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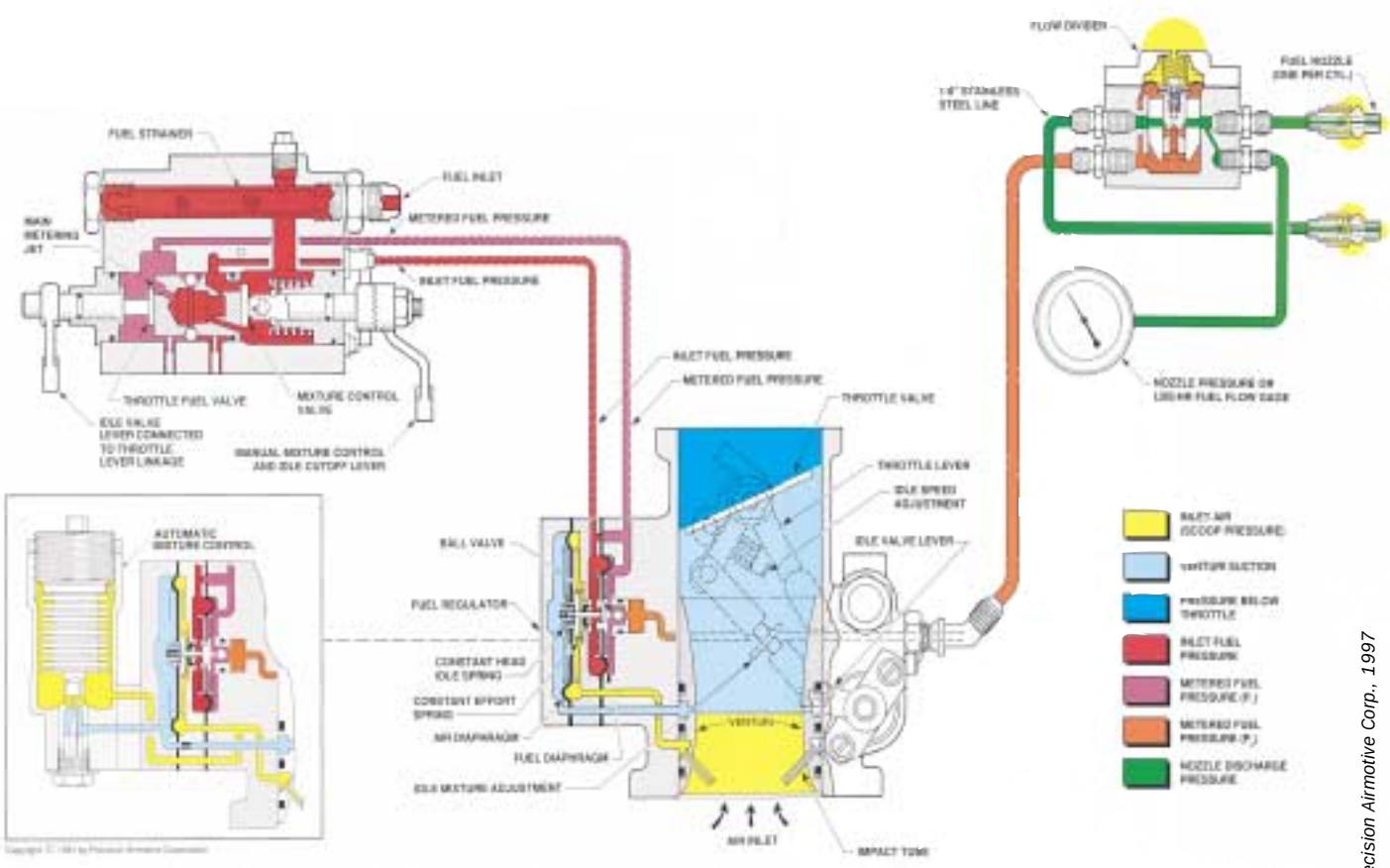

Precision Airmotive Corp., 1997

Troubleshooting is an Art

By Randy Knuteson

When it comes to troubleshooting the RSA fuel system, time given to careful and thoughtful analysis is time wisely invested. Often, by merely starting with the basics, one can readily determine the cause of a given problem. Initially, limit yourself to the essentials by asking the obvious — do I have air. . . fuel. . . spark? Given in proper proportion and appropriate timing, these are the elements that enable our engine to run.

