

WHY USE LITHIUM

1
Lithium batteries can tolerate partial state of charge or deficit cycling.

Lead acid batteries need to be fully charged frequently or they will sulfate quickly and lose capacity. Lithium batteries can stay partially charged or discharged with no damage. So, it doesn't matter if your client only partially charges their lithium battery each day – they will not be damaged.

2
Very high cycle life at very low depth of discharge.

Lithium batteries like the WeCo can provide 7,000 cycles at 100 percent depth of discharge. This means 19 years expected life if cycled every day

3
Fast charge and discharge rates.

Lithium batteries like the WeCo can be fully charged in about one hour and can also be discharged in the same time. This means that you may only need to run the generator for about an hour to fill your battery bank (if you have sufficient generator capacity).

4
Prices of lithium are now much lower.

Lithium batteries like the WeCo are similar to high quality lead acid batteries, which makes them very affordable considering the advantages. WeCo batteries are similarly priced to lead acid batteries now.



4 REASONS
WHY YOU SHOULD
USE WECCO LITHIUM
BATTERIES

WHICH LITHIUM IS SAFE?



Safety

There are at least five different lithium battery chemistries on the market today. After a careful review, we have chosen lithium iron phosphate, sometimes called lithium ferro phosphate or LiFePo_4 . It seems that most users in the renewable energy industry agree with this selection, because it is the most common chemistry. It has slightly less power density than some of the chemistries used in electric vehicles, but it is also much safer.



Fire Resistant

Many people are scared by the possibility of lithium batteries catching fire, and that is a valid concern with some chemistries, but lithium iron phosphate or LiFePo_4 is very safe. The WeCo LiFePo_4 battery will not catch fire until about 370 degrees celsius (700°F). For reference, wood catches fire around 250°C and aluminum starts to melt at about 315°C



THERMAL RUNAWAY CHARACTERISTIC

Lithium Nickel Cobalt Aluminum Oxide (thermal runaway at 150°C / 302°F)

Lithium Cobalt Oxide (thermal runaway at 150°C / 302°F)

Lithium Manganese Oxide (thermal runaway at 250°C / 482°F)

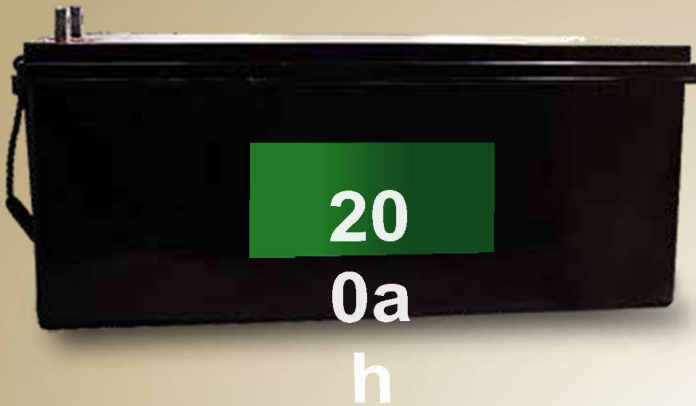
Lithium Nickel Manganese Cobalt Oxide (thermal runaway at 210°C / 410°F)

Lithium Ferro Phosphate LiFePo_4 (thermal runaway 370°C / 700°F)

HOW TO SIZE

Lithium is sold by the kWh, rather than by the Ah ratings used with lead acid batteries. But the conversion is quite simple and it avoids confusion about battery voltage. Notice that most lithium batteries are sold in 48v, whereas most lead acid batteries are 12v or less. As long as we calculate in kWh, the conversion stays simple. Let's compare a standard 200ah lead acid battery and a WECO 4k4 LiFePo4 battery.

LEAD ACID BATTERY



WECO

4k4 LifePo4 Battery



01

GROSS CAPACITY

Traditional Lead Acid Battery = 210 Ah at C/100 or 183 Ah at C/20. Using the C/20 rating, total gross kWh would be $183 \text{ Ah} \times 12\text{V} = 2.196 \text{ kWh}$

WeCo 4K4 capacity = 4.95 kWh gross at 48V. Or, to rate in Ah, $4,950 \text{ Wh} / 48\text{V} = 103 \text{ Ah}$ at 48v. (Note: WeCo actually uses 52v to compare Ah, rather than 48v, since lithium voltages are so stable, but don't let that confuse you here...)

