

CHARGING BATTERIES IN SERIES VS. PARALLEL

To understand differences between charging batteries in series vs. parallel is critical if you have multiple battery systems.

How you connect batteries will determine how they perform in different applications. Below is a closer look at how batteries are wired in series vs. parallel and when each method is appropriate.

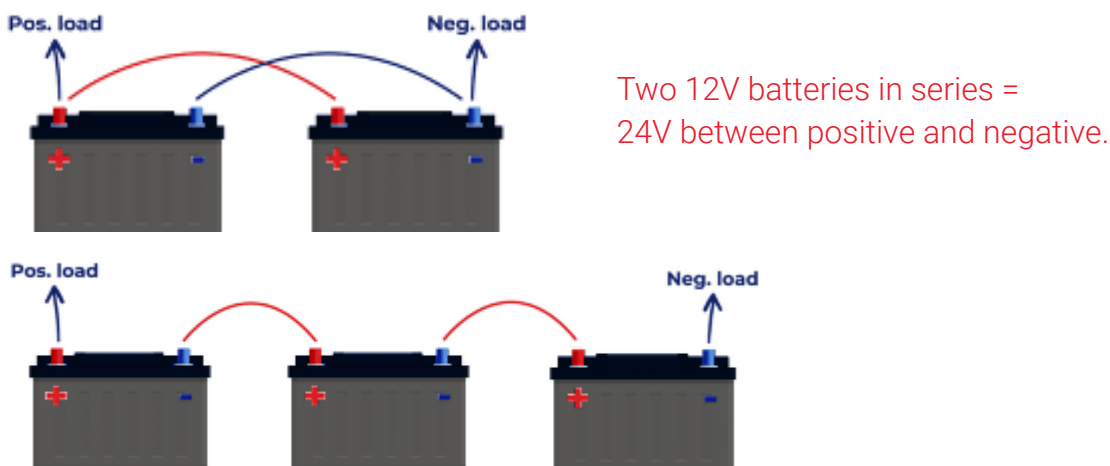
WHAT IS THE DIFFERENCE BETWEEN WIRING BATTERIES IN SERIES VS. PARALLEL?

Main difference in wiring batteries in series vs. parallel is the impact on the output voltage and the capacity of battery system. Batteries wired in series will have their voltage added together whereas batteries wired in parallel will have their capacity (measured in amp-hours) added together. However, the total available energy (measured in watt-hours) in both configurations is the same.

For example, connecting two 12 Volt batteries with 100Ah capacities in series will output 24 Volts with 100Ah capacity, but wiring the same two batteries in parallel will output 12 Volts with 200Ah capacity. Both systems will have a total available energy of 2400 watt-hours (watt-hours = volts x amp-hours).

WIRING BATTERIES IN SERIES

To wire multiple batteries in series, connect the positive terminal of each battery to the negative terminal of the next battery. Then measure system's total output voltage between negative terminal of the first battery and positive terminal of the last battery in series. Please see graphic representation of wiring batteries in series below.



Advantages of Series Connection

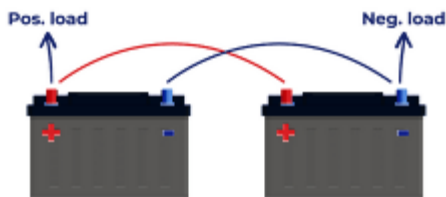
Wiring batteries in series provides a higher system voltage which results in a lower system current. Less current means you can use thinner wiring and will suffer less voltage drop in the system.

Disadvantages

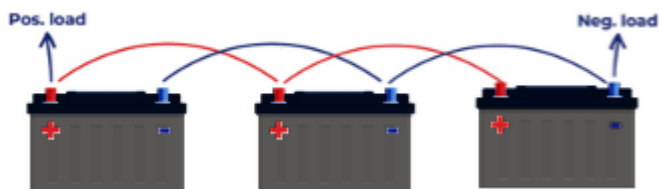
In a battery system wired in series, you cannot get lower voltages off the battery bank without using a converter. Either all equipment needs to function at a higher voltage, or an additional converter is needed to use 12V appliances on the system.

WIRING BATTERIES IN PARALLEL

To wire multiple batteries in parallel, connect all the positive terminals together and all the negative terminals together. Since all the positive and negative terminals are connected, you can measure the system output voltage across any two positive and negative battery terminals. Let's look at two examples to make this clear.



The first example is two 100 Ah batteries wired in parallel. The positive terminal on the first battery is connected to the positive terminal on the second. Likewise, the negative terminals of both batteries are also connected. The total system voltage is 12 Volts, and the total capacity is 200 Ah.



The second example is wired the same way but with a third battery. The capacities of all three batteries add together, resulting in a total capacity of 300 Ah at 12 Volts.

Advantages

The main advantage of wiring batteries in parallel is that you increase the available runtime of your system while maintaining the voltage. Another advantage to wiring batteries in parallel is that if one of



your batteries dies or has an issue, the remaining batteries in the system can still provide power.

Disadvantages

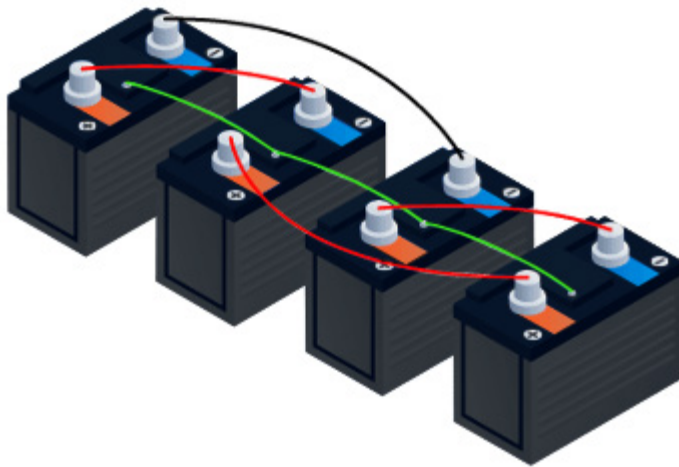
Main drawback to wiring batteries in parallel vs. series is that the system voltage will be lower, resulting in a higher current draw. Higher current means thicker cables and more voltage drop.

SERIES AND PARALLEL CONNECTION

You can also increase both the voltage and the capacity by connecting at least four batteries both serially and in parallel. This gives you a higher voltage battery bank that also has a longer run time for your application. This is a common practice for applications such as electric vehicles and large UPS systems. There are different ways to connect the batteries to achieve the increased voltage and capacity.

With four batteries, you can create two series that are connected via a parallel connection, or two parallel banks connected by one serial connection. Either way results in the same voltage and capacity gains.

You cannot wire the same batteries in series and parallel because it would short the system, but you can wire sets of batteries in series and parallel to create a larger battery bank at a higher voltage.



REFERENCES:

1. "What's The Difference Between Wiring Batteries in Series Vs. Parallel?"

[What's The Difference Between Wiring Batteries in Series Vs. Parallel?](http://battlebornbatteries.com) (battlebornbatteries.com)

2. Series and Parallel Sealed Lead Acid Battery Connections

[Series and Parallel Sealed Lead Acid Battery Connections](http://batteryclerk.com) (batteryclerk.com)

