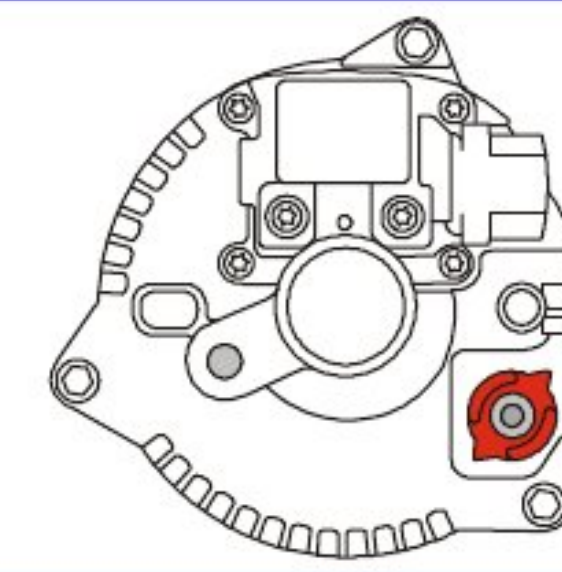


TECH BASICS 6

FORD 3G CHARGING SYSTEMS



Ford introduced the 3G alternator in 1990. The voltage regulator is attached to the rear housing. **FIGURE 1** shows the components and wiring for the charging system. Here's a list of the components as shown in **FIGURE 1** and some common problems. You should read this list and familiarize yourself with the parts.

- A** Alternator -- be sure to clean corrosion off the grounding areas where the alternator mounts
- B** Voltage regulator and plug -- Use dielectric grease on all connections.
- C** Indicator Light and resistor
- D** I Circuit Fuse -- in dash-mounted fuse box.
- E** Ignition switch
- F** Battery -- should be fully charged and load tested before diagnosing any charging problem.
- G** Power Distribution Box -- under hood.
- H** Starter relay -- isn't part of the charging system, but serves as a connection point for fusible links and the positive battery cable.
- I** Fusible links -- protect the wire to the alternator **B+** terminal and the voltage regulator **A** terminal.

