need for maintenance, such as adding water or chemicals, nor is there corrosion of terminals or containment facilities, or dispersion of fumes as with other battery types. Once installed, PHI 3.5 Batteries are maintenance free.

5.2.4 – Life Cycles
PHI 3.5 Batteries are designed for thousands of cycles while maintaining 80 percent or more of their initial capacity. To achieve this, it is critical to follow the operating conditions outlined in the warranty.

5.2.5 – Disposal
PHI products are non-hazardous, may be disposed of without damage to the ecosystem, and returned to the earth, while easily recombining with the elements without harmful by-products. 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.

5.2.6 – Lithium Ferrous Phosphate Batteries and the Environment
As the use of this battery chemistry in larger batteries becomes more common, questions of sustainability and environmental impact inevitably arise. Of the lithium ferrous phosphate chemistries being considered for large format batteries, SimpliPhi Power believes that batteries based on our proprietary lithium ferrous phosphate chemistry and circuitry offer a clear advantage, not only over alternate Li-ion chemistries (lithium cobalt oxide), but all battery chemistries that are currently commercially available. This belief is based on the minimal environmental impact associated with the manufacturing of PHI 3.5 Batteries, the extended cycle life and the significantly smaller end-of-life footprint that results from the use of PHI 3.5 Batteries.

Section 5.3 – Summary
The Lithium Ferrous Phosphate (LFP) cells utilized throughout the entire PHI and LibertyPak product lines are classified as non-hazardous by OSHA and WHMIS. They are non-toxic, unlike NiMH, NiCad or Lead Acid types of batteries (including AGM). The PHI 3.5 Batteries contain the least amount of toxic metals, and are the most eco-friendly of all common battery types. Lithium easily combines into harmless compounds when disposed of. The PHI 3.5 Batteries are the least polluting rechargeable batteries on the market today – no fumes, leaking, or gas discharge and no chemicals or acids to worry about.

Designed and Assembled in the USA Using Exclusive American Patented Technologies.

Section 6.0 – SimpliPhi Technical Support
For technical support related to your PHI 3.5 Battery, please contact us as follows:

805.640.1874
technicalsupport@simpliphipower.com
Appendix A – Material Safety Data Sheet

A.1 – Product Identification

Product Name: Electronically Managed Energy Storage Device (Battery)
Models: PHI 2.6, PHI 3.5
Product Use: Electric Power Supply - Harmony Code #8504.40.9540, Foreign Trade Schedule B

A.2 – Composition and Ingredient Information

Under normal use, this battery does not expose the user to hazardous ingredients.
USA: This battery is an article pursuant to 29 CFR 1910.1200 and, as such, is not subject to the OSHA Hazard Communication Standard Requirement.
The information contained in this Material Safety Data Sheet contains valuable information critical to the safe handling and proper use of the product. This MSDS should be retained and available for employees and other users of this product.
Canada: This is not a controlled product under WHMIS. This product meets the definition of a “Manufactured Article” and is not subject to the regulations of the Hazardous Products Act.

A.3 – Hazards Identification

<table>
<thead>
<tr>
<th>Common Chemical Name</th>
<th>CAS #</th>
<th>Percent of Content (%)</th>
<th>Classification &amp; Hazard Labeling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lithium Ferrous Phosphate (LiFePo4)</td>
<td>15365-14-7</td>
<td>25–35</td>
<td>Eye, Skin, Respiratory Irritant</td>
</tr>
<tr>
<td>Carbon, as Graphite</td>
<td>7440-44-0</td>
<td>12–18</td>
<td>Eye, Skin, Respiratory Irritant</td>
</tr>
<tr>
<td>Aluminum Metal</td>
<td>7429-90-5</td>
<td>3–7</td>
<td>Inert</td>
</tr>
<tr>
<td>Copper Metal</td>
<td>7440-50-8</td>
<td>5–9</td>
<td>Inert</td>
</tr>
<tr>
<td>Electrolyte</td>
<td>12-17</td>
<td></td>
<td>Mixture:</td>
</tr>
<tr>
<td>Ethylene Carbonate</td>
<td>96-49-1</td>
<td></td>
<td>Flammable; Reactive; Sensitizer</td>
</tr>
<tr>
<td>Dimethyl Carbonate</td>
<td>616-38-6</td>
<td></td>
<td>Eye, Skin, Respiratory Irritant</td>
</tr>
<tr>
<td>Ethyl Methyl Carbonate</td>
<td>623-53-0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lithium Hexafluorophosphate</td>
<td>21324-40-3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5.0

Preparation Hazards and Classification: Not dangerous with normal use. The battery should not be disassembled or incinerated. Exposure to the ingredients contained within or their combustion products could be harmful.
Appearance, Color, and Odor: Solid object, no odor.
Primary Route(s) of Exposure: Risk of exposure will only occur if the battery or cell is mechanically, thermally or electrically abused and the enclosure is compromised. If this occurs, exposure to electrolyte solutions contained within the battery or cell may occur by inhalation, eye contact, skin contact and ingestion.
Potential Health Effects:

**Inhalation:** Inhalation of material from a sealed battery is not an expected route of exposure. Vapors or mists from a ruptured battery may cause respiratory irritation.

**Ingestion:** Swallowing of material from a sealed battery is not an expected route of exposure. Swallowing mists from a ruptured battery may cause respiratory irritation, chemical burns of the mouth and gastrointestinal tract irritation.

**Skin:** Contact between the battery and skin will not cause any harm. Skin contact with positive and negative terminals of high voltages may cause burns to the skin. Skin contact with a ruptured battery can cause skin irritation.

**Eye:** Contact between the battery and eye will not cause any harm. Eye contact with the contents of a ruptured battery can cause severe irritation to the eye.

**Medical Conditions Aggravated by Exposure:** Not Available

A.4 – First Aid Measures

**Skin Contact:** Wash affected area with lukewarm water for at least 30 minutes. If irritation or pain persists, seek medical attention.

**Eye Contact:** Wash affected eye with lukewarm water for at least 30 minutes. Rinse with saline solution if possible. Seek medical attention.

**Inhalation:** Move victim to fresh air and remove source of contamination from area. Seek medical attention.

**Caution:** In all cases if irritation persists, seek medical assistance at once.

A.5 – Firefighting Measures

**Extinguishing Media:** Water, carbon dioxide, dry chemical powder and foam are most effective means to extinguish a Lithium Ferrous Phosphate (LFP) battery fire.

**Fire Fighting Procedure:** Put on fully protective gear, including self-contained breathing apparatus, goggles, fireproof jacket and gloves.

**Unusual Fire and Explosion Hazards:** Exposing battery pack or cell to excessive heat, fire or over voltage condition may cause a leak, fire, hazardous vapors and hazardous decomposition products. Damaged or opened cells can result in rapid heating and the release of flammable vapors.