

WHY BUY SMART BATTERY LIFEPO4? ROUGH INTERNAL DRAFT

WEIGHT SIZE STRUCTURE ADVANTAGE:

- **SIGNIFIGANTLY LESS WEIGHT:** Half the weight of an equivalent capacity lead acid.
- **ORIENTATION** Can be operated in any orientation. AGM lead cannot be mounted upside down.
- **VIBRATION PROOF:** Li-Fe cells are of solid construction — there are no fragile/brittle plates made of lead, which can be prone to failure over time as a result of vibration.
- **Cylindrical cells are more stable** and tolerant of harsh conditions, overcharge, and temp variations
- **Smaller cylindrical cells** have higher discharge rate and cool better than bigger sizes
- **SMART LifePO4 batteries are much smaller & lighter** The SB100 12-volt 100 Amp Hour LiFePO4 battery weighs 31 lbs. an AGM Battery of the same size (GRP31) weighs 76lbs. And when you take “usable” capacity into account, the weight advantage of lithium is even more dramatic. 100 amp hours of lithium will deliver 80 amp hours, no matter the discharge rate, without worry. 100 amp hours of AGM can only safely deliver 30-50 Amp hours, depending on the discharge rate. So not only is lithium smaller and lighter than AGM per amp hour, you need significantly less stored amps to get the same usable capacity.
- **More Power in a Smaller Footprint: SMART LIFEPO4** batteries are ideal if you have space constraints and want maximum capacity in the smallest possible size. Or if you wish to maximize the capacity in your existing lead battery space.

CAPACITY ADVANTAGE:

- **EXTREME CYCLE LIFE:** Over 2000-3000 deep discharge cycles (80% DOD) life compared to typically around 300 for lead acid
- **10 TIMES the expected life of a lead battery.**
- Double the usable capacity of similar amp hour lead acid batteries
- What many battery owners and users fail to realize about the lead acid battery is that its capacity (Ah) rating is usually specified at the 20 hour discharge rate. At high rates of discharge the useable capacity is reduced due to “Peukert’s Effect”. A typical 100Ah lead acid when discharged in an hour or two may have an actual measured capacity of as little as 60-70Ah.
- Another major factor which should be taken into consideration when replacing a lead acid battery with a [LiFePO4 Battery](#) is that due to the higher energy density and greater performance of the lithium battery, often a smaller battery can be used which will provide equivalent performance to the original lead battery.
- For many applications a 60Ah [Lithium Iron Phosphate](#) battery will provide equivalent performance to a 100Ah lead acid battery.
- 12V 20Ah LiFePO4 battery is all that is required for a starting battery up to an engine size of 3000cc.
- Lithium has 3 x’s the energy density and power density. Rule of thumb, 1Ah of Lithium = 3Ah of lead.
- **HIGER ENERGY DENSITY:** 4X higher energy density than lead-acid battery: The gravimetric energy density of the LiFePO4 battery is ~130 Wh/kg, almost four times higher than that of a typical Lead-acid battery, at 35Wh/kg. For the UPS user, this means far greater run times while running on battery, without any space penalty.
- Superior performance to lead for energy density and power density. Remember, that 100 amp hours of lithium will deliver 80 amp hours, no matter the discharge rate, without worry. 230 amp hours of AGM can only deliver 70- 115 amp hours, depending on the discharge rate.
- **Superior “Useable” Capacity** Unlike with lead acid batteries, it is considered practical to regularly use 80% or more of the rated capacity of a lithium battery bank, and occasionally more. Consider a 100 amp hour battery – if it was lead acid you would be wise to use just 30 to 50 amp hours of juice, but with lithium you could tap into 80 amp hours or more.
- **Not Affected by Peukert’s Loss:** Another huge advantage of lithium batteries is that Peukert’s losses are essentially non-existent. This means that LiFePO4 batteries can deliver their full rated capacity, even at high currents. Whereas lead acid can see as much as a 40% loss of capacity at high loads. In practice, this means that LFP battery banks are very well suited to powering high current loads

VOLTAGE ADVANTAGE:

- **STABLE VOLTAGE UNDER LOAD:** Virtually flat discharge curve means maximum power available until fully discharged (no "voltage sag" as with lead acid batteries) As soon as a load is placed on a lead acid, there is a sudden drop or "sag" in voltage. The voltage continues to decrease until the battery is completely discharged. By contrast the discharge characteristic of a LiFePO₄ battery is very different. The discharge curve is close to being a straight line. Even under very heavy electrical loads a LiFePO₄ battery will maintain almost full power with very little reduction in nominal voltage throughout its discharge cycle until the battery becomes almost exhausted and in need of recharging.
- Can be connected in series for higher voltages or parallel for higher capacity.
- **HIGHLY EFFICIENCY:** Higher efficiency, electricity is generated from movement of ions rather than from a chemical reaction as in a lead battery
- A SMART BATTERY LiFePO₄ battery is a very good drop in replacement; it has the same voltage range as lead acid.
- **Voltage Sag Virtually Non Existent** The discharge curve of lithium batteries (especially relative to lead acid) is essentially flat – meaning that a 20% charged battery will be providing nearly the same output voltage as an 80% charged battery. This prevents any issues caused by the "voltage sag" common to lead acid as they discharge.

