Note. Major changes and/or additions are in bold face font. Contributions by web members are underlined with dots and credit given when known. Minor changes, usually just wording, are not drawn attention to by any special font.

********* ELECTRICAL ***********

Revised: April 15, 2009

*************************GENERAL*************************

WIRE SIZE FOR 6 VOLT SYSTEMS: If in doubt, use the larger size.

GAUGE	MAX. AMPS	TYPICAL APPLICATIONS
18	5	License plate, dome, glove box, dash lights, & other small loads
16	10	Instruments, radio
14	20	Field wiring, generator ground, heater fan Overdrive wiring, cigarette lighter, tail & brake lights, park lights & misc wiring
12	30	Headlights
10	50	Charging, Amp meter, main supply
8	80	

6 Volt Battery cables should be #1/0 minimum.

HEAD LIGHT WIRING: There are three prongs on either a seal beam or bulb...... two vertically and one horizontally.

Looking at the back of the head light seal beam or bulb at the bare prongs, the top horizontal prong is for the low beam.

The right vertical prong is for the high beam.

The left vertical prong is for the ground.

TEST LIGHT USED FOR LOCATING SHORTS & TESTING CIRCUITS: If it’s a fused circuit, the fuse blows before you can even begin troubleshooting. If you replace the fuse with a piece of copper tubing or a screw, the insulation will begin smoking long before you can trouble shoot the system. Use an old dash bulb and socket. You’ll have to solder a second wire onto the light socket’s metal base for a ground wire. Use the same voltage bulb as the system you’re checking. On both a fused and a non-fused circuit the bulb will limit the current and prevent things from smoking. On a fused circuit, connect a lead to each end of the fuse holder’s contacts. The bulb replaces the fuse but, unlike the fuse, won’t blow or cause a dead short. The current flows through the light to the short (ground) which completes the circuit. As long as the bulb is lit, there is a current flowing to ground and there is a short. If the bulb is not lit, there’s no short. Simple. Beats replacing fuses by the gross or spending a day or so replacing smoked and charred wire looms. Tip: Use a seat warning buzzer off a new car in place of the bulb. Works great when you can’t see the bulb, but with my geezer hearing, I have to stick to the bulb.

ELECTRICAL SHORTS: If your battery keeps discharging or going dead for no apparent reason, there is a good chance there is a short. But how to check for a short and, better yet, how to find it? Partially charge the battery if it's dead. It doesn't need to be anywhere near fully charged. In the following, I'll be using the terms "load side" and "line side". The line side is the side of the circuit that comes from the battery. The load side is the side of the circuit that goes to the light or motor (load).

Checking for a short: Disconnect one battery cable from a battery post (either one works). Lightly touch the inside of the cable's terminal to the post. If there is any kind of spark, there is a short. Sometimes the spark is very faint (a small short) and you can only see the faint blue spark if you shield out all light. If there isn't any spark, there isn't a short. Problem is probably in the battery and/or charging systems. Another means of testing is to hook up your dash test light between the battery cable and the hot negative battery post. If it lights up, there is a short. Often the bulb barely glows which signifies a small short.

Let's suppose there is a spark. How to find it is the next step. I'm assuming there are no blown fuses in the following discussion. There are basically two types of circuits.... fused and non-fused.

Determining if it's in a fused or non-fused circuit: Leave the battery cable disconnected from its hot negative battery post. Hook a dash bulb test light (described in the preceding TEST LIGHT FOR LOCATING SHORTS) between the battery cable and it's negative battery post. Since there is a short, the bulb lights up or just barely glows. This tells us there is current flowing through the bulb to ground (the ground is the short itself). Next we test to see if the short is in a circuit protected by a fuse. With the test light still lit up, watch it while you remove one fuse at a time at the fuse panel. When the test light goes out, the short is in that fused circuit. If the light does not go out after pulling all the fuses, the short is in a circuit that's hot all the time (a non-fused circuit or on the line to the fuse panel).

Fused circuit: If the test light goes out when a fuse is pulled, the short is in the load side of the circuit that particular fuse protects. Push the fuse back in. The test light should be lit. Watch it while you track the circuit between the fuse panel and the load...... jiggling wires and wiring harness as you go. Examine the wiring very closely as you trace it. Often times you'll find the insulation worn through and the bare wire touches a ground. When the light flickers, it means you're very close to the short and should be able to locate it visually.

Non-fused circuit: If the test light does not go out after pulling all the fuses, the short is in a circuit that isn't controlled by a fuse. It's either in:

(a) one of the wires feeding (line side) the fuse panel.

(b) a circuit that's hot all the time. Examples of "hot all the time" circuits are the line sides of; the head light switch, the horn button (switch), brake light switch, the ignition switch, cigar lighter, the starter button, and the dome light switch. Notice all circuits are hot all the time regardless of what position the ignition switch is in (off or on). Also each has a switch in their circuit. The short has to be between the battery and the switch (line side of the switch). The short cannot be on the load side of the switch because a switch that's in the off position prevents current from going to the light or motor (on the load side of the switch).