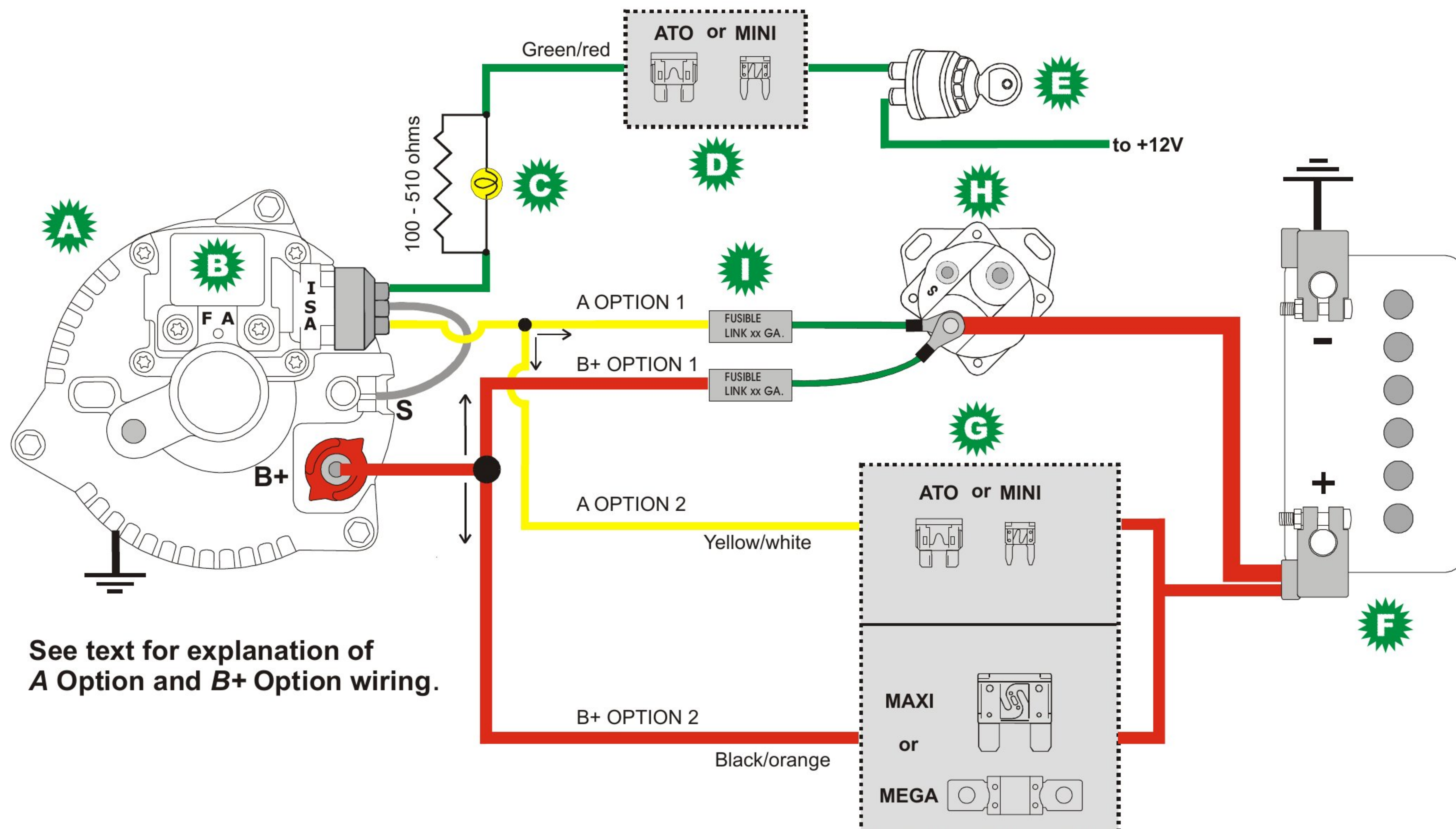
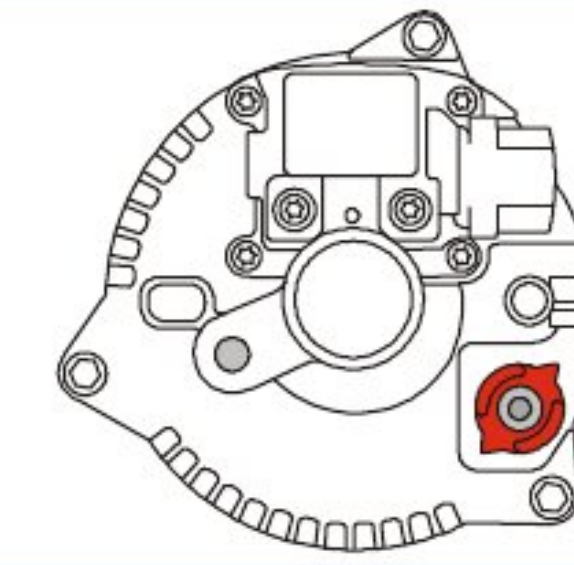


Figure 1 -- Components of a typical 3G charging system



CHARGING SYSTEM - How it Works

The charging system has **four** separate circuits. They are the **I**, **S**, **A** and **B+** circuits. Each circuit, except the **S**, is protected by either a fuse or a fusible link. The following section will explain the function of each circuit.

- **I CIRCUIT** - (color code green with red stripe) The **I** circuit controls the indicator light and turns on the charging system. The voltage regulator turns on the indicator light by completing the ground path for the light bulb. When the voltage regulator senses current at the **I** terminal, it turns on the alternator and starts to charge.

The **I** circuit is protected by a fuse located in the dash-mounted fuse box.

- **S CIRCUIT** - (color code white with black stripe) Once the alternator starts charging, it sends a signal to the **S** terminal of the voltage regulator. When the voltage regulator senses current at the **S** terminal, it opens the ground path at the **I** terminal which causes the indicator light to go out.