CHARGE/DISCHARGE ADVANTAGE:

- **HIGH DISCHARGE RATE:** High discharge rate capability, 10C continuous, 20C pulse discharge **C=BATTERY CAPACITY**
- **FLEXIBLE RECHARGING:** You can partially charge a LiFePO₄ battery without damaging it, unlike a lead battery, which would cause it to be damaged due to sulfation.
- **DISCHARGE CHARACTERISTICS:** Extremely low self discharge rate (unlike lead acid which will go flat quite quickly if left sitting for long periods)
- **RAPID RECHARGE** Can be safely rapidly recharged — when fully discharged can be brought to a state of over 90% fully charged in 15 minutes
- Another very big characteristic No need for trickle charging, a charged Li battery will stay charged for a year on the shelf. Assuming no parasitic drain.
- **Fast & Efficient Charging** LiFePO₄ batteries can be "fast" charged to 100% of capacity. Unlike with lead acid, there is no need for an absorption phase to get the final 20% stored. This can save you hours of generator run time. And, if your charger is powerful enough, lithium batteries can also be charged insanely fast. If you can provide enough charging amps – you can actually fully charge a lithium ion battery just 20 minutes but even if you don't manage to fully top off to 100%, no worries – unlike with lead acid, a failure to regularly fully charge LFP batteries does not damage the batteries.
- **Very Little Wasted Energy** Lead acid batteries are less efficient at storing power than lithium ion batteries. Lithium batteries charge at nearly 100% efficiency, compared to the 85% efficiency of most lead acid batteries. This can be especially important when charging via solar, when you are trying to squeeze as much efficiency out of every amp as possible before the sun goes down or gets covered up by clouds. Theoretically, with lithium nearly every drop of sun you're able to collect goes into your batteries. With limited roof & storage space on RVs for panels, this becomes very important in optimizing every square inch of wattage you're able to mount.
- **FUEL CHARGING COST SAVINGS:** Especially combined with the fast charging ability, this also translates to less fuel costs when running your generator to charge the batteries.

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- **Smaller cylindrical cells** have higher discharge rate and cool better than bigger sizes
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- **More Power in a Smaller Footprint: SMART LiFePO₄ batteries** are ideal if you have space constraints and want maximum capacity in the smallest possible size. Or if you wish to maximize the capacity in your existing lead battery space.

MAINTENANCE ADVANTAGE:

- Absolutely maintenance free for the life.

ENVIRONMENTALLY GREEN ADVANTAGE:

- Does not contain any toxic heavy metals such as lead, cadmium, nor any corrosive acids or alkalis thus making LiFePO4 batteries the most environmentally friendly battery chemistry available
- Non-contaminating, easy disposal, 100% recyclable
- SMART BATTERIES are RoHS compliant: RoHS regulations are designed to limit or eliminate substances that are dangerous to the environment and to people.

COST ADVANTAGE:

- **LIFEPO4 BATTERIES COST LESS THAN ANY LEAD BATTERY:** If your application requires a capacity of 400 AMPS to operate and using industry standard calculations you would require roughly 800 amp hours of AGM (at 50% usable), or 500 amp hours of lithium (at 80% usable). If we take the numbers above for simplicity the upfront costs we are comparing are:

800 amp hours of 31 AGM – 8 (GRP31 AGM) X \$279.00=\$2,232.00

500 amp hours of the SMART LifePO4 – 5 (SB100 GRP31 LifePo4) X \$1390.00=\$6,950.00

Things look bad for lithium based on the *upfront* Price.... until you look at the lifetime of the battery cost!!!

Laboratory results indicate that we should expect to see 2,000 to 5,000 cycles out of a well cared for LiFePO4 battery bank. In contrast, conventional deep cycle AGM lead acid batteries are typically only good for 200-300 “deep” cycles.

BATTERY	COST	WEIGHT	USABLE AH	CYCLES	COST/CYCLE
SMART SB100 x 5	\$6,950.00	155lbs	400AH	2000	\$3.47
AGM-GRP31 x 8	\$2,232.00	568lbs	400AH	300	\$7.44

This clearly shows that using the SMART LifePO4 Battery is less than HALF the cost of any type of Lead Battery!!

