not distorted in any way and that the threads are not damaged. Overtorque of the fuel line B-nut to nozzle will distort the nozzle, may cause disruption of fuel flow, and require nozzle replacement.

Another check can reveal a leak between the air and fuel chamber, which will cause idle mixture variation (mixture will not stay adjusted) and a rich mixture particularly at idle: 1) remove inlet duct from injector unit. 2) Disconnect outlet fuel line from injector to flow divider at injector. 3) Cap injector outlet fitting at injector. 4) Place throttle in wide-open position. 5) Place mixture control in full rich position. 6) Turn on electric boost pump for three minutes then shut off, close mixture control and return throttle to idle. 7) Observe air inlet area and impact tubes for leakage of fuel.

A few drops of fuel is OK but any measurable fuel requires that the injector unit be removed for repair/overhaul. If no excessive amount of fuel is observed reassemble the inlet duct and replace the fuel line.

Air in the fuel system is abnormal, and will cause poor idle cutoff, erratic engine operation (fuel flow fluctuation) and possibly a reduction in maximum power. A check for air in the fuel system can be made using this procedure:

Remove the fuel line between the flow divider and the outlet of the injector unit. Replace the fuel line with a clear Teflon tube (clamp tube to appropriate A.N. fittings that attach to flow divider and injector) and operate engine with enough cowling removed to observe the clear tube.

Operate a warm engine at a moderate power setting with the electric pump on for a short period and then off for a short time. This will allow a good check for air bubbles in the fuel system. Caution: excessive ground operation with any part of the cowling removed can damage the engine.

Air/vapor in the fuel system can be caused by deteriorated fuel hoses, deteriorated main fuel pump inlet seals, electric boost pump seal leakage, and improperly assembled, damaged or worn fuel line fittings. Fuel lines routed too close to exhaust or fuel lines without proper protective sleeving installed also cause trouble.

It is possible for fuel lines to "leak" air but not fuel, especially in parts of the system that "suction" feed. If the bubbles go away or engine operation improves when switching the electric fuel pump on then the problem could be between the electric fuel pump and the main fuel pump.

These techniques are best done by an experienced professional (or under his supervision). For certificated aircraft these tests fall outside the scope of owner preventive maintenance.

Operational Techniques

Starting difficulties are prevalent in hot weather until the operator becomes familiar with the injection system and aircraft peculiarities. Reading and becoming very familiar with the POH is the first thing for starting information.

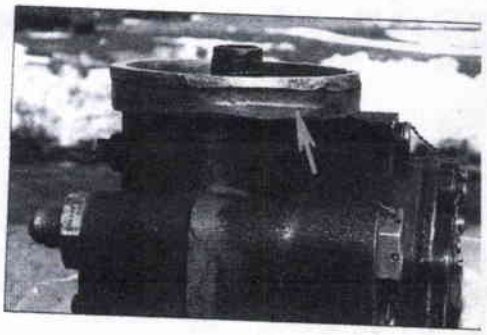
Generally, unless a different procedure is recommended by the airframe manufacturer, the cold starting procedure for a engine equipped with RS or RSA (Precision) fuel injection is: 1) Mixture control in idle cutoff. 2) Throttle set 1/8 open. 3) Master on. 4) Boost pump on. 5) Move mixture control to full rich position until fuel indicator reads 4 to 6 GPH and then immediately return to cutoff. 6) Engage starter, as engine begins to start move mixture to rich.

With the engine warm follow the same procedure as starting with the engine cold except leave the mixture control in idle cutoff and engage starter while moving the mixture control to rich as engine starts. As discussed earlier, the flow divider provides a positive cutoff of fuel to the injection nozzles during shut down.

Unfortunately, fuel remains in the injector unit and supply line to the flow divider after shut down. Engine heat during prolonged ground operations and after shut down warms this fuel and causes some or all of the fuel to vaporize.

Fuel injection systems are designed to operate on liquid fuel until reaching the nozzle where it is atomized. Proper engine operation and "hot" starting depend on purging vapor from the system. The amount of vapor present is dependent on the individual airframe installation, how well the fuel system has been maintained (sleeved fuel lines, and proper routing), and the time heat has had to migrate into the fuel system.

During ground operations and after parking, taking some precautions will minimize heating problems. 1) Avoid excessive ground operation. 2) Increase cooling airflow with slightly higher idle rpm. 3) Keep cowl flaps full open on the ground. 4) Operate the engine at 1200 to 1500 rpm after starting a warm engine to reduce residual heat.



This servo was damaged by improper mounting of nearby equipment in the engine compartment.

When parking with the intention of restarting the engine within the next hour: Park into the wind if possible, leave the cowl flaps full-open, partially open the engine cowling. If not possible, open oil service/inspection doors.

Leaning

Using just the fuel flow gauge for leaning can cause engine problems to develop, especially if one or more fuel nozzles are even partially plugged. Those cylinders supplied by partially plugged nozzles will operate in a much leaner condition than "normal" causing high EGT and cylinder temperatures. An EGT and CHT probe installed at each cylinder will help with troubleshooting and preventing engine damage.

The continued reliable operation of the RS/RSA fuel injection is dependent upon proper maintenance, detecting changes in operation and correcting deficiencies before they become serious. Keep abreast of new information available on Precision's Web site. Assistance is available by e-mail through the web site.

Product support professionals (310-651-8282) will accept phone calls, but do your homework first by reading the manuals and FAQ's. Have specifics such as exact engine and dash number, parts list number of injector unit, etc.

Mike Berry is an IA, an airline captain and contributing editor to Light Plane Maintenance.