Unfortunately, we humans become so myopic in our focus that we sometimes fail to see the obvious. For instance, suppose you encounter an excessively rich condition at idle, accompanied by higher than normal takeoff fuel flow readings. You might be led to believe that the fuel servo was either incorrectly calibrated or that something failed internally within the unit. Either of these suppositions are fair; however, you dare not limit your thought processes so quickly. Instead, compile as much pertinent information possible before settling on a solution to your problem. This information will include, but not be limited to, magneto drop, rpm, CHT/EGT readings, OATs, altitudes, power settings, MAP, fuel flow, attitude of the plane, etc.

In the case of our suspect servo, we could take it off the engine and have it bench tested by some reputable Repair Station. However, this would cost both financially and perhaps more significantly in extended downtime. The tendency to replace something . . . anything. . . in a futile attempt to cure a problem is a practice that often reveals a lack of expertise or experience. Unless the solution is glaringly obvious, always begin with the cheapest fix.

To avoid being labeled a troubleshooter that uses a "scattergun" approach, it would be advantageous for us to follow a sequential and logical process of elimination. With our servo, the rich idle condition persists despite any adjustments we make to the mixture clevis assembly. We began to carefully scrutinize our other clues. . . high takeoff fuel flows, loss of power, unusual engine roughness, and, perhaps more telling, a multi-probe CHT or EGT reading that indicates uneven fuel dispersion to the cylinders. A simple and effective "bottle" check of the nozzles (See April '97, Page 24) may reveal a partially plugged injection nozzle, a kinked flow divider line, or damaged divider outlet port.

Any such restriction causes an erroneous high fuel flow reading due to the additional fuel diverted to the gauge port of the flow divider. A back pressure at the plugged nozzle now re-routes the same amount of fuel elsewhere. Hence, the corresponding richness at idle. The restriction now causes the same amount of fuel to be routed to five cylinders instead of six, causing those five to run rich. Most mechanics would attest to the fact that cleaning or replacing a fuel nozzle is by far a more pleasant task than wrestling with a servo that may be buried deep within the engine.

We've just examined one of numerous scenarios that arise when troubleshooting what appears to be fuel-related problems. Indeed, at times the fuel servo is indicted as the chief cause of the problem. However, more often than not, the problem lies hidden in some other area not yet considered.

Improper magneto timing, weak valve springs, low cylinder compression(s), choice or pitch of propeller, and a list of other challenges make troubleshooting truly an art. All too often, expensive components frequently get replaced in hopes of solving a problem. Unfortunately, it's difficult to convince a manufacturer to warranty a perfectly good system. And it's equally difficult to justify such an expenditure to a disgruntled customer.

Troubleshooting requires both patience and thoughtful analysis. Resisting the desire to immediately pull and ship a "bad component" may pay off. It certainly forces you to further hone your skills at properly identifying the actual underlying cause of a given problem. Some careful consideration can often lead you to the source of the trouble with a minimum of effort! AMT

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RSA-5 & RSA-10 Troubleshooting chart

