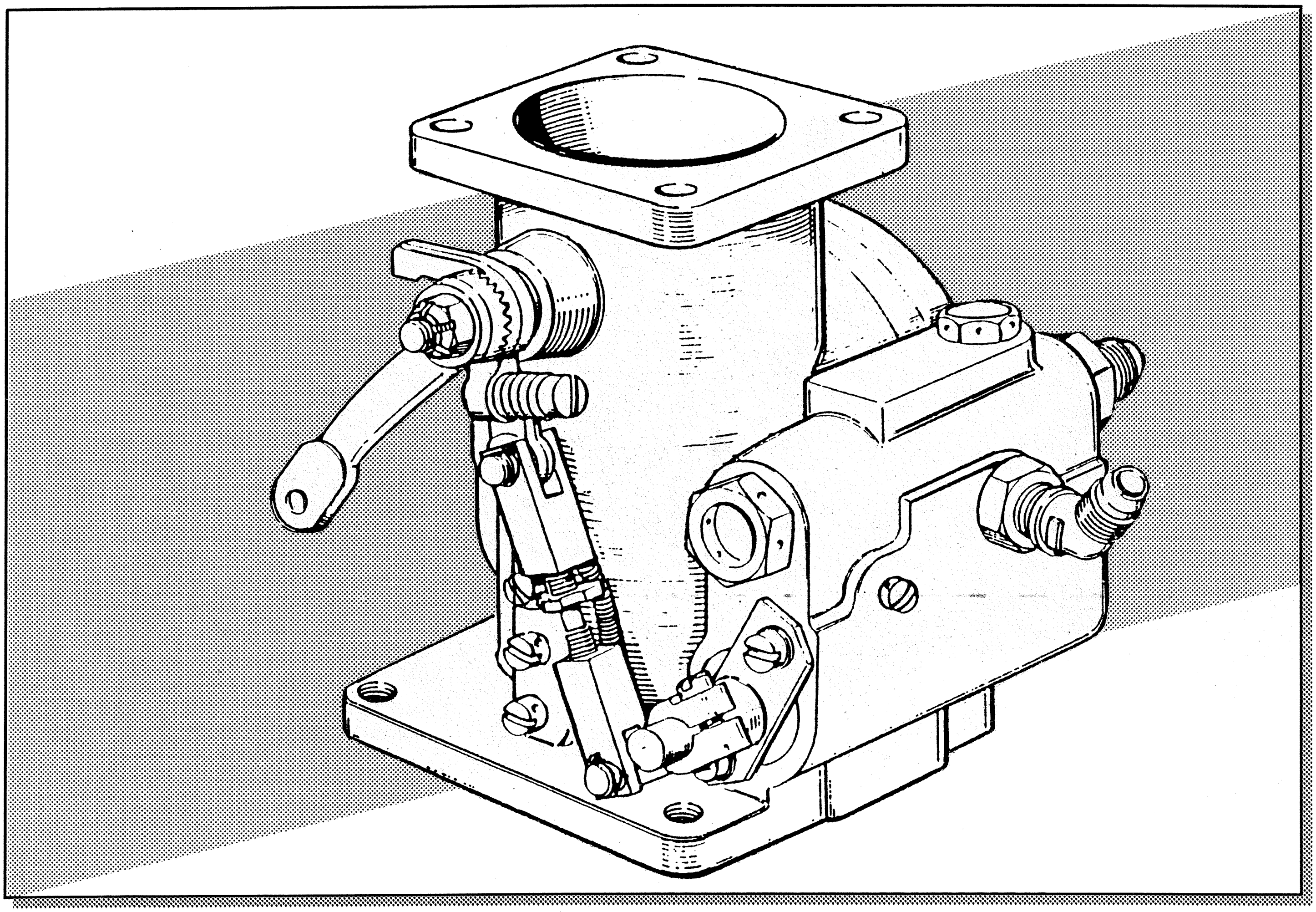
RSA-5 & RSA-10AD1
Fuel Injection Systems

Operation & Service Manual

- OPERATION
- INSTALLATION
- ADJUSTMENT
- SERVICE



PRECISION
AIRMOTIVE CORPORATION
3220 100th Street S.W. #E, Everett, WA 98204 USA

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PRECISION AIRMOTIVE CORPORATION
FUEL INJECTION SYSTEMS
OPERATION AND SERVICE MANUAL

MODEL RSA-5 AND RSA-10AD1

LIST OF EFFECTIVE PAGES

Insert latest changed pages; dispose of superseded pages in accordance with applicable regulations

NOTE: On a changed page, the portion of the text affected by the latest change is indicated by a vertical line, or other change symbol, in the page number margin of the page.

RECORD OF CHANGES

Total number of pages in this manual is 35, consisting of the following:

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PRECISION AIRMOTIVE CORPORATION
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INTRODUCTION

This operation and service manual has been prepared and distributed by Precision Airmotive Corporation, and is intended for use by personnel responsible for the installation, adjustment, and maintenance of Fuel Injection Systems.

Periodic revisions to this manual will be made to incorporate the latest operation and maintenance procedures. If, in the opinion of the reader, any information or procedures have been omitted or require clarification, please direct your comments and suggestions to the above office. An endeavor will be made to include such information in future revisions.

NOTE

If operation, installation, and maintenance procedures in this manual conflict with those specified in the applicable airframe and/or engine manual, the procedures in the airframe and/or engine manual shall apply.

NOTE

For application information, refer to Precision Airmotive publication "Fuel Metering Certification List", Form Number 15-769 or the Aircraft-type certificate Data Sheet.

MODEL RSA-5 AND RSA-10AD1

DESCRIPTION AND PRINCIPLES OF OPERATION

GENERAL

1-1. All RSA type fuel injection systems are based on the principle of measuring engine air consumption by use of a venturi tube and using the airflow forces to control fuel flow to the engine. Fuel distribution to the individual cylinders is obtained by the use of a fuel flow divider and air bleed nozzles with the exception of some helicopter installations that use an engine manufacturer furnished fitting.

GENERAL DESCRIPTION

1-2. The following is a description of the operation of the injection system.

AIRFLOW SECTION

1-3. A measure of the airflow consumption of the engine is accomplished by sensing impact pressure and venturi throat pressure in the throttle body. These pressures are vented to the two sides of the air diaphragm. (In the case of the RSA-5AB1, these two pressures are connected by an air channel in which the AMC unit is located). By movement of the throttle valve, a change in engine air consumption occurs that will change the velocity of the air in the venturi; this will reflect an immediate change in the air differential pressure. The air pressure is the engine manifold pressure.