No matter how you play with the numbers, formulas and assumptions – over the life of the battery the SMART BATTERY LifePO4 costs less and you do not need to be changing them out every few years as lead prices increase. (Imagine what your lead batteries will cost in 3 years when you replace them? You will probably never replace your SMART BATTERY they will most likely out-last your application.)

WARRANTY ADVANTAGE:

- FIVE YEAR REPAIR OR REPLACE WARRANTY
- Lowest warranty return rate in the LifePO4 Industry

QUALITY ADVANTAGE:

- **SMART BATTERIES:** Highest Quality in LifePO4 Manufacturing:
- **Factory calibrated and matched cells** for optimum performance
- **Bolted not welded cells:** less impedance and resistance larger current loads, better charging and discharging and stronger vibration resistance
- **Battery Management System:** All SMART BATTERY LiFePO4 Batteries are provided with a Battery Management System (BMS) that protects the battery cells within the Battery pack. The BMS will protect the cells to be sure they do not go outside of the normal limits of Cell voltage of the minimum discharge voltage of 2.8 V, the working voltage of 3.0 V – 3.3 V, and the maximum charge voltage of 3.6 V. The BMS also provides short circuit protection, which prevents high current in the event of an external short circuit.
- ISO 9001-2008
- ISO/TS 16949-2002
- NQA Global Assurance Quality management certified and registered
- IATF Certified
- INTERTEK Certified
- CE EC Certified
- UL Certified
- UN38.3
- PONY Testing International Group results
 - Altitude Simulation - PASS
 - Thermal Test – PASS
 - Vibration Test – PASS
 - Shock Test – PASS
 - External Short Circuit Test – PASS
 - Impact Test – PASS
 - Force Discharge Test – PASS
 - Safety with Power Test – Equivalent or better than traditional lead batteries the lifePO4 has hybrid characteristics: It is safe as a lead battery and is as powerful as a lithium ion battery.
- Life PO4 is Overall superior to all the following battery chemistries:
 - Flooded Lead Acid
 - AGM Lead Acid Batteries
 - lithium [cobalt oxide](#) batteries ([LiCoO2](#))
 - lithium-ion batteries include lithium-[manganese oxide](#) (LiMn2O4)
 - lithium-[nickel oxide](#) (LiNiO2)
 - NiCad Batteries
 - NiMH Batteries

SAFETY ADVANTAGE:

- Safe technology, will not catch fire or explode with overcharge
- Does not suffer from "thermal runaway"
- Cylindrical cells have a safety vent built in to relieve internal pressure
- Inherent safety: they do not produce flammable hydrogen under any circumstances (even if overcharged) a LiFePO₄ battery can be safely installed in a confined area without fear of a fire or explosion.
- LifePO₄ batteries are safe and cannot burn: But as you might recall from the many news stories a few years ago around defective laptop batteries bursting into flame – lithium ion batteries also earned a reputation for catching fire in a very dramatic fashion. The commonly used lithium ion battery formulation had been Lithium-Cobalt-Oxide (LiCoO₂), and this battery chemistry is prone to thermal runaway if the battery is ever accidentally overcharged. This could lead to the battery setting itself on fire – and a lithium fire burns hot and fast. SMART BATTERY is a LifePO₄ formulation are intrinsically non-combustible, and thus vastly safer than any other Lithium ion battery chemistry.
- Battery Management: All SMART BATTERY LiFePO₄ Batteries are provided with a Battery Management System (BMS) that protects the battery cells within the Battery pack. The BMS will protect the cells to be sure they do not go outside of the normal limits of Cell voltage of the minimum discharge voltage of 2.8 V, the working voltage of 3.0 V – 3.3 V, and the maximum charge voltage of 3.6 V. The BMS also provides short circuit protection, which prevents high current in the event of an external short circuit.
- SMART BATTERY Single Cell Triple Protection Technology: High Temp shutdown, High Pressure Current cutoff, Internal Pressure relief valve.
- SMART BATTERY P-pack Technology: No Fire No Explosion fusing system
- SMART BATTERY PCB Board Safety
- Smart Battery LiFePO₄ batteries are considered to be safe, non-flammable and non-hazardous by international and federally regulated standards. ROHS compliant, 70% lighter, worldwide shipping, import/export from our Canadian international headquarters and distribution center.

TEMPERATURE ADVANTAGE:

- Can be used safely in high ambient temperatures of up to +60 °C without any degradation in performance.
- Wide temp range, -20 to +60C... in freezing temps, successive cranking attempts gets faster. Over 60C limits batteries capacity but does not harm it.