

## **Battery Issues – Two 6 Volt vs One 12 Volt**

By Duane Larson

The batteries we use in our cars, tractors, etc. are built up by combining lead-acid cells (which each produce about 2 volts) in series. A 6V battery is made up of 3 cells and a 12V battery has 6 cells. So, battery voltage is determined by the number of lead-acid cells in the battery. Battery technology was driven by the automotive industry, and they did not start using 12V batteries in mass production until the mid '50s, following development of higher compression engines. So, tractor and industrial 12V needs prior to that were usually met by hooking two 6V batteries in series. The 1960 Tractor Supply catalog was the first of their catalogs to carry 12V batteries.

Energy stored in a battery is historically given in terms of amp-hours (A-H). An 80 A-H battery will provide 8 amps for 10 hours, or 10 amps for 8 hours, or.... . However, batteries for starting, lighting, and ignition (SLI) are designed to provide a large amount of current for a short time (during starting), and then loafing (operating the ignition system, radio, lights, ...) while being recharged. Thus, the A-H method of describing energy storage is not really relevant. A concept named Cold Cranking Amps (CCA) replaced A-H to describe SLI batteries, and tells how many amps can be drawn from a battery for 30 sec at 0 deg F.

When batteries are connected in series, the voltage adds but the CCA is that of the lowest battery in the circuit. So, if two 6V batteries, one 400 CCA and one 600 CCA, are connected in series, 12 volts are obtained but the CCA remains at 400.

When batteries are connected in parallel, the voltage is that of the original batteries, but the CCA adds. So, in the above example one would obtain 6V and 1000 CCA.

Power (in watts) is simply voltage (in volts) times current (in amps). So, in the above examples, the power involved for two batteries in series would be 12V x 400 CCA or 4800 watts. For the parallel case the power is 6V x 1000 CCA, or 6000 watts. So, in this example the two 6V batteries in parallel will deliver more power than the two 6V batteries in series. Either case shows why we use large cables to conduct current to a starter.

Battery failure often occurs due to structural failure of the plates, or sulfation of battery plates. Proper maintenance, including checking liquid levels and charging, will reduce problems, but with two batteries you have two chances of battery failure rather than one.

A final note – all John Deere two cylinder tractors came from the factory as positive-ground – i.e., the positive terminal of the battery is connected to the frame of the tractor and the negative terminal goes to the starter terminal, lights, and other loads.