REGULATOR SECTION

1-4. The regulator system consists of a fuel diaphragm which opposes the force of the air diaphragm; this force is transmitted through a regulator stem.. The fuel pressure shown on the ball side of the fuel diaphragm is the pressure after the fuel has passed through the fuel strainer, the manual mixture control rotary plate, the main metering jet and rotary idle plate, and is transferred to as metered fuel pressure. Fuel inlet pressure is applied to the opposite side of the fuel diaphragm. Since three of the four pressures involved in the regulator (namely, impact air, venturi throat, and inlet fuel pressure) are fixed, the fourth pressure (metered fuel pressure) must vary to keep the regulator in balance. This is accomplished by the ball valve controlling the orifice opening.

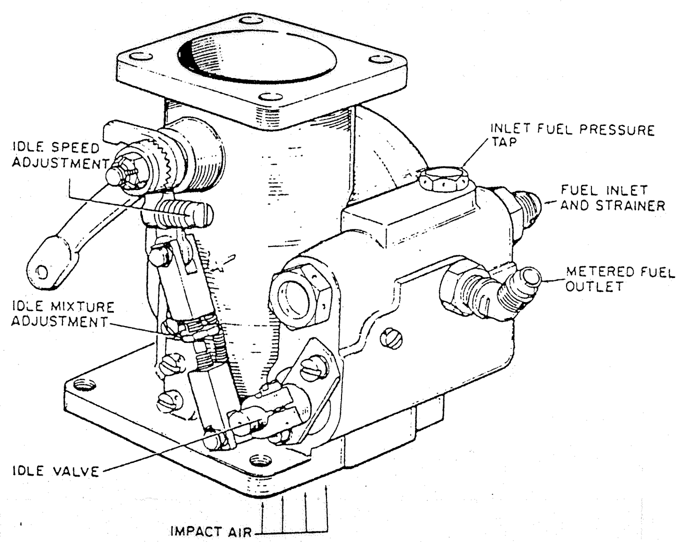


Figure 1. RSA-5AD1 External View

1-5. Since the air differential pressure is a function of the volumetric airflow, and the fuel differential pressure is a function of the fuel flow, a consistent fuel-to-air ratio is always maintained with this system, regardless of the quantity of air being consumed by the engine.

1-6. Consideration has been made for the low air forces experienced in the idle range by the incorporation of the constant head idle spring. This spring provides a constant fuel differential pressure that will allow adequate fuel supply for the idle range. As the air forces increase, the spring compresses until the spring retainer touches the air diaphragm and acts as a solid member.

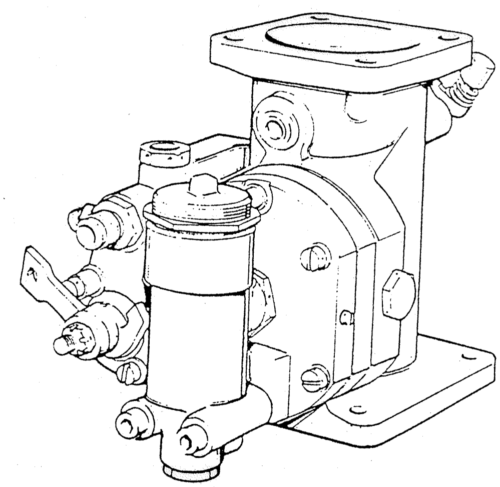


Figure 2. RSA-5AB1 External View

FUEL METERING SECTION

1-7. This section incorporates an inlet fuel strainer, a manual mixture control valve, and an idle valve. The idle valve is connected to the throttle valve by means of an external adjustable link. The main metering jet is incorporated in the passage between inlet fuel pressure and metered fuel pressure. In some cases (according to the parts list requirement) an enrichment jet is also located between these pressures. The enrichment jet fuel channel is also uncovered by the idle valve at a pre-determined point to provide additional fuel enrichment in the power range.

1-8. The manual mixture control valve produces a full rich condition when the lever is against the rich stop, and a progressively leaner mixture as the lever is moved toward idle cut-off.

1-9. Both idle speed (closed throttle position) and idle mixture (relationship between throttle position and idle valve position) may be readily adjusted externally to meet individual engine requirements.

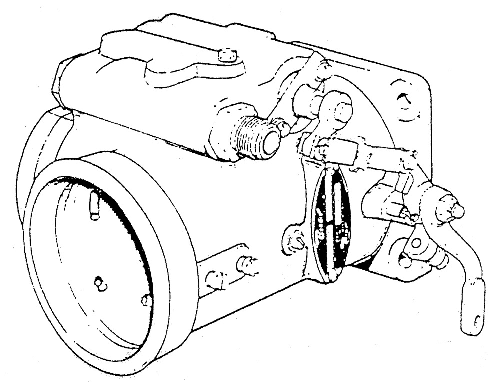


Figure 3. RSA-10AD1 External View

1-10 The fuel metering section of the RSA-5AD2 also incorporates a take-off adjustment valve. This valve should be adjusted in accordance with the engine manufacturers instructions. This will allow the fuel flows on twin engine aircraft to be matched within approximately ± 1% from engine to engine.

FLOW DIVIDER

1-11. The metered fuel is delivered from the fuel control unit to a pressurized flow divider. This unit keeps metered fuel under pressure, divides fuel to the various cylinders at idle and off idle, and shuts off the individual nozzle lines when the control is placed in I.C.O. Referring to the schematic diagram, metered fuel pressure enters the flow divider through a channel that permits fuel to pass through the I.D. of the flow divider valve. At idle the fuel pressure from the regulator must build up to overcome the spring force applied to the diaphragm and valve assembly. This moves the valve upward until fuel can pass out through the O.D. annulus of the valve to the fuel nozzle. Since the regulator meters and delivers a fixed amount of fuel to the flow divider, the valve will only open as far as necessary to pass this amount to the nozzles. At idle the opening required is very small, and the nozzle discharge pressure is negligible, thus the fuel is divided for the individual cylinders at this point by the flow divider. As fuel flow through the regulator is increased above idle requirements, fuel pressure builds up in the nozzle lines, fully opens the flow divider valve, and fuel distribution to the engine becomes a function of the discharge nozzles.