For both (a) and (b), watch the lit bulb as you examine and jiggle the wiring on the line side of the switch on each of the circuits. When the light flickers, you've very close to the short and should be able to visually find the short.
One more thing: Don't discount a bulb from being the culprit. Even though it works, I replace the bulb first to eliminate the possibility of a dinked up bulb. TIP: Always make sure the bulb or motor is grounded when something ceases to work. You'll find it's often the culprit.

************************ GENERATORS ************************

CHECKING 2 BRUSH GENERATORS & REGULATORS ON THE CAR: A 2 brush system that is functioning properly should show charge somewhere in the 4 amp range when the battery is fully charged. Let's assume the ammeter shows a slight discharge with the engine running and everything else turned off. With the engine running above idle, temporarily connect a jumper wire between the field terminal and the armature terminal at the regulator. This essentially removes the regulator from the circuit. If the ammeter shows charge, the regulator is at fault. If the ammeter shows no charge, the generator is at fault. However, at times the generator may have taken the regulator with it when it failed, so don't rule out this possibility if the generator checks faulty. Note the generator goes to full charge when the field is jumped to the armature.

6V GENERATOR VOLTAGE: Ford 6V two brush generator output specification is 7.2 to 7.5 volts DC (direct current).

POLARIZING A 2 BRUSH GENERATOR: Disconnect the FIELD terminal wire at the voltage regulator. Momentarily touch this wire to the BAT terminal a couple of times. Note: Failure to disconnect the field wire at the regulator (using a jumper wire) could overload the regulator and ruin it.

******************* VOLTAGE REGULATORS *******************

ADJUSTING VOLTAGE REGULATORS: These are touchy to adjust. Barely touching one will make a big change. When looking at MOST regulators (which are mounted on the firewall) the voltage relay is on the left. The amps relay is in the center. The cutout is on the right. Most of the regulators have their terminal stamped.
The cutout should close at about 6.7 volts. Using a good voltmeter on the battery, watch the voltage. It should charge up to 7.3 volts and the voltage relay kick off. The arms the springs are on are bent SLIGHTLY to increase or decrease the voltage or amperage. More spring tension increases the volts or amps. Do the volts first, then turn on the head lights with the rpms up. If the voltage drops below +3 or 4 with the lights on, increase the amps until you get to +3 or 4.
This isn't a five minute job as the components heat up causing the values to change. When the cover is installed, it takes a while before the settings are at their operating temperature. Thanks to GM for this post on March 13,2007.

MECHANICAL VOLTAGE REGULATOR ON A TWO BRUSH GENERATOR: All 6V regulators at this time are mechanical to my limited knowledge. Whereas all 12V regulators are electronic (except for a few NOS lingering around). Unlike the electronic type, the mechanical type can be tinkered with and adjusted.

Mechanical type. Often times the points become pitted and stick shut. Disconnect all of the wires at the regulator terminals and dress the points with a point file and check for point sticking shut. There have been times when I needed to know the physical location of the various relays under the cover of the voltage regulator. This info has been needed to coax a voltage regulator into working until I could come up with a replacement (like on the road... or my social security check.

The cutout relay is directly behind the BAT terminal.

The current relay is directly behind the ARM terminal.

The voltage really is directly behind the Field terminal. To increase the output of any of these relays, bend the rest the flat spring lays on upward. This will increase the output of that particular relay. Bending to be VERY minor in nature (less than 0.020"). This doesn't always work, but it's worth a try in an emergency.

************************** BATTERIES **************************

CHARGING OPTIMA DRY CELL BATTERIES: Although special chargers are available for charging these types of batteries, they can be charged using just a standard battery charger. This requires a good battery of the same voltage as the Optima you want to charge.

I always wear protective clothing and good safety glasses when I'm working on a battery. Connect jumpers to the posts of the two batteries in parallel (positive to positive and negative to negative). Connect the battery charger to the good battery and start the charger.

After an hour check the Optima to see if it's warm or hot. If it's hot, there is something wrong with the Optima and you should stop the charging. If you hear gas escaping, stop the charge immediately since the battery could explode.

Once the Optima shows 10.5 volts or higher, the charger will be able to charge the Optima battery by itself. Remove the good battery and hook the charger directly up to the Optima. It should take a full charge or until the charger automatically stops charging. From an article in Street Rodder Magazine written by Ron Ceridono.

************************* STARTERS ****************************

STARTER CURRENT: Starting current on flathead V8's through '48 is 550 amps. Beginning in '49 it increased to 600 amps.

STARTER RPM: Starters spin '48 and older V8 engines 100 rpm at 6V. Starters spin '49-'50 V8 engines 130 rpm (standard transmission) at 6V. Starters spin '51 V8 engines 150 rpm (standard transmission).