However, those calculations only show gross energy stored, not useable energy stored. WeCo does not market their battery on gross energy, but on useable energy stored, so we should consider the recommended depth of discharge to calculate actual useable energy stored in both batteries.

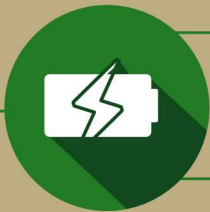
02

RECOMMENDED DISCHARGE RATE

Lead acid recommended depth of discharge is 50%, therefore useable power is only $2.196 \text{ kWh} \times .50 = 1.098 \text{ kWh}$.

WECO recommended depth of discharge is 90%, therefore useable power is actually $4.95 \text{ kWh} \times .90 = 4.45 \text{ kWh}$.

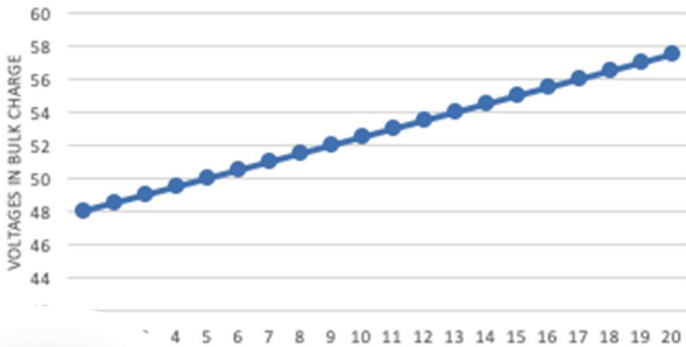
In other words, the useable capacity of one WeCo 4K4 is almost exactly the same as four high performing lead acid batteries. That is a useful comparison, but the easiest way is to simply calculate your storage needs in kWh rather than Ah.



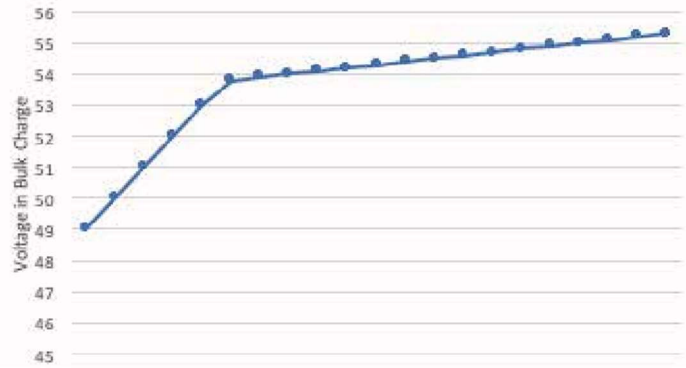
HOW TO CHARGE

The chart below shows that the voltage of a lithium battery changes very little as it charges.

Lead Acid Battery in Bulk Charge



Lithium Battery in Bulk Charge



This means that the charge settings are more sensitive and therefore even 0.1 V can make a big difference in the state of charge. In lead acid batteries, such a small voltage change does not matter too much, so we need to be more exact with lithium batteries.



Equalization is a major challenge with lead acid batteries. One of the reasons we like the WeCo lithium battery is because it has built in cell equalization. The battery management system keeps all of the individual cells (16 cells per 4K4 module) in balance and within tolerance. You can watch it happen via their remote monitoring!



Lithium batteries also do not need absorption charges - they can be completely charged in one mode (Bulk, also called Constant Current). The WeCo battery can be charged with inverters that are programmed to communicate directly with it (like Schneider and Victron) or with any inverter that has adjustable charging parameters. If you are using an inverter without communication, you simply program the charger to comply with WeCo's maximum charge current and voltage settings.



Lithium batteries like the WeCo have an internal computer hence you can log on with your phone or laptop to observe the battery's state of charge. So, even if you didn't have WeCo's recommended charge settings, you can see when your battery is almost full or empty and you can adjust your charger accordingly. We call this an Open Communication BMS (battery management system) and it will work with virtually any inverter or charge controller that has adjustable setpoints.