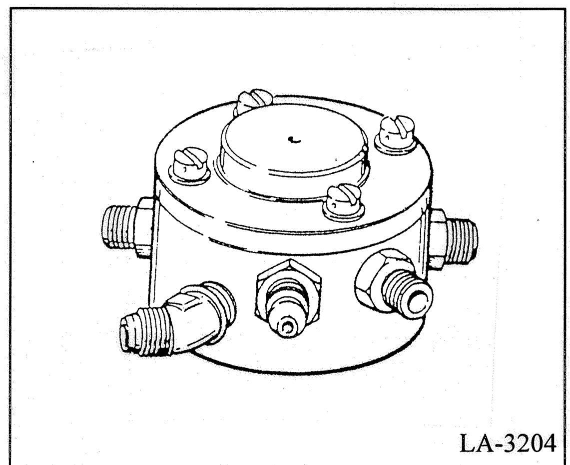


Figure 4. Flow Divider - Four, Six or Eight Cylinder Outlet

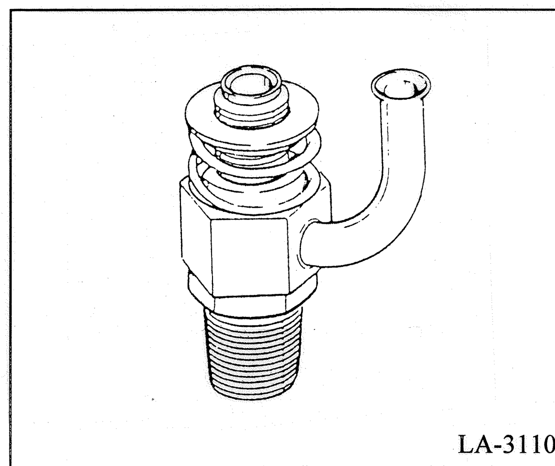


Figure 5. Shrouded Nozzle 2524370

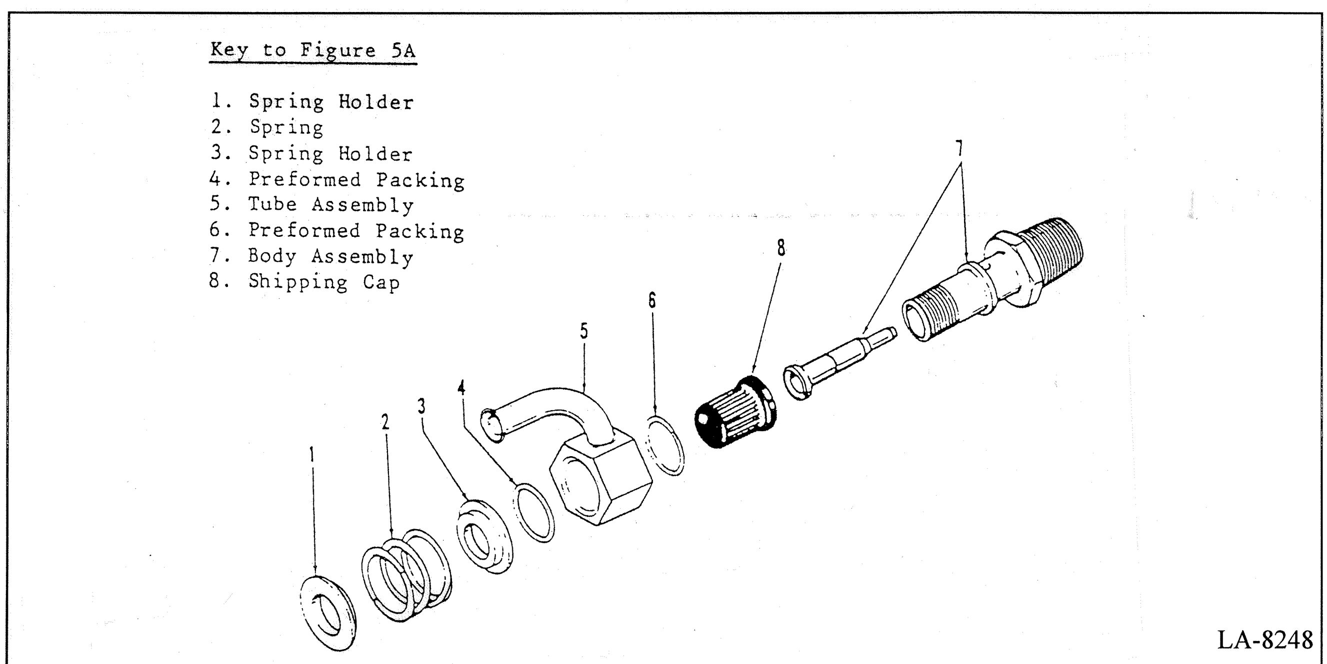


Figure 5A. Airbleed Nozzle Assembly 2524866 (Replaces Shrouded Nozzle 2524370)

