

Chapter Eight

VOLTAGE REGULATORS

It is the job of the voltage regulator to make sure that the electrical system has a constant, regulated source of voltage, regardless of the condition of flight. Fundamentally, it is the electrical system's equivalent to a propeller governor. There is a rule of thumb that says if a battery is using too much water, the voltage regulator is set too high; if the battery doesn't seem to stay charged, then the voltage regulator is set too low. Essentially that is true. However, once again Murphy sneaks into the picture. In flight the battery is recharged by the alternator; this happens because the mechanic has set the voltage regulator to a value slightly above battery voltage. A 12-volt battery system will have an alternator output of 14.25 volts; a 24-volt battery system will have an alternator output between 28 and 28.5 volts. Because the alternator is putting out a higher voltage, it is in essence force-feeding the battery.

Unfortunately, the voltage regulator makes mistakes too. If it is set too high, the battery will overcharge, causing excessive operating temperatures, which means the active material will slough off all the faster, significantly shortening the life of the battery. Additionally, the hotter temperatures will cause the water in the electrolyte to evaporate, necessitating frequent additions of water. In general, having to add water more frequently than every 50 hours is an indication.

In extreme cases, the battery temperature may get so high that the plates will buckle or the electrolyte will boil and pour out of the battery vent caps. If, however, the voltage regulator is set too low, the battery will never completely charge. This is a tricky area in which to be playing detective, though, because if you have added electrical equipment to your aircraft, it is possible that the alternator is inadequate to meet the demand. The result would be the battery has to make up the difference, and instead of being recharged in flight, it would end up discharging by trying to share the load of the alternator. In this case one set of symptoms could indicate two very different problems: inadequate alternator and low-voltage regulator setting. Playing with voltage regulators can be deceptive, so consult a mechanic if you suspect a problem.

The Voltmeter

An excessive system-voltage reading on the voltmeter probably indicates regulator trouble. This can lead to several serious problems: The battery can be overcharged, causing severe, internal damage; acid may be forced out of the battery and damage surrounding equipment; and electrical overvoltage may damage other equipment, including light bulbs.

Overvoltage Protection

Some aircraft manufacturers incorporate an overvoltage control system. This protects the charging circuit from malfunction with a mechanical relay and solid-state triggering device. If the voltage reaches a preset value, the relay opens and the alternator field circuit disconnects. The relay remains open until the alternator switch is turned off. The electrical system then is supported entirely by the battery unless the aircraft happens to have a backup alternator installed.