VOLTAGE REGULATOR

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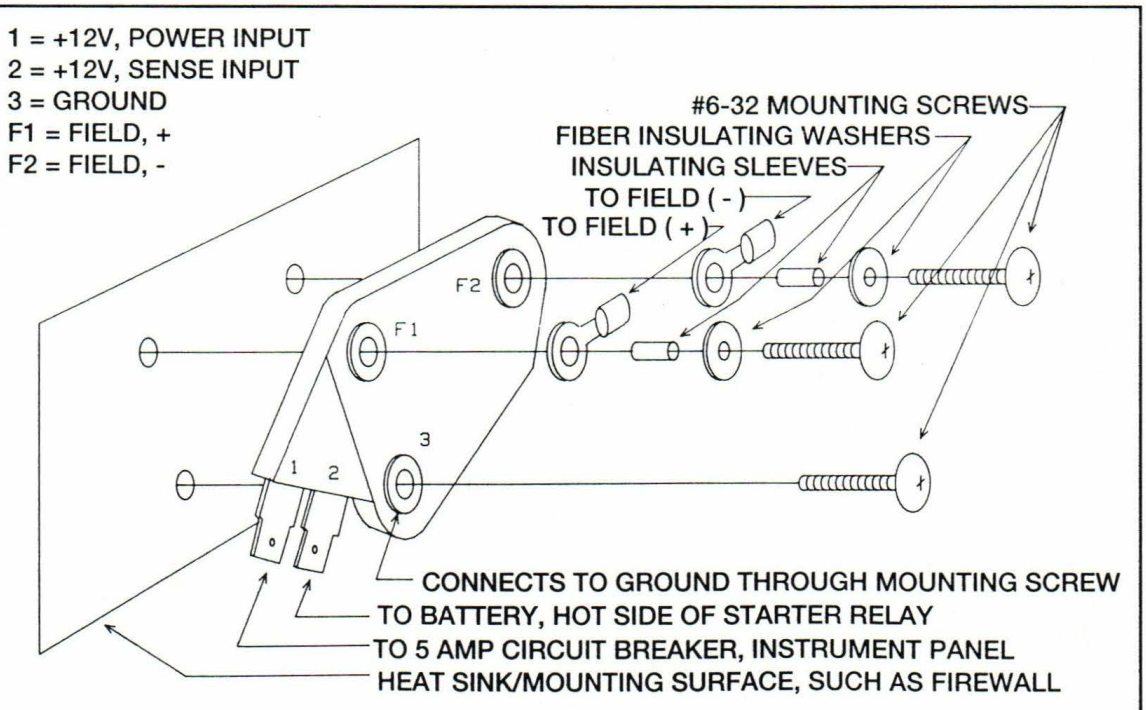
When you finally get that low time engine for your project, you may be lucky enough to get an alternator with it. But it is very unlikely that you will also get a voltage regulator. That was the case with my engine and I decided that the asking price for a new voltage regulator was too much. With my experience as a design engineer of generator equipment for the "big" jets, I decided I had to find a better way. After some research, I found that the recommended regulator for my Prestolite 40 ampere alternator is exactly the same circuit configuration as the voltage regulator for the GM/Delco automotive alternator. Both are the electronic switching type. The Delco regulator, however, is not the prettiest thing because it normally mounts inside the automotive alternator. However, it weighs in at 1.5 ounces and a brand-new replacement from the local auto parts house cost less than nine bucks (in 1986). Suddenly, it looked very pretty! I bought one and immediately began an evaluation program to confirm its compatibility with the aircraft alternator. As expected, it worked great with no hint of instability detected, even with the appropriate high-tech diagnostic equipment. It has now worked perfectly for five years in my Acro Sport II.

The GM/Delco voltage regulator actually performs better than the types found in small aircraft because it has a separate battery voltage sensing terminal. The extra connection prevents the regulator from "galloping" or charging at full capacity for a few seconds and then shutting completely off for a few seconds, in a continuing cyclic mode. This occurs because when field current is sent to the alternator, the field current causes the "apparent" battery voltage to immediately drop causing the regulator to switch full on. The battery voltage didn't really drop, the current in the wire made it appear to. A few seconds later, the regulator finally switches off, the field current goes away, and the apparent battery voltage rises and causes the regulator to switch full off. I have observed this effect in production aircraft and have tried fixing them, but to no avail. The combining of the voltage sensing with the field current into one conductor is just inherently susceptible to this fault. The galloping may improve at different engine speeds, or get worse, or just change frequency. It is not intended to operate in this mode, although it is not self destructive in nature. Actually, the battery is being overcharged slightly then undercharged slightly during this galloping mode of operation. The separate sensing feature in the GM/Delco regulator removes the field current completely from the sensing circuit and assures that the system will work as it should.

The diagram shows how to connect the regulator into the electrical system. The terminal identifier numbers in the diagram are mine, and will not show up on the actual regulator. Use the diagram to mark them indelibly on your regulator to save confusion later. Cooling of the regulator is through the mounting footprint, so it must be mounted to a thermally conductive surface. I mounted mine on the firewall, which is a cooler place than the inside of an alternator and, therefore, is a good location. I used a piece of 0.090 inch thick aluminum behind the firewall, with nutplates to accept the regulator mounting screws, to help stiffen the relatively thin firewall and to provide additional heat sink mass. The bottom of the Delco regulator is metal and it is O. K. if it contacts a grounded metal surface.

Please note that the mounting screws passing through the field connections (F1 and F2) must be electrically insulated from those terminals. This is done with a



GM/DELCO ALTERNATOR VOLTAGE REGULATOR INSTALLATION

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combination of fiber insulating washers and heat shrink tubing (sleeves) as indicated in the diagram. If the insulating hardware is not used, then these terminals would be shorted to ground through the mounting screws and defeat the regulator. Terminals #3 on the regulator is the ground connection and it must be connected to ground through the mounting screw, therefore, do not use insulation on this screw. Use standard fast-on terminal lugs to connect to terminals #1 and #2. For safety's sake a dust cover should be used over the regulator to assure nothing inadvertently shorts across the terminals. The voltage regulator itself is completely sealed and very rugged and no environmental protection is otherwise needed. ◆

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