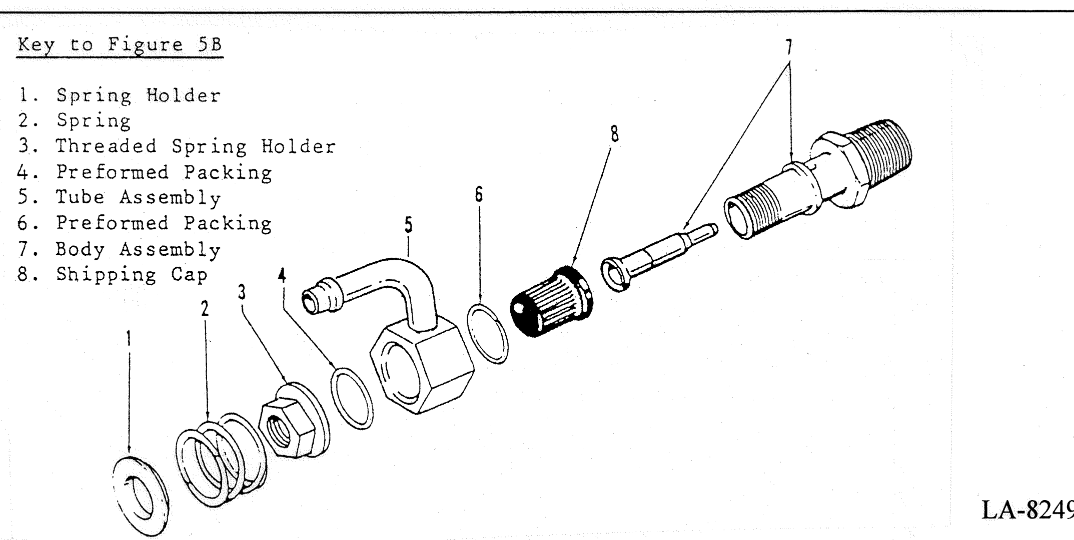


Figure 5B. Airbleed Nozzle Assembly 2524917

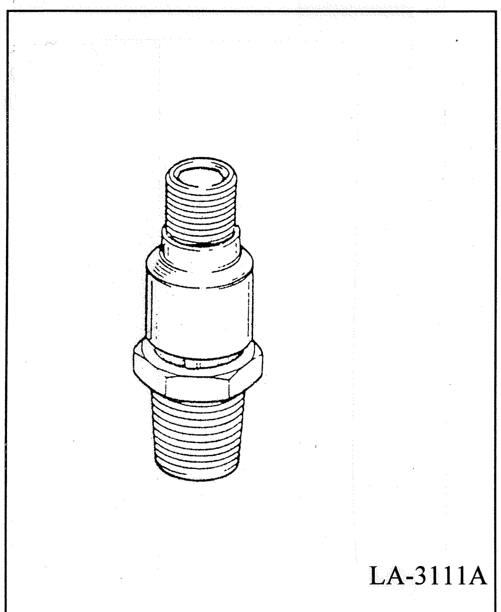


Figure 6. Nozzle Assembly 2524107

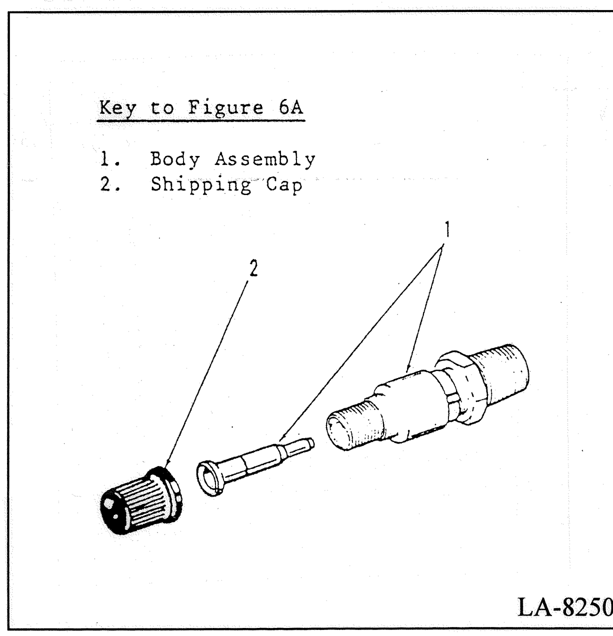
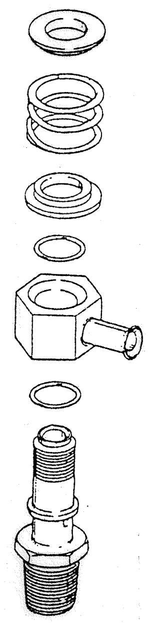


Figure 6A. Airbleed Nozzle Assembly 2524864



LA-3112A

Figure 7. Shrouded Nozzle 2524369

AIR BLEED NOZZLES

1-11. The fuel discharge nozzles for the individual cylinders are of the air bleed configuration. Each nozzle incorporates a calibrated jet, the size of which is determined by; 1) fuel inlet pressure available, and 2) the maximum fuel flow required by the engine. All nozzles are calibrated to flow alike (within ± 2%) and are interchangeable between engines and cylinders.

1-12. The fuel is discharged through the fuel jet into a fuel/air chamber located between the fuel jet and the fuel/air jet. This mixture of fuel and air is then expelled into the intake manifold.

1-13. Fuel pressure, before the individual nozzles, is in direct proportion to fuel flow; therefore, a simple pressure gage can be calibrated in fuel flow, gallons per hour, and be employed as a flowmeter.

1-14. Engines modified with turbo-superchargers must use shrouded nozzles. By use of an air manifold these nozzles are vented to the injector air inlet pressure.

Key to Figure 7A

1. Spring Holder
2. Spring
3. Spring Holder
4. Preformed Packing
5. Tube Assembly
6. Preformed Packing
7. Body Assembly
8. Shipping Cap

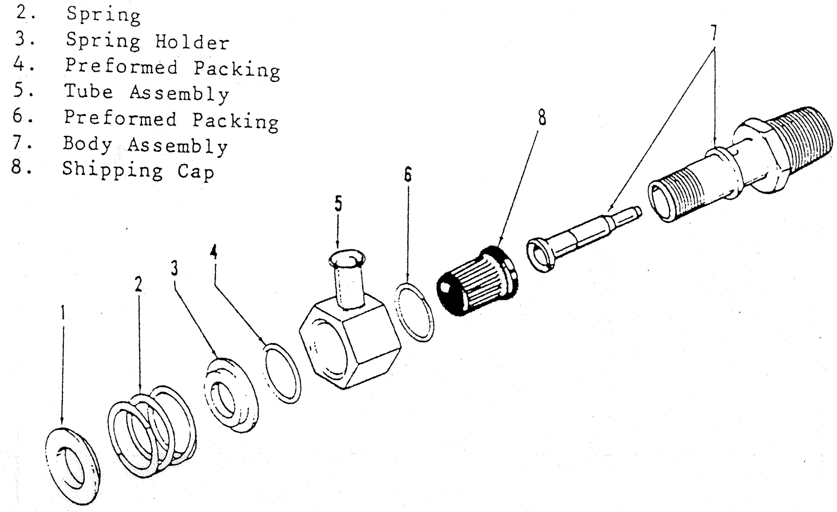


Figure 7A. Airbleed Nozzle Assembly 2524865

AUTOMATIC MIXTURE CONTROL UNIT

1-15 Air flow into an engine is normally referred to as pounds per hour. As a rule of thumb, the engine consumes six pounds of air per brake horse power regardless of altitude. A volumetric air flow metering unit will enrich approximately 1.7 to 2.3 percent for every one thousand feet in altitude. This enrichment variation depends on the specific altitude. Variations are greater at the higher altitudes.

1-16. The direct reason for the enrichment is the change in air density. If altitude or temperature is increased it will require a greater air volume to flow the same weight of air into the engine. This will increase the air metering forces and in turn increase the fuel metering forces resulting in a richer fuel/air mixture as altitude increases.

1-17. To automatically correct for this natural enrichment at altitude an automatic mixture control assembly is incorporated in the RSA-5AB1 fuel injector. The automatic mixture control works independently of, and in parallel with, the manual mixture control. It provides a variable orifice between the two air chambers (impact pressure and venturi throat pressure) to regulate the air metering forces.

