

APPENDIX I

TROUBLE-SHOOTING THE BENDIX RSA FUEL INJECTOR

There are some sections of the Bendix fuel injector that a mechanic may not work on in the field, such as the regulator section which consists of the air and fuel diaphragm and associated parts. Any modification of the regulator section by a mechanic without the use of a flow bench could result in a change in fuel flow through the injector. However, there are some things that a mechanic may do that will not affect the operation of the fuel injector.

In the following paragraphs we would like to discuss some of the things that a mechanic can do, and some procedures a mechanic can use to determine if the problem is in the fuel injector or an associated part, i.e. – flow divider, fuel nozzles, fuel lines, etc.

Whenever a fuel injector problem arises, the first thing a mechanic should do before he removes the injector or any part of it, is to make sure the rigging is correct, and that the throttle and mixture controls are both traveling to their full open and full closed stops; and make sure there are no fuel leaks. Another important item to consider is – Do you get a rise of 25 to 50 RPM at idle when the mixture control is moved from full rich to idle cut-off? If you are experiencing poor acceleration of the engine, this may be the problem. To adjust the idle mixture, turn the scalloped wheel at the side of the injector either rich or lean, as required, until the desired rise in RPM is reached. When adjusting the idle mixture, you will have to adjust the idle RPM too. A good idle RPM is around 600 to 650 RPM.

We would like to make everyone aware that there is a filter screen at the fuel inlet to the injector. This screen should be removed and cleaned at 100 hour inspection. Some cleaning solvents that can be used are methyl-ethyl-ketone or acetone. It is also permissible to use a sonic cleaner. After the screen has been cleaned, blow it out with compressed air. When removing the screen from the fuel injector, always take it from the same side of the injector to which the fuel line is attached. This is to prevent depositing any dirt back in the fuel injector that might have been picked up in the screen. On early injectors, the screen is attached to the inlet adapter, so it can only be removed from that side. On later model injectors the screen is spring loaded to provide a fuel bypass in case it becomes plugged. This type of screen can be removed from either side.

If you are experiencing a rough shut-down and the engine does not want to quit when the mixture control is retarded, it may be because there is a score on either the mixture control jet or rotating plate, or a bad “O” ring on the jet. Prior to disassembly of the fuel injector, a test can be run to see if this is the problem area. Disconnect the fuel line coming out of the fuel injector and leave the fitting open. Pull the mixture control and throttle all the way back (off) and turn on the booster pump. If any fuel is observed coming out of the open fitting, there is a score on the mixture control jet, or rotating plate, or the “O” ring is damaged or deformed. The repair is to remove the mixture control assembly and eliminate the scores by lapping the mixture control jet and rotating plate on a good lap plate using a mild abrasive. The final repair should be done by lapping the jet and plate together, using Bon-Ami or equivalent type abrasive. After this is accomplished, clean and reassemble the parts using a new “O” ring each time.

If no fuel is observed coming out of the open fitting on the injector when the test is performed, the mixture control assembly is working correctly and other causes should be looked at. Some things to consider are the fuel injector nozzles. If the air bleed hole becomes plugged, the engine will not shut down smoothly. On normally aspirated engines, there is a screen covering the air bleed hole which makes a visual inspection impossible. Therefore, you must remove the nozzles from the engine and clean them thoroughly and blow them out with compressed air. If this does not solve the problem, then there may be a nozzle that is improperly assembled, or the only other solution is to replace the nozzles.

On turbocharged engines, the air bleed hole is shrouded and vented back to the compressor discharge pressure “deck pressure”. Inspect these lines and fittings to make sure they are free of dirt, leaks or obstructions. After the shroud is removed from the nozzle, it can be removed from the cylinder, cleaned thoroughly and blown out with compressed air.

NOTE

When any nozzle that is installed horizontally is reassembled into a cylinder, make sure that the letter “A” that is stamped on the hex portion of the nozzle is pointing down; this positions the air bleed hole up, and the correct torque valve is applied at 60 in.-lbs.

