Talkin' Tech:
Electrical Load

Paul Crowe's outstanding Electrical System series of articles rounds out in this issue with an examination of electrical load. Thanks again Paul for your hard work!

Wikipedia defines an electrical load as the electrical component or portion of a circuit that consumes electrical power. This is opposed to a power source, such as a battery or generator, which produces power. In electric power circuits examples of loads are ignitions, cooling fans, starting motors, and electric water pumps.

In the past two articles we discussed electrical generation and wiring. Now we need to discuss the actual load your electrical system must support.

Starter Motor: If you are upgrading yours, consider options such as gear reduction and amperage draw compared to your stock motor.

DIRECT DRIVE	GEAR REDUCTION
Large, low speed motor	Small, fast motor
Rotates a pinion gear in a 1:1 ratio	Rotates a pinion gear in a 4:1 ratio
Typically cheaper	Typically expensive

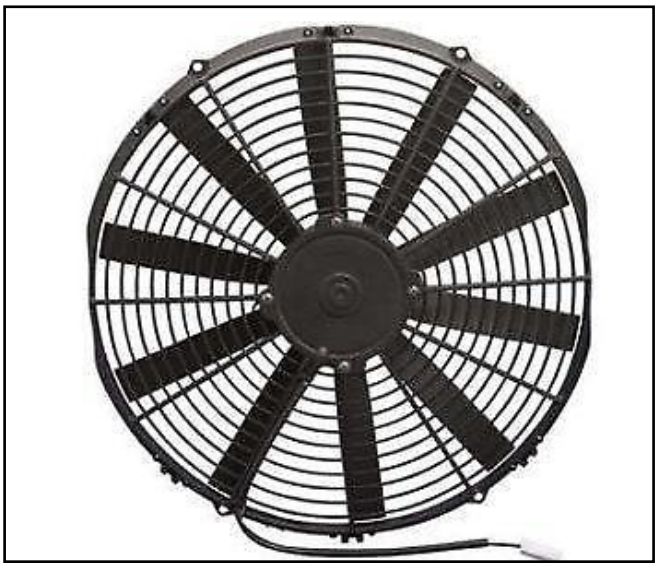
Although gear reduction starters are superior to direct drive in most cases, there are still a few reasons to use direct drive. The most obvious benefit of direct drive is price, which can become a rather large issue. For instance, direct drive starters are often the better choice for heavy duty diesel applications. In some applications, a gear reduction starter can cost 30 percent more than a direct drive unit.

No matter which design you choose, get the best quality starter you can afford. It is a big ticket item and serves an important role. Nothing is more frustrating than getting to a pull only to find out the grim reaper visited your tractor.

Regarding load, if you install your battery on the front weight bar you have a very long run for the power supply. Consult the wire gauge chart I shared in the previous article. When in doubt, go BIGGER. Josh Blackburn tested his John Deere G starter for me and found it to use in excess of 600 amps!

Cooling Fan: Electric fans typically draw a large amp spike upon start up, then consume less power once spinning. 60 amp spikes are not uncommon with a 30-45 amp steady draw. Use a fuse or circuit breaker appropriate for the manufactures rated draw at start up.

Your supply wiring needs to be large enough to handle the start up load so don't cut corners on the gauge. As with any electrical accessory, leave the fan off until the engine is running.



Water Pump: More tractors are showing up with electric pumps. Meziere and Moroso are two companies with a reputation for quality pumps.

Flowing anywhere from 20 to 36 gallons per minute (GPM) of coolant when installed, most electric water pumps can flow over three times what their mechanical counterparts are capable of at idle.

Amperage draw is typically between 8-12 amps with a minor spike during start up. You can wire the pump to run automatically or using a quality on/off switch.

Ignition system: With an original points system only the coil uses electricity, since the points are driven by the crank or camshaft. Electronic ignitions often have a trigger, a spark box, and a high voltage coil. Our C5 ignition has no spark or rev box and uses a few tenths of an amp with special coils that have very low amperage draw.

For tractors we mainly focus on coil amperage since they need the most energy. There are several things to consider regarding coil design.

Coils typically come in three distinct "ohms" rating. Depending on what trigger you are using the coil will be 5 ohm, 3 ohm, or 1.0-1.2 ohm. So what does that mean?

Coil "ohm" ratings relate to the amount of amperage (or flow) a coil uses when it is "on" and generating magnetism. Mechanical points use a coil with higher resistance so amperage is restricted. This is done to protect the system from overheating and premature failure. Electronic systems use lower resistance coils which flow more electricity when they are turned on. The ballast resistor on old tractors was used to restrict amperage.

It would seem that using a 5 ohm coil would be the best option, since it uses less power while turned on….but you would be wrong.

High end modern ignitions use variable dwell. That means at low rpm the coil is only on for a short time. As rpm increases the coil is turned on for a longer amount of time. If you mate a modern ignition with a high quality coil, you can greatly reduce electrical load while actually increasing available spark energy.

Example: A traditional oil filled coil draws about 2.4 amps but must remain on for a very long time to generate 20,000 volts. Our new MC-2 coil draws 4 amps but has dwell of just 10 degrees at start up and generates 40,000 volts. It uses less battery power but provides twice the available voltage using modern technology.

To summarize, if you use a modern coil design with variable saturation, you can produce more voltage using less battery power from your tractor.

In the end, your main focus should be to choose an alternator and battery that supports the load of all your electrical accessories. This is especially true of the starter motor draw during a cold engine start up. After that, you must consider the steady drain of the fan, waterpump, lights, and ignition coils while the tractor is running. Take your time, design it correctly, and you will avoid headaches for years to come.