1-18. The mixture control assembly consists of a contoured needle that is moved in and out of an orifice by a bellows assembly. This bellows assembly is sensitive to changes in air pressure and temperature. At ground level, the needle attached to the bellows is positioned to restrict the orifice and a large differential pressure between impact pressure and venture suction sides of the air diaphragm. When the aircraft increases altitude, the bellows elongates and moves the needle further into the orifice due to the change in air density. The reverse taper of the needle increases the orifice opening and bleeds air from the impact pressure side of the air diaphragm to the venturi suction side. This reduces the differential pressure and in turn reduces the fuel flow. The needle is contoured such that regardless of altitude (or air density) the correct differential pressure (impact to venturi suction) is established across the air diaphragm in the regulator for any specific air flow to the engine.

MANUAL LEANING

1-19. The setting incorporated in the injector satisfies the engine requirements for sea level operation. As air density decreases (altitude) the throttle is opened to maintain the same power. Opening the throttle causes a higher air metering force which, in turn, results in a greater fuel flow. The manual mixture control may then be moved towards the cut-off position to reduce fuel flow to the desired value.

1-20. Since the automatic mixture control unit compensates for altitude enrichment in the RSA-5AB1 injector, manual leaning to cruise power fuel flow is the only adjustment needed.

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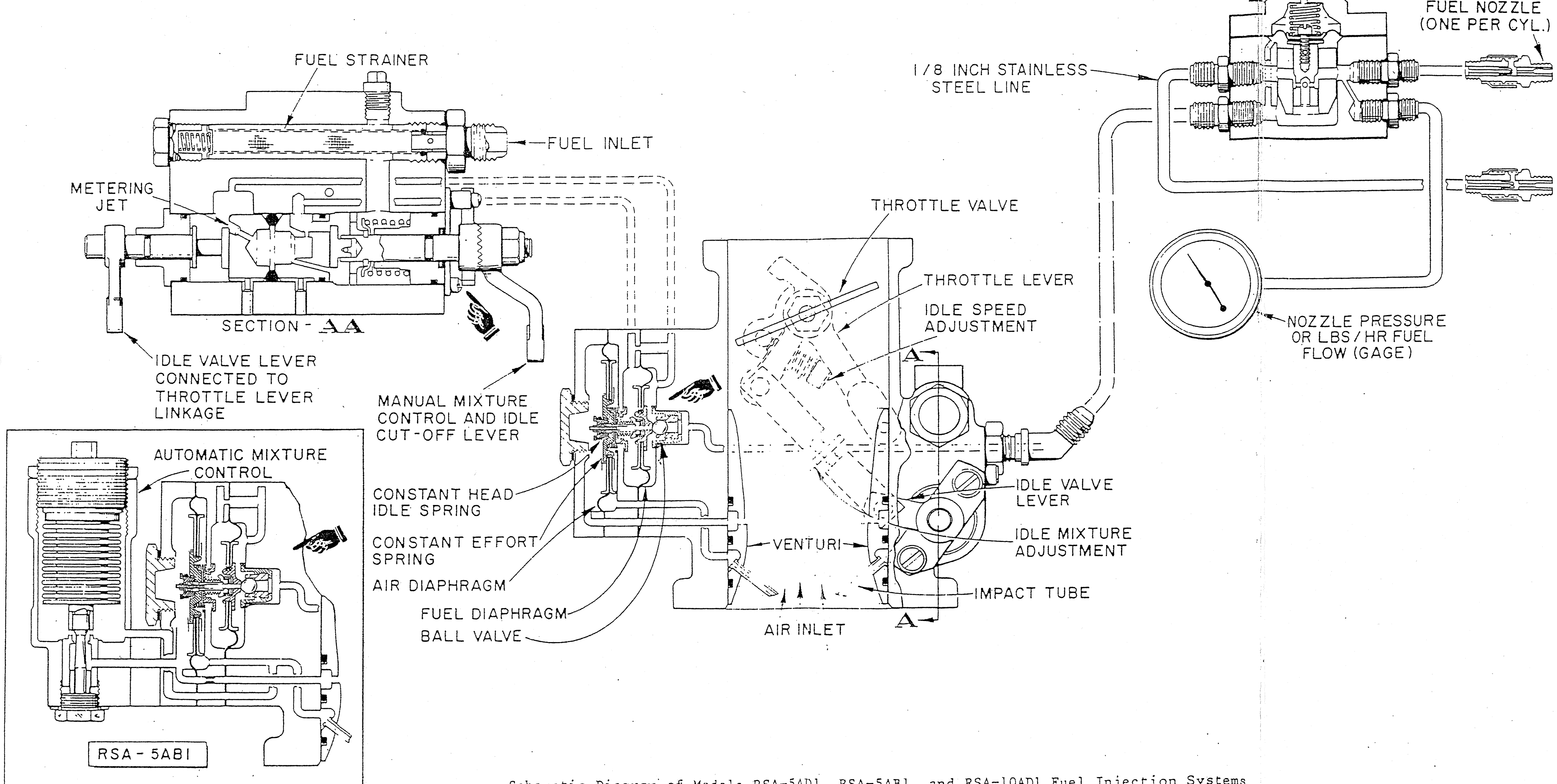

Schematic Diagram of Models RSA-5AD1, RSA-5AB1, and RSA-10AD1 Fuel Injection Systems

C-3925A

INSTALLATION

MOUNTING UNIT ON ENGINE

2-1. The injector can be mounted on the engine intake manifold inlet flange at any attitude to facilitate engine to air frame combination installation, taking into consideration that the throttle linkage and manual mixture control linkage must be attached to the unit.

2-2. An allowance should be made for adequate ventilation to the injector because of possible high ambient temperatures within the engine nacelle.

MOUNTING FLOW DIVIDER

2-3. The flow divider can be mounted at an optimum location with a predetermined bracket configuration, however, it must be mounted with the nozzle line fittings in a horizontal plane.

INSTALLATION OF NATURALLY ASPIRATED AIR BLEED NOZZLES

(Refer to Figures 5, 5A, and 5B.)

2-4. Install nozzle in cylinder using a clean, deep well 1/2 inch socket wrench. Tighten and torque nozzle to 60 lbs-inches. Refer to manufacturer's maintenance manual for "A" alignment.

NOTE

Do not remove shipping cap from nozzle until nozzle is installed.

