

Alternator Troubleshooting & Test Adaptor

Nuckolls Aeroelectric Connection

When an alternator quits alternating, good data is useful in making an accurate diagnosis of the problem. If you don't know what the alternator field voltage is doing when the system is failed or misbehaving, you're not ready to put a wrench to the airplane. There are few mechanics out there that even know about what you're going to learn here . . . and even fewer that will stand behind a running propeller to gather the needed information. So consider this:

Referring to Figure Z-23, you can see where a 1K, 1/2 watt resistor can be spliced into the alternator field lead at any point along the route between the regulator and the alternator's field terminal. Splice a 22AWG wire to the other end of the resistor and then cover the whole business with heatshrink before you tie it back into the wire bundle. The resistor serves as a current limiting device to isolate the test wire from the field wire and eliminate the need for a fuse to protect the test wire. The resistor also prevents a shorted test wire from upsetting normal alternator operations.

Now, extend the wire into the cockpit where you'll attach it to a Radio Shack 274-1576 receptacle. The receptacle is small and would not take up much room on a panel but if you want it out of sight, at least make it easy to reach from the pilot's seat--perhaps on a bracket behind the panel. Ground the receptacle's shell to the instrument panel ground bus with another piece of 22AWG wire.

You'll need to make up a short cable assembly consisting of a Radio Shack 274-1573 plug (mates with receptacle above) and banana plugs on the other end to connect with a handheld multimeter . . . preferably an analog meter but if all you have is a digital, it will do. We'll cover this in more detail in a future update to the alternator chapter but here's how this feature becomes really useful:

- (a) If the alternator field voltage is zero when the output is zero, then the regulator or associated wiring has failed.
- (b) If the alternator field voltage shows some fairly healthy reading on the order of 10 volts or more and alternator output is zero, the alternator has failed.
- (c) If the alternator has become unstable . . . loadmeter is jumpy, panel lights flicker . . . watch the field voltage and compare it with loadmeter readings. If the field voltage and loadmeter readings swing up and down together, then the regulator has become unstable. Check for increased resistance in regulator field supply wiring and components. Breakers, switches, overvoltage relays, and connectors are all contributors to regulator instability when their resistance ages upward a few milliohms in resistance. for regulation at full load. If your system is working properly and pulley ratios are appropriate, engine RPMs should be equal to or LESS than required to sustain flight.
- (d) If the loadmeter swings UP while the field voltage is swinging DOWN, then the alternator has some unstable connections inside . . . perhaps worn brushes?
- (e) If field voltage is high, does not drop significantly when engine RPM increases but bus voltage seems normal under light load and sags under heavy loads, then the alternator may have one or more diodes open/shorted.
- (f) While operating with full system loads, carefully observe the engine RPM where alternator field voltage peaks: i.e. begin at idle RPM with all loads ON--if your bus voltage is lower than the regulator set point, then the alternator is turning too slow to support present loads. Now, adjust engine RPM carefully to get the highest possible

(g) Should your alternator suddenly become "noisy" in that alternator whine becomes markedly worse, you may have suffered a blown diode in the alternator. Before taking the alternator off the airplane, Attach a multimeter to the alternator case and the b-lead (output terminal). Set the multimeter to read AC voltage. Run the engine up and turn everything electrical ON. If the AC voltage exceeds 500 millivolts, there's a good chance that a diode is bad. If it's less than 200 millivolts, then it's more likely that the noise is getting into your audio system via a ground loop (noise is present even when radio volume is all the way down) or failed noise filter (noise goes up and down with radio volume control).

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