If you have an inverter (like the Victron) that has the protocol to communicate with the WeCo battery, then you can simply connect the communication cables and the inverter will automatically adjust charge and discharge settings to match the battery. We call this Closed Communication BMS (battery management system). WeCo is constantly adding their communication protocol to more inverters, so soon this option may be available with almost all inverters. It is rare to find a lithium battery that features both an open and closed communication BMS, and that is one reason the WeCo is so valuable in Africa.



CELL TYPE

When choosing a lithium battery, it is important to notice the type of cell used. LiFePo4 batteries may be manufactured in at least three cell configurations:

POUCH TYPE



Pouch type cells are housed in an envelope or pouch. This makes manufacturing cheaper, but it is generally not as durable as other designs. Pouch type cells are difficult to balance when connected in a battery module. Also, allowance in the design must be made for swelling and shrinking of the pouch as the battery is cycled. Generally, the number cycles is quite low and we would not recommend pouch type batteries in renewable energy applications.

CYLINDRICAL CELLS



Cylindrical cells look like traditional alkaline batteries and are very durable, but more challenging to organize into a package or restricted space. Many cells need to be connected together to create one battery module, meaning many welding points and potential imbalances between cells. Single cell failure rate is comparatively high and will cause an entire string to fail. Cycle life for most cylindrical cells is in the region of 2,000 - 4,000 cycles.

PRISMATIC CELLS



Prismatic cells are designed in long flat plates and were developed for applications where space saving design was important. WeCo uses prismatic cells that are manufactured using a solid lamination process with copper separators. This enables the electrolyte to be distributed evenly and balanced between the plates. WeCo prismatic cells incorporate Nano Graphene and a high concentration of pure lithium to give faster charging rates and a higher depth of discharge and cycle life. These are the cells that give WeCo's battery 7,000 cycles and very stable temperature characteristics.

PROTECTION

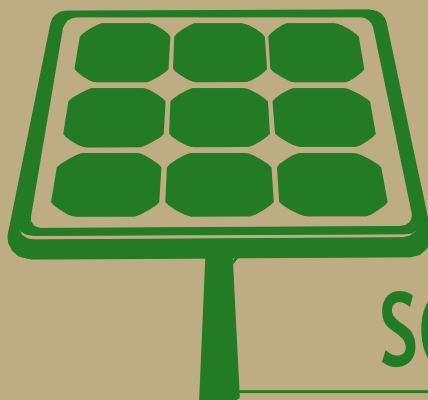


Remember that a lithium battery is much more sensitive to voltage than a traditional lead acid battery. Charging a flooded lead acid battery at too high a voltage may result in some gassing and overheating, but charging a lithium battery at too high a voltage may result in permanent damage to the battery management system (BMS). Also, a lithium battery can only accept or discharge a limited amount of current instantaneously - exceeding that limit can cause permanent damage to the battery cells and BMS.

So, it is very important to choose a battery with a rugged BMS that can handle these voltage and current events while protecting the battery. Many manufacturers use printed circuit boards (PCB) to handle the power flowing through their BMS. This saves money and may be sufficient under most conditions. But when these batteries with a PCB get mistreated, the BMS is very likely to be destroyed, so we don't recommend those battery manufacturers.

The WeCo battery has a rugged BMS that uses contactors and in-line fuses to control power and protect the cells. In normal operations, any attempt to charge at a current or voltage which is too high will be intercepted by the BMS and the battery will shut down (open the contactor) to protect itself. The battery will then periodically check to determine if it is safe to resume normal operations. In our experience, the battery will not be damaged, but these over current and over voltage shut downs will become an annoyance to the end user and will encourage them to follow the current and voltage parameters specified with each battery module.

Because of these great protections, when you turn on a WeCo battery, you will hear a loud click as the relay closes (similar to the relays on our best transformer-type inverters). We are not inviting you to abuse the WECO battery, but we are confident it can stand up to most of those unfortunate events that happen in the field.



SOLAR APPLICATION

Most lithium battery manufacturers serve a variety of markets. The larger ones have products for vehicle, tools, boats, UPS and solar applications. We are happy to partner with WeCo, who focuses only on renewable energy applications. WeCo's parent company has been a European solar installer for more than a decade, so the WeCo team understands the solar business and how to make the batteries that we need.

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