2-5. Remove shipping cap and connect fuel line to nozzle. Tighten fuel line union nut (AN-805-2) to a torque value of 25-50 lbs-inches. It is also permissible to tighten fuel line union nut finger tight and then continue tightening nut with a wrench - 30° to 60° (1/2 to 1 flat of unit). Torque in excess of 50 lbs-inches may result in damage to the parts.

INSTALLATION OF TURBOCHARGED AIR BLEED NOZZLES

(Refer to Figures 6, 6A, 7 and 7A).

2-6. Install nozzle in cylinder using a clean, deep well 1/2-inch socket wrench. Tighten and torque nozzle to 60 lbs-inches. Refer to manufacturer's maintenance manual for "A" alignment.

INSTALLATION

2-7. Remove shipping cap and assembly packings, tube assembly, spring and spring holders. Tighten fuel line union nut (AN-805-2) to a torque value of 25-50 lbs-inches. It is also permissible to tighten fuel line union nut finger tight and then continue tightening nut with a wrench - 30° to 60° (1/2 to 1 flat of unit). Torque in excess of 50 lbs-inches may result in damage to the parts.

NOTE

Care should be taken not to drop the fuel restrictor during installation.

The new part number nozzle is physically and functionally interchangeable with the corresponding old nozzle.

FUEL LINE CONNECTION AND INSTALLATION

2-8. A flexible hose is used from the engine driven fuel pump to the injector fuel inlet. This hose size may differ according to installations.

2-9. Fuel strainer configuration may differ according to installation requirements. In most cases a 74 micron screen is used. The current production inlet fuel strainers are shown in Figure 8.

METERED FUEL LINE

2-10. In most installations a No. 4 flexible hose is used from the injector outlet to the flow divider. Later model injectors have an alternate fuel outlet 180° from the standard outlet. Either can be used according to the installation.

2-11. A 1/8 inch OD stainless steel tubing is routed from a restricted fitting (marked "GAGE") on the flow divider to the fire wall. A No. 3 low pressure hose is usually used from the fire wall to the gage. In all cases hose volume should be held to a minimum.

2-12. Provisions are made at the fuel strainer to measure inlet fuel pressure, if desired.

INSTALLATION OF NOZZLE LINES

2-13. The nozzle line length will depend on the engine installation and location of the flow divider. The nozzle lines are formed from 0.085-0.090 ID x 1/8 inch OD stainless steel tubing, with suitable fittings to connect to the top of the nozzle and to the flow divider. The lines are clamped at suitable locations to reduce line vibration.

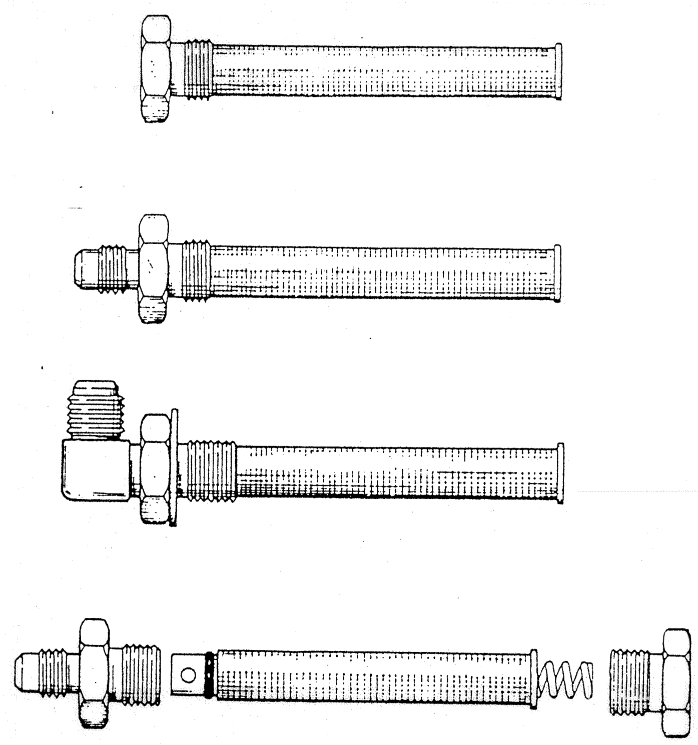

Figure 8. Fuel Strainers

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MODEL RSA-5 AND RSA-10AD1

TROUBLESHOOTING CHART

PROBLEM	PROBABLE CAUSE	REMEDY
HARD STARTING	Technique.	Refer to aircraft manufacturer's recommend 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.

TROUBLESHOOTING CHART

PROBLEM	PROBABLE CAUSE	REMEDY
ROUGH IDLE (Continued)	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.

TROUBLESHOOTING CHART

PROBLEM	PROBABLE CAUSE	REMEDY
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 Section Four.
ROUGH ENGINE (TURBO CHARGED) AND POOR CUTOFF	Air bleed hole(s) clogged.	Clean or replace nozzles.

TROUBLESHOOTING CHART

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.

SERVICE NOTES

GENERAL

4-1. Several phases of ground operations are adversely affected by fuel vaporization in the lines. Fuel vaporization may be experienced under extreme conditions of ambient and/or nacelle temperatures. Starting, idle operating, and engine shutdown procedures must all be modified to obtain optimum results under these conditions.

STARTING

4-2. In cold weather, the engine compartment (nacelle) temperature drops off rapidly following engine shutdown and the nozzle lines remain nearly full of fuel. Cold starting procedures are therefore simple with highly predictable results. However, in extremely hot weather, nacelle temperatures increase rapidly following engine shutdown, and fuel in the lines vaporizes and escapes out into the manifold. Hot starting procedures therefore depend considerably on how soon the next start is attempted. Within the first 20-30 minutes the manifold is nicely primed and the empty nozzle lines will fill before the engine dies. After 20-30 minute wait, the vaporized fuel in the manifold will have nearly disappeared and some slight "priming" could be required to refill the nozzle lines and keep the engine running after first firing.

IDLING

4-3. During ground operation every precaution should be taken to keep nacelle temperatures from increasing to the extent that fuel will vaporize in the lines. The following suggestions are aimed at minimizing this problem:

A. Keep nacelle temperatures as low as possible by:

1. Avoiding excessive ground operation.

2. Keeping cooling airflow up by keeping engine rpm's as high as practical.

3. Placing cowl flaps in the wide open position whenever practical.

4. Upon restarting of a hot engine, operating engine at 1,200-1,500 rpm for several minutes to reduce the residual heat in the engine compartment.

B. Keep fuel temperatures as low as possible. Higher rpm's with the accompanying higher line pressure and flow will help to dissipate some of the heat within the lines.