The **S** circuit is not fused.

- **A CIRCUIT** - (color code yellow with white stripe) The voltage regulator uses the **A** circuit to sense the battery state and adjust the charging system output as needed. The **A** circuit is also the source of field current inside the alternator.

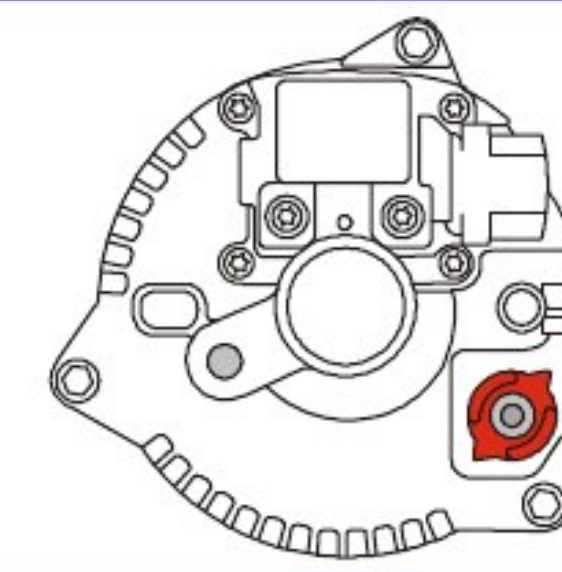
The **A** circuit can be protected in two different ways:

1. A fusible link wire that attaches to the starter relay (see **Figure 1** - A option 1).
2. A fuse in the under-hood fuse box (see **Figure 1** - A option 2)

- **B+ CIRCUIT** - (color code black with orange stripe) The **B+** circuit is the path the alternator-produced current follows to power accessories and charge the battery.

The **B+** circuit can be protected in three different ways.

1. A fusible link wire that attaches to the starter relay (see **Figure 1** - B+ option 1).
2. A maxi-fuse in the under-hood fuse box (see **Figure 1** - B+ option 2)
3. A mega-fuse. Most mega-fuses are mounted on the outside of the power distribution box (see **Figure 1** - B+ option 2). A few vehicles (Contour/Mystique and trucks with diesel engines) have the mega-fuse mounted on the engine.



HOW TO TEST AND REPAIR

START BY DOING A CHARGING SYSTEM TEST.

Step 1. The battery must be fully charged and load tested. The engine must be off. Be sure the alternator belt is properly tensioned. Connect the negative lead of a voltmeter to the negative battery post and the positive voltmeter lead to the positive battery post. Write down this reading - it will be referred to as “base voltage”. Do both of the following tests:

LOAD TEST: Start the engine. Turn the headlights on and the heater/ac motor to high. Increase engine speed to 2000 RPM. Check the voltage across the battery terminals. See chart for results.

LOAD TEST VOLTAGE READINGS:	RESULT:
Voltage increases at least 0.5 volts over “base voltage”	<i>Pass</i>
Voltage does not increase at least 0.5 volts over “base voltage”	<i>Fail</i>

NO-LOAD TEST: Turn off the accessories, decrease engine speed to 1500 RPM and check the voltage across the battery terminals again. See chart for results.

NO-LOAD TEST VOLTAGE READINGS:	RESULT:
Voltage is less than 2.0 volts over “base voltage”	<i>Pass</i>
Voltage is more than 2.0 volts over “base voltage”	<i>Fail</i>

- ✓ **If both LOAD TEST and NO-LOAD TEST Pass and charge-light is out,** the charging system is working correctly.
- ✓ **If LOAD TEST Fails,** skip to **Step 2**.
- ✓ **If NO-LOAD TEST Fails,** the alternator is faulty. Repair and repeat **Step 1**.

Steps 2 - 3 are performed with the engine off

Step 2. Use a voltmeter or a test-light and check for power at the **B+** output stud at the rear of the alternator. If power is present, skip to **Step 3**. If no power, check the fusible link or maxi-fuse or mega-fuse as shown in **Figure 1**. Repair and retest.