8 VOLT BATTERIES: I tried one of these in my roadster when I was having starting problems. Burned out 6V head light and 6V tail light bulbs so fast it was unbelievable! How about 25 minutes for a tail light bulb, 45 minutes for a low beam head light bulb, and 20 minutes for a brake light! Tried adjusting the regulator to charge 8V, but it didn't help. The generator case got hot quickly. I constantly worried about throwing solder off the generator's commentator due to heat. But I sure liked the way it cranked the engine over and the bright head and tail lights. However, I dreaded driving at night since the bulbs burned out so quickly. Finally, after burning out both 6V headlights (brights and dims) in

a 3 hour homeward bound cruise one night (no tail or brake lights after the first hour), I pitched the 8V battery and went back to the 6V. This time I used an Optima battery instead of a lead acid. It's interesting to note a brand new lead acid 6V battery wouldn't crank my souped up flathead after it was up to operating temperature, but the 6V Optima would. However, even it doesn't like turning it over when the engine's got a good heat soak going. See the following for the remedy I use.

PROBLEM: 6 VOLTS TURNS ENGINE OVER SO SLOWLY IT'S HARD TO START : This can often be a problem with our hopped up flatheads. The often drastic increase in cubic inches and accompanying high compression loads down the 6V starter. Newly built engines with tight clearances also have 6V starting problems. A solution I use is adding a 12V battery for balky starting only. The car retains the entire stock 6V electric system. Beats changing everything over to 12V as far as I'm concerned (ever try to find a non-indexed 12V headlight dual filament bulb on the road?).

Two batteries are used..... a 6V and a 12V battery. The car's <u>entire</u> electrics remain 6V <u>including the starter</u>. Even the charging system remains 6V. A 12V battery is added for use only when 6 volts are unable to start the engine. This is an easy cure for a purist plagued with a fresh or tight engine or one that won't (or is hard to) start when hot.

Install a 12V battery somewhere in the vehicle (in the trunk, behind the spare tire, under the floor, etc.). Connect the positive post of the 12V battery to a good ground like the frame using a battery cable. Install a 12V starter solenoid (I used one for a 12V Falcon) close to the 6V starter motor. The 12V solenoid mounting bracket has to be grounded. Connect a battery cable from the negative post of the 12V battery to the post marked BAT on the solenoid. Run two #14 gauge wires from the solenoid location in to the inside of the car. Install a universal type starter button which has <u>two</u> terminals. Connect a #14 wire to each of the starter button terminals. Connect the other end of one #14 wire to the large terminal on the solenoid which also has the 12V battery's negative cable. This will supply 12V to the new starter button. Connect the remaining #14 wire to the left small terminal on the solenoid (the right terminal provides 12V to the coil for starting purposes only and is not used). The only thing left is to run a short battery cable from the remaining large terminal on the 12V solenoid to the starter motor. Both the new 12V cable and the existing 6V cable are bolted, one on top of the other, to the starter motor's terminal. Tighten all connections and you're done.

I use the 6V to start the engine most of the time. But if the engine doesn't start right up, I hit the 12V starter button. *CAUTION: Do not push both starter buttons at the same time since it'll feed 12V back through the entire 6V electrical system… NOT a pretty sight!* The 12V side is a "total loss electrical system" in that it doesn't receive any charge from the car's generating system (6V). I've found a trickle charge overnight once a year keeps the 12V battery functional for the year. A side benefit when using 12V to start is all of the 6V battery power is dedicated to the ignition since none is needed for the starter. Sure makes starting a lot easier and faster.

************ CONVERTING 6V GENERATORS TO 12V ************

I don’t understand why flatheaders take their 6V generators to a rebuilder and have them converted to 12V. The charge is pretty high, usually around $100, when you consider only the generator fields have to be changed. The fields from a Falcon/Mustang/Comet bolt up in flathead generator cases.

Like many things Ford did, there always seems to be an exception. If you’re using an original ‘39 or ‘40 generator, you will have to drill a hole in the case and install a grounded terminal for the new 12V field. Ford grounded these internally during ‘39-’40 and depended on the generator mounting for a ground. This new external ground terminal will replace the existing internal ground. These ‘39-’40 generators have only two external terminals instead of the usual three.

I’ve been told 12V Falcon/Mustang/Comet complete generator cases will interchange with 6V flathead 8BA generator cases by simply grinding a locator pin slot in the 12V case, but I’ve not done any of these. It’s something to look at if you’re doing one of these change overs.

A consideration: The armatures for a 12V Falcon/Mustang/Comet and a Ford 6V two brush generator are a one-way interchange because the 6V armature winding uses about twice the size wire as the 12V. The 6V armature works on 12V, but the 12V armature won’t work on 6V (the 12V armature wire size is too small for the current the 6V produces). Okay, okay..... there is one more thing when using a 6V armature in a 12V generator.... a 6V armature makes only about 75%-80% of the amperage the 12V armature does because there is one less commentator bar and winding in a 6V armature.

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