C. Make an idle speed and mixture adjustment that is a compromise between the engine's requirement during the cool of the morning and the heat of the day.

1. Adjust idle speed stop to provide 700-750 rpm or as high as practical. A higher idle rpm is objectionable to some pilots due to its effect on landing and braking characteristics, both on roll-out and during taxiing.
2. Adjust mixture in the cool of the morning to provide a 50 rpm rise when the mixture control is pulled slowly into cut-off.
3. Deleted.

SHUTDOWN (CUT-OFF)

4-4. The idling procedure practiced just prior to engine shutdown has considerable bearing on the "cleanness" or smoothness with which the engine stops. If the idling procedures suggested above are not followed and fuel is vaporizing and emptying the lines, the engine may continue to idle rough for a few seconds. This is despite a 100% cut-off of fuel supply by mixture control. An air shut-off valve is provided in some installations and is to be used in addition to the fuel shut-off valve (mixture control in the cut-off position) under these circumstances.

AUTOMATIC MIXTURE CONTROL

A. Dirt on the AMC needle will cause rich operation. This build-up on the needle can become so severe that the needle will stick, with resultant loss of altitude compensation.

B. Clean the AMC unit without disturbing the calibration by observing the following instructions.

A. Carefully remove the AMC unit. If gasket is damaged a new gasket, PAC P/N 2523555, must be used for replacement.

B. Remove the 9/16-24 plug and immerse the unit in clean hydrocarbon solvent or other suitable solvent. Invert the unit to fill with fluid. Excerise the AMC needle with a hardwood or plastic rod to facilitate cleaning. Shake the unit vigorously while allowing fluid to drain. Repeat several times to wash out all traces of contaminates.

C. Drain the unit; allow the cleaning solvent to evaporate thoroughly. Do not dry with air pressure.

D. Replace 9/16-24 plug and reinstall unit on injector. Torque to 55-60 inches-lbs.

FIELD ADJUSTMENTS

STARTING PROCEDURES

5-1. The following starting procedures has been proven successful; however, if there is a conflict, information given in the Aircraft Operation Manual should be followed.

A. Cold starts

1. Mixture control in idle cut-off position.
2. Set throttle to 1/8 open position.
3. Master switch -ON-.
4. Boost pump switch -ON-.
5. Move mixture control to FULL-RICH until fuel flow indicator reads 4 to 6 GPH then immediately return mixture control to cut-off position.

NOTE

On installations where a fuel flow indicator is not used allow 4 to 5 seconds in place of reading 4 to 6 GPH on the gage.

6. Engage starter -- when engine starts move mixture control to full rich position.

B. Warm starts

Use the same procedure as for cold starts except the boost pump may be left "off" and step 5 eliminated. **DO NOT PRIME.**

IDLE SPEED AND MIXTURE ADJUSTMENT

5-2. Start the engine and warm up in the usual manner until oil and cylinder head temperatures are normal. The relationship of the aircraft to the direction of the prevailing wind will have an effect on the propeller load and its RPM; hence, it is advisable to make the idle setting with the aircraft crosswind.

5-3. Check magnetos in accordance with instructions furnished in the aircraft operational manual. If the "mag-drop-off" is excessive, check for fouled plugs. If the "mag-drop" is normal, proceed with idle adjustment.

5-4. Set throttle stop screw so that the engine idles at the airframe manufacturer's recommended idling RPM with a closed throttle. If the airframe manufacturer's information does not have an idle RPM setting, 700 RPM - 750 RPM is recommended. If the RPM changes appreciably after making idle adjustment during the succeeding steps, readjust the idle speed to the desired RPM.

5-5 When the idling speed has been stabilized, move the cockpit mixture control lever with a smooth, steady pull toward the "Idle cut-Off" position and observe the tachometer for any change during the leaning process. Caution must be exercised to return the mixture control to the "Full Rich" position before the RPM can drop to a point where the engine cuts out. An increase of more than 50 RPM while "leaning out" indicates an excessively rich idle mixture. An immediate decrease in RPM (if not preceded by a momentary increase) indicates the idle mixture is too lean.

5-6. The optimum idle setting is one that is rich enough to provide a satisfactory acceleration under all conditions and lean enough to prevent spark plug fouling or rough operation. A rise of 25-50 RPM will usually satisfy both of these conditions.

5-7. If the above indicates that the idle adjustment is too rich or too lean, turn the idle mixture adjustment in the direction required for correction, and check this new position by repeating the above procedure. Make additional adjustments as necessary until a check results in the desired RPM rise. Each time the adjustment is changed, the engine should be run up to 2000 RPM to clear the engine before proceeding with the RPM check.

5-8. The actual idle mixture adjustment is made by the lengthening (richening) or shortening (leaning) of the linkage between the throttle lever and idle valve lever. The center screw assembly has right hand threads on both ends but one end has a No. 10-24 thread and the other end has a No. 10-32 thread. For easy reference, consider only the coarse thread end. When it is turned out of its block, the linkage becomes longer and a richer mixture is provided. When it is turned into its block, the linkage is shortened and a leaner mixture is provided.

5-9. A major adjustment is available for use when the center screw bottoms out on either of the blocks. If the idle adjustment is almost satisfactory, measure the distance between the two blocks. Disconnect the spring from the most accessible linkage pin and remove the pin. Turn the block and adjustment screw until the adjusting wheel is centered and the distance between blocks is as previously measured. There is now additional adjustment range and the reference point is retained.

5-10. Make the final idle speed adjustment to obtain the desired idling RPM with closed throttle.

FIELD ADJUSTMENTS

5-11. The above method aims at a setting that will obtain maximum RPM with minimum manifold pressure. In case the setting does not remain stable, check the idle linkage; any looseness in this linkage would cause erratic idling. In all cases, allowance should be made for the effect of weather conditions and field altitude upon idling adjustment.

5-12. Idle speed and mixture adjustments made according to this method should require very little further attention except for extreme variations in temperature and altitude.

5-13. On the RSA-5AD2, take-off fuel flow adjustments shall be made in accordance with the engine manufacturer's instructions. Adjusting the valve counter-clockwise will increase fuel flow. Clockwise adjustment will decrease the fuel flow. Approximately 6 clicks will result in a one gallon per hour change.

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FUEL SYSTEM REQUIREMENTS

FUEL PRESSURE

6-1. The minimum fuel pressure requirement for this system is dependent upon the installation. See engine specifications for correct operating pressures. In general, inlet pressure 5 to 10 psi greater than engine requirements will not adversely affect the operation of the system.