PROBLEM	PROBABLE CAUSE	REMEDY
HARD STARTING	Technique	Refer to aircraft manufacturer's recommended starting procedure
	Flooded	Clear engine by cranking with throttle open and mixture control in ICO.
	Throttle valve opened too far	Open throttle to position approximating 800 rpm.
	Insufficient prime	(Usually accompanied by a backfire). Increase amount of priming
ROUGH IDLE	Mixture too rich or too lean	Confirm with mixture control. A too rich mixture will be corrected and roughness decreased during lean-out while a too lean mixture will be aggravated and roughness increased.Adjust idle to give a 25-50 rpm rise@ 700 rpm.
	Plugged nozzle(s)	(Usually accompanied by high take-off fuel flow readings.) Clean nozzles in Methyl-Ethyl-Keytone, acetone, hydrocarbon cleaning solvent or a chlorinated solvent equivalent to chlorothene. Check system for source of contamination.
	Slight air leak into induction system through manifold drain check valve	(Usually able to adjust initial idle but rough in 1,000-1,500 rpm range.) Confirm by temporarily plugging drain line. Replace check valves as necessary.
	Air leak in fuel line from tank to servo unit	Confirm by connecting clear tubing between servo and flow divider and watch for air bubbles. Locate and correct source of leakage. May include boost pump or main pump seal leakage.
	Slight air leak into induction system through loose intake pipes or damaged “O” rings	(Usually able to adjust initial idle but rough in 1,000-1,500 rpm range.) Repair as necessary.
	Large air leaks into induction system, such as missing pipe plugs, etc.	(Usually unable to throttle engine down below 800-900 rpm.) Repair as necessary.
	Internal leak in injector	(Usually unable to lean-out idle range.) Replace injector.
	Unable to set and maintain idle	Replace injector.
	Fuel vaporizing in fuel lines or distributor	(Encountered only under high ambient temperature conditions or following prolonged operation at low idle rpm’s.) Refer to the suggestions in Section Four.
LOW TAKE-OFF FUEL FLOW	Injector out of adjustment	Replace injector.
	Faulty gage	In a twin engine installation, criss-cross gages. Replace as necessary. Single engine, change gage.
	Sticky flow divider valve	Clean flow divider valves.
HIGH FUEL FLOW READING	Plugged nozzle if high fuel flow is accompanied by loss of power and roughness	Remove and clean nozzles in Acetone, MEK, hydrocarbon cleaning solvent, or a chlorinated solvent equivalent to chlorothene is recommended. Check system for source of contamination.
	Faulty gage	Criss-cross gages and replace if necessary.
	Injector out of adjustment	Replace injector.
STAGGERED MIXTURE CONTROL LEVERS	If take-off is satisfactory, do not be too concerned about staggered mixture control levers because some misalignment is normal with twin engine installation	Check rigging.
POOR CUT-OFF	Improper rigging of aircraft linkage to mixture control	Adjust.
	Mixture control valve scored or not seating properly	Eliminate cause of scoring (usually burr or dirt) and lap mixture control valve and plug on surface plate.
	Vapor in lines	Refer to the suggestions in manual.
ROUGH ENGINE (TURBO CHARGED) AND POOR CUTOFF	Air bleed hole(s) clogged	Clean or replace nozzles.
ENGINE WILL NOT ACCELERATE PAST A GIVEN RPM.	Plugged nozzles if accompanied by high fuel flow	Clean or replace nozzles. Check system for source of contamination.
	Improper internal engine timing or magneto problem	Correct timing problem.
	Plugged or restricted exhaust manifold	Refer to engine manual for corrective action.
IDLE MIXTURE VARIATION (WILL NOT HOLD ADJUSTMENT)	Leaking seal between fuel and air chamber	Confirm leak in seal by: 1. Remove four cap screws holding air inlet duct to injector. 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 lever in Full Rich. 6. Turn on boost pump for three minutes. 7. Observe air inlet to injector at venturi. 8. If no fuel is present in venturi at the end of three minutes, shut off boost pump. Return throttle and mixture control to off position. Remove cap from injector outlet fitting and reconnect flow divider line. Replace four cap screws that secures air inlet duct to injector and wire. 9. If fuel leakage appears in venturi section, the injector must be removed for repair.
	Oil in air chamber	Refer to P.A.C. Service Information Letter #RS 40.

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