

Talkin' Tech: Electricity

Paul Crowe once again steps up to bat with a wealth of electrical and ignition expertise to share with the HOOK Readers. This is the first of a three-part series Paul has graciously offered to share, and I extend him a big thank you for his efforts! -BL

Electricity

elektridē/

noun

1. a form of energy resulting from the existence of charged particles (such as electrons or protons), either statically as an accumulation of charge or dynamically as a current.

Anyone who has ever turned a key and discovered a dead battery knows the importance of electricity. Sufficient voltage and amperage are essential to proper vehicle function. So why are so many vehicles wired together like a spaghetti dinner gone bad?

I believe electricity is confusing because we can't see it. When you have a coolant leak the puddle is easy to see. When electrical parts fail we stand there scratching our head.

Over the next few issues we will discuss the three critical areas of a strong electrical system for your vehicle.

Source = Battery & Alternator/Generator

Path = Wiring Harness & Connectors

Load = Starter motor, Solenoid, Coil, Cooling fan, Electric water pump, Etc...

Alternator or Generator?

What is the best method of charging your battery?

- Alternators can spin at a faster rpm allowing energy to be produced at lower engine speeds. This makes for a more efficient system however both systems, when in good working order, can provide sufficient power to charge and maintain the battery.

Many alternators now have built in voltage regulators that simplify wiring and reduce harmful voltage spikes.

- Generators are larger, produce less energy at low rpm, and are considered old technology. It is also more difficult to find replacement parts if it fails the day before an important tractor pull.

If you are upgrading your charging system look for an alternator that provides proper output for the load you have. Most small alternators produce 40 amps or more but check before you buy! Also consider the RPM range that the alternator was designed to operate. Using an alternator designed for 3,000 rpm won't necessarily work on your stock John Deere running 800 rpm.

Here is a sample power usage charge:

Electric Fuel Pump	4-5 amps
Electric Water Pump	6-8 amps
Electric Fan	15-25 amps
Ignition coil	3-4 amps
Total draw	28-42 amps

Voltage Regulator

Although most modern alternators have built in regulators, if you still have an external regulator consider upgrading to a new Mosfet electronic style. Why?

The MOSFET is a bit more intelligent... It doesn't rely on the current for opening the door, and it doesn't try to close it slowly... Instead the switch is really a switch which creates a lot less heat, and makes it more exact... A lot more exact! The loss of precision creates wilder swings between high and low voltage, making the regulator work harder to maintain proper output voltage. The harder it works, the more heat it produces, which in turn causes an even greater loss in precision. The end result is brutal voltage swings that burn up electronic components such as ignitions and cause random issues that are impossible to solve.

Batteries

Your battery acts like a water tower for your local town. It functions as a storage device, energy supplier, and to a certain extent it buffers electrical spikes and brown outs caused by your charging system. Using a cheap or under sized battery places extreme stress on your vehicle's electrical system.

Batteries need to be in good condition and rated for the correct amperage to start an engine. Truck or farm rated batteries can be purchased in a variety of sizes and capacities. Odessey Battery even offers one that has a 2250 CCA (cold cranking amp) rating!

Battery terminals are critical to the transfer of electricity and many of us are guilty of battery neglect. The clamps should be sturdy, clean, and the positive (+) post should be protected to prevent accidental shorting. Corroded terminals add resistance which reduces output and increases heat which can harm the battery and accessories.

Battery cables need to be appropriately sized for the distance between the battery and starting motor and rated for the load it must carry. Starter motors can draw 250+ amps and you need a cable designed to handle that load, especially if you mount the battery away from the starter.

Amperes	250-300	4-ga.	2-ga.	2-ga.	1/0-ga.	1/0-ga.	1/0-ga.	2/0-ga.
	200-250	4-ga.	4-ga.	2-ga.	2-ga.	1/0-ga.	1/0-ga.	1/0-ga.
	150-200	6 or 4-ga.	4-ga.	4-ga.	2-ga.	2-ga.	1/0-ga.	1/0-ga.
	125-150	8-ga.	6 or 4-ga.	4-ga.	4-ga.	2-ga.	2-ga.	2-ga.
	105-125	8-ga.	8-ga.	6 or 4-ga.	4-ga.	4-ga.	4-ga.	2-ga.
	85-105	8-ga.	8-ga.	6 or 4-ga.	4-ga.	4-ga.	4-ga.	4-ga.
	65-85	10-ga.	8-ga.	8-ga.	6 or 4-ga.	4-ga.	4-ga.	4-ga.
	50-65	10-ga.	10-ga.	8-ga.	8-ga.	6 or 4-ga.	6 or 4-ga.	4-ga.
	35-50	10-ga.	10-ga.	10-ga.	8-ga.	8-ga.	8-ga.	6 or 4-ga.
	20-35	12-ga.	10-ga.	10-ga.	10-ga.	10-ga.	8-ga.	8-ga.
0-20	12-ga.	12-ga.	12-ga.	12-ga.	10-ga.	10-ga.	10-ga.	
		0-4 ft.	4-7 ft.	7-10 ft.	10-13 ft.	13-16 ft.	16-19 ft.	19-22
		Length in feet						

Are all batteries the same?

The two common automotive batteries are Flooded Lead Acid (FLA) and Absorbed Glass Mat (AGM). Although most of us grew up using the FLA type with their removable caps unassuming black case, the AGM battery is becoming more popular, especially the unique Optima cylindrical shaped "red top" battery.

What is an AGM battery?

Unlike a gel battery, in which a silica agent is added

to the electrolyte to form a semisolid, an AGM battery uses an ordinary sulfuric acid solution like any standard automotive battery (about 60/40 water and acid at full charge). However, here the electrolyte is absorbed and retained by layers of boron-silicate glass matting between the lead plates. While both battery types can rightly be considered leakproof and spill-proof, AGM is currently considered the superior technology,

My friend Chris Kobs works in the battery industry and states that AGM batteries are improving all the time and he listed a few advantages of the AGM over FLA type:

- 1. AGM batteries typically provide more cold cranking amps (CCA) than lead acid in the same group size because they have a larger plate surface area.**
- 2. AGM battery generally charge faster than lead acid type.**
- 3. AGM doesn't need to be filled with water or electrolytes and can be mounted sideways because it is sealed.**
- 4. AGM batteries do not experience the type of terminal corrosion that lead acid batteries have.**

Is an Optima battery worth the extra money and will it perform better?

After weeks of reading internet articles and personal reviews, this quote from an Interstate employee summed it up best: "I work for Interstate batteries so I can attest to the quality of the standard Interstate lines as well as the Optimas. I use a yellow top because my vehicle has a slow drain and they have superior deep cycle abilities and resistance to temperature extremes. That being said, you can expect the same life span out of both batteries -- the Optima although different in its construction, doesn't really offer any extra CCA or life span compared to the conventional types.

Amazingly, you can choose a battery with "too much CCA" according to Interstate Batteries. Since a higher cold cranking amp battery requires more plate material inside, this reduces the batteries ability to stay cool in hot climates. Heat also accelerates battery component corrosion so consider this when deciding how to mount your battery. I live in the frozen north and for us it is all about keeping the battery warm. Extreme temps = fail.

Let's end this article with a fun fact: Wives Tale: Setting your battery on a concrete floor will destroy it. FALSE. Back when batteries had wooden cases with glass containers inside, this could cause issues with leakage if the glass container froze and cracked. Eventually batteries used a rubber housing which allowed electrical energy to pass through the battery case. Modern battery material does not allow this to happen and there is no longer a risk. Next issue we will discuss wiring and connectors.