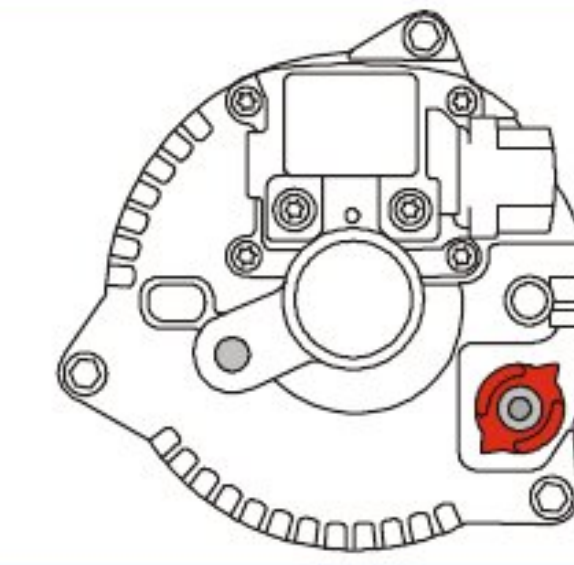
Step 3. Remove the voltage regulator plug from the alternator. Turn the key to the “run” position (engine off). Use a voltmeter or a test-light and check for power at both the **I** and the **A** terminals of the voltage regulator plug (not the alternator).

If there is no power to the **A** terminal of the voltage regulator plug, check for a broken wire or a poor connection at the plug. Also check for a bad fusible link or a bad fuse as shown in **Figure 1**. Repair and retest.

If the voltage regulator **I** terminal does not have power, the most likely cause is a bad fuse in the dash-mounted fuse box as shown in **Figure 1**. If the fuse is good, it’s time to start checking for unusual problems. Check for corroded connectors, corroded fuse box terminals, cut wires, loose plug at the instrument cluster or a bad ignition switch. What about the bulb? A bad bulb will not prevent power from flowing to the regulator plug **I** terminal, since the resistor offers an alternate path. The time to test the bulb is after restoring power to the regulator plug **I** terminal. Just ground the **I** terminal from the voltage regulator plug and the charge-light will come on if the bulb is good. Reconnect the plug to the voltage regulator. Make certain the key is still in the “run” position (engine off). If the charge-light comes on, go to **Step 4**. If the charge-light does not come on, the alternator is faulty. Replace the alternator and repeat **Step 1**.

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FORD 3G CHARGING SYSTEMS



Step 4. Reconnect everything and start the engine. Do the following test at idle, with the engine warm. Probe the wires and test the voltage at the *S* wire and the *A* wire of the voltage regulator. The *S* wire should be about one-half the voltage of the *A* wire. If no voltage or low voltage is present at the voltage regulator *S* wire, the alternator is faulty. Replace and repeat **Step 1**. When you have verified correct voltage, go to **Step 5**.

Step 5. Reconnect everything and start the engine. Is the charge-light off? If the charge-light is still on, then the alternator is faulty. Replace the alternator and repeat **Step 1**. At this point, you have verified every function of the system. Go to **Step 6**.

Step 6. Be sure all wires are reconnected and run the engine at 1500 RPM for several minutes or until battery voltage stabilizes. Repeat the **LOAD** and **NO-LOAD** tests done in **Step 1**. If both pass you are done.

If the system fails the **LOAD** test, the alternator is faulty. Replace the alternator.

If the system fails the **NO-LOAD** test, the alternator is faulty. Replace the alternator.

The final test is to verify that the entire system is working correctly. Repeat the **LOAD** and **NO-LOAD** tests done in **Step 1**.

About the author:

This Tech Basics guide was written by Wesley S. Grueninger. Wes has been in the rebuilding industry since 1975, the year he started Auto Lab. Auto Lab specializes in remanufacturing import alternators and starters in addition to stocking a full line of domestic units. Many hours of research have gone into the Tech Basics series and we want to hear from you if you have any suggestions or comments. Contact us at autolab@execpc.com.