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Another area to consider would be an internal leak in the fuel injector body seal. All of the fuel that is delivered to the engine should go through the individual fuel lines to the nozzles and on into the combustion chamber. If there is an internal leak in the injector, there will also be fuel entering the injector at the throat, and going to the cylinder much like a carbureted engine. If a center body seal is suspected of leaking, there is a brief test that can be run. First, remove enough of the induction system to enable one to see the impact tubes on the fuel injector. Then disconnect the fuel line from the fuel injector to the flow divider and cap off the fitting in the fuel injector. Move the controls to the full throttle and full rich position and turn on the booster pump. If any fuel is observed coming out of the impact tubes of the injector, this indicates that there is a center body seal leaking. Since this is part of the regulator system the mechanic may not make the necessary repairs, but must remove the injector from the engine and send it to an overhaul facility for reconditioning and recalibration.

In addition to a rough shut-down, the engine may display some other symptoms that may indicate that there is a center body seal leak. Some of these indicators are:

The engine is rich at idle and low power settings, or the pilot has to retard the mixture control upon flare-out and landing to prevent the engine from becoming too rich and stopping, or if the mechanic has to adjust the idle mixture lean every few days or weeks because it has drifted rich. Each of these symptoms indicates a drift to the rich side and may be a warning of an internal leak in the injector.

Another area where problems may be encountered in the fuel injector is the possibility of scores on the main meter jet and rotating plate assembly. Any scores in this area may be removed by lapping the main meter jet and rotating plate on a good lap plate using a mild abrasive. The final repair should be made by lapping the jet and plate together. When all scores are removed, clean thoroughly and reassemble the injector. Any indication that the main meter jet is scored would be a rich idle mixture, and by adjusting the mixture control lean, the mechanic could get a satisfactory idle, but when the engine was accelerated, it would stumble and not accelerate smoothly.

If there is any occasion when the fuel injector idle mixture adjusting wheel has been turned to its limit, either rich or lean, and the idle is not satisfactory, the linkage between the air valve and the fuel valve on the injector may be removed and the idle mixture adjusting wheel positioned back to the center of its travel. Prior to removing the linkage from the injector, measure the overall length of the linkage. This must be the same after repositioning the wheel back on center as it was before removing it from the injector. After the length of the linkage has been established, adjust the wheel back to center of travel by backing one end of the linkage assembly out half the distance and adjusting the other end of the linkage in until you have the same overall length you had prior to removing it from the injector. After the linkage is adjusted, assemble the injector, making sure to install the pins, wave washers and cotter keys correctly.

Other items in the fuel injection system that could be a source of trouble are the flow divider, fuel lines and injector nozzles. If you suspect that the flow divider valve is sticking, remove the flow divider from the engine and disassemble it. The valve can be freed by polishing the valve and bore together using a mild abrasive. Do not interchange flow divider parts because they are a matched assembly. After the valve is operating freely, clean thoroughly and reassemble the flow divider.

NOTE

Also reference the latest revision of Lycoming Service Bulletin No. 382 or Bendix Bulletin No. RS43 for latest modification to flow dividers.

If the fuel flow gage suddenly shows an increase in flow, the first thing to do is check for a plugged or partially plugged fuel nozzle. The procedure for doing this is as follows:

Disconnect the fuel lines and remove the nozzles from the cylinders. Then attach the nozzles to the fuel lines and direct the nozzles into bottles of equal size. Baby food or coke bottles work very well. Move the throttle and mixture controls full forward and turn on the booster pump. Fill the bottles approximately one-half full. Turn off the booster pump and retard the throttle and mixture. Remove the bottles from the engine and set them on a table or other flat surface. A visual check of the fuel contents in the bottles will tell you which nozzle is plugged.

NOTE

While flowing fuel into the bottles, check each nozzle to make sure all of the fuel is coming out of the discharger end of the nozzle in a solid stream approximately the size of the lead in a mechanical pencil and not some fuel coming out of the air bleed hole.

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After locating the plugged nozzle, it can be cleaned in methyl-ethyl-ketone or acetone and blown out with compressed air. If a thorough cleaning fails to remove the dirt, the nozzle will have to be replaced. Prior to replacing the nozzle, check the fuel line to be sure that a primer line is being used for a fuel line. Primer lines are smaller on the inside diameter, and will give a false reading on the fuel flow gage. Also check the flow divider for obstructions.

NOTE

When cleaning fuel nozzles, fuel lines or flow dividers, never use a small drill or a piece of wire.