



48Amp single phase VS 50 Amp three phase

As many of you who ride 1997 to 2005 FLH/FLT models have discovered, they do not seem to get the stator life you may expect. For those of you that do not know what a stator is, it is part for the charging system. Its job is to supply electrical current to charge the battery and run electrical devices.

In 1995 Harley Davidson introduced its first production fuel injected motorcycle. A larger charging system was needed to run the electric fuel pump. A 38-amp single-phase system was developed. It was a dependable system that delivers 16 amps at 1000 rpm and 38 amps at 2500 RPM. The full dressed fuel injected models still needed more electrical power. Instead of developing a completely new system Harley bumped up the output of the 38-amp system by increasing the strength of the magnets on the rotor. This is where the problems began. To make an analogy it is kind of like taking a stock motor, boing and stroking it to the max, then adding the most radical cam you can find. Man, it really puts out but when it hits it hits hard. All this extra power puts more stress on downstream components. This extra stress can shorten the life span of some parts that are not designed to handle it.

With the addition of the stronger rare earth magnets on the rotor the system was called a 45-amp system. In 1999 with the introduction of the twin cam motor they started calling it a 48-amp system. The 45 and 48 amp systems are basically the same systems. This is the first system Harley made that can produce more amperage than it is rated for. This system puts out 30 amps at 1000 RPM and about 54 amps maximum. When drawing over 45 amps out of this system, the stator will produce heat faster than it can get rid of it. The temperature of the stator will rise until it gets hot enough to melt the insulation. Once the insulation burns up the stator shorts out and will no longer work.

We spent years upgrading our stators to increase the durability of this system. As luck will have it all of our other stators have received the benefits from this quest.

The plastic over molding insulation used on other stators melts at 425⁰ F. By 450⁰ they are toast. We have developed a stator that can withstand peaks of 600⁰F. But Continuous operation at this temperature will shorten the stators life span. Drawing full power out of the 48-amp system (54 amps) can result in temperatures this high.

Another drawback to using the stronger rare earth magnets is they produce an AC waveform that results in harsh power delivery. Alternators produce alternating current commonly refers to as AC. If you made a graph plotting AC voltage agenst time it would make a reciprocating wave. Ideally it would make what is known as a sine wave. A sine wave has a rounded almost semi-circle shape to it. The more commonly used ceramic magnet rotors produce a wave that rise and drop of more

gradually. The stronger magnets used on the 48-amp rotor produce a square output wave. This square waveform indicates a very fast change in voltage which leads to very high instantaneous current. These high instantaneous current spikes produce a lot of heat and go hard on the regulator and battery. This is what I mean when I say the 48 amp system hits hard.

Until recently there were no other charging systems available with enough output to replace the 48 amp single phase system. The introduction of the 50 amp three-phase system gives another option. There are many benefits to the 50-amp system. The three main advantages are better durability: smoother power delivery and lower cost.

The larger three-phase stator used in the 50-amp system has 18 poles to do the same work of the 12 poles on the single-phase stator. This spreads the load out over a larger area. On top of that each pole has only two layers of wire compared to four layers on the old stator. This will lead to better heat dissipation and lower operating temperature.

The 50 amp three-phase system delivers a smoother power delivery for two reasons. First of all, the rotor in this system uses ceramic magnets. As I mentioned before they make a smoother output wave. The second reason is the three-phase system has three sets of charging coils. These coils produce waves that are offset 120 degrees from each other. This is kind of like having a motor with three smaller cylinders instead of one big one. The smaller smoother more frequent waves produced by this system delivers a smoother charge.

The rare earth magnets used in the 48 amp three-phase system are dreadfully expensive. The ceramic magnets used in the 50-amp system are fairly inexpensive. So basically, for a little more than the cost of the 48-amp rotor you can buy the entire 50-amp system. All things considered, compared to the 48-amp system, the complete 50-amp kit is the way to go.