FUEL CONTAMINATION

6-2. Satisfactory operation of the fuel injection system depends on the fuel being relatively free of contamination. To fulfill this requirement, a 74 micron strainer is incorporated in the injector.

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INJECTION SYSTEM NOTES, GROUND AND FLIGHT

INDUCTION SYSTEM ICING

7-1. There are two types of icing conditions which are of considerable concern to the operator of any aircraft. The first is ice formation due to fuel vaporization, and the second is rime or atmospheric icing. The conditions that bring about these two ice formations are considerably different in their origin and, therefore, will be discussed separately.

VAPORIZATION ICING

7-2. Ice formation within a float-type carburetor, due to fuel vaporization or refrigeration, is a result of a temperature drop at the point of fuel entering the air stream. The rapid vaporization of the gasoline at the point of discharge can result in a 40° to 70°F drop in temperature. As moisture is always present in engine intake air, ice will form in the immediate area downstream from the discharge nozzle. In a float-type carburetor this ice will usually form on the venturi and throttle valve and shaft, and if permitted to accumulate will restrict the induction system to such an extent as to cause complete engine failure.

7-3 One of the main advantages of the RS-type injection system is its "non-icing" characteristics. As fuel is discharged directly into the valve port of the intake manifold the possibility of ice formation within the throttle body is eliminated.

ATMOSPHERIC ICING

7-4. Atmospheric (or rime) ice will usually form when flying through heavy rain, snow, or ice when the temperature is in the vicinity of 32°F. This type of ice not only collects on the wing and propeller surfaces of the aircraft, but may completely restrict the inlet air scoop filter. Since this ice cannot be removed by the application of carburetor heat, continued flight must be made on either heated or protected intake air.

INJECTION SYSTEM NOTES, GROUND AND FLIGHT

ICE AND SNOW

7-5. Power loss resulting from induction system restriction is often encountered when operating under these conditions. The restriction can form in the air scoop. Preventative action consists of moderate application of carburetor heat prior to entering this type of precipitation. In the event a restriction has already accumulated, the application of carburetor heat and/or protected air source must be sufficient to raise the temperature of the critical areas above freezing.

CAUTION

The maximum C.A.T. (Carburetor Air Temperature) specified by the engine manufacturer must not be exceeded.

7-6. To summarize the foregoing paragraphs, operation in certain adverse weather conditions could result in the accumulation of ice or snow in the air induction system. Observing normal pilot precautionary and corrective measures, as well as the airframe manufacturer's prescribed procedures, such as use of heated or protected induction air, should be adhered to whenever flying in icing conditions.

MAINTENANCE, LUBRICATION AND PREPARATION FOR STORAGE

MAINTENANCE

8-1. In general, little attention is required between injector overhauls. However, it is recommended that the following items be checked during periodic inspection of the engine.

A. Check tightness and lockwiring of all nuts and screws which fasten the injector to the engine.

B. Check all fuel lines for tightness and evidence of leakage. A slight fuel stain adjacent to the air bleed nozzles is not cause for concern.

C. Check throttle and mixture control rods and levers for tightness, travel and lockwiring.

D. Remove and clean the injector inlet strainer at the first 25 hour inspection and each 50 hour inspection thereafter or as recommended by the airframe/engine manufacturer. Remove the strainer from the inlet fitting side ONLY. Cleaning can be accomplished using acetone or M.E.K. followed by a rinse in stoddard solvent and then air drying the strainer. Damaged strainer O-rings should be replaced.

Inlet Fitting and Filter O-Ring part numbers

Model	Inlet Fitting	Filter
RS/RSA-5 series	951789	953541-10
RS-7 & RS/RSA-10 series	951790	951392

WARNING

Methyl Ethyl Ketone (MEK) and acetone are flammable and harmful to eyes, skin and breathing passages. Keep ignition sources away. Provide adequate ventilation and protective clothing.

Compressed air used for cleaning purposes will not exceed 30 psi. Use only with effective chip-guarding and personal protective equipment (goggles, shields, gloves, etc.).

E. Remove fuel line union nut from nozzle. Remove fuel restrictor from nozzle body or nozzles indicated in Figures 5, 5A, 5B, 6, 6A, 7 and 7A. It is not necessary to remove nozzle body from cylinder. Clean restrictor in Methyl Ethyl Keytone (MEK) or acetone. Do not clean any internal passages with sharp instruments such as drills, pins, needles, etc. Use air pressure to clean nozzle body in cylinder.

NOTE

In all instances, keep each restrictor with its respective body.

8-2. Test prove that gasoline which becomes stale due to prolonged storage absorbs oxygen rapidly. This stale oxidized gasoline acquires a very distinctive odor similar to varnish and causes rapid deterioration of synthetic rubber parts, and also forms a gummy deposit on the internal metal parts. This condition, however, does not occur during normal operation of the injector where fresh fuel is being constantly circulated.

8-3. If an aircraft is to be placed in storage for a maximum of three months, shut down engine using the idle cutoff lever in the normal fashion. Leave in idle cutoff position during storage. If the aircraft is to be stored for a period greater than three months, fill the control with preserving oil (any good grade of clean No. 10 nondetergernt oil is satisfactory) or run engine for a minimum of 10 minutes every three months. Use the procedure that is the most convenient. Longer storage than three months with unused fuel could cause gum formation in the fuel section.

A. The Time Between Overhaul (TBO) for all fuel injectors and fuel system components utilized on general aviation aircraft is the same as the TBO specified by the engine manufacturer for the engine on which Precision Airmotive parts are installed, or a maximum of 10 years after date of installation or last overhaul (Ref. PRS-97).

B. Air bleed nozzles are to be cleaned and inspected at overhaul. Reuse is permissible after satisfactory flow test. More frequent cleaning may be required based on aircraft/engine service history.

C. A complete overhaul is mandatory regardless of any FAR operational category when the injector or fuel system component has been subjected to severe environment such as but not limited to:

1. Engine fire, external or prolonged air intake manifold fire or accident when the service history of the unit is unknown.

2. Contaminated fuel such as water, rust, sand, etc.

3. Fuel that does not meet engine manufacturer's requirements may be detrimental to engine operation. If non-specified fuel is inadvertently pumped into the aircraft fuel system and drained, injector overhaul is not required.

4. If uncertainty exists regarding the need for overhaul, contact Precision Airmotive Corporation Product Support Department, 3220 100th Street S.W., Everett, Washington 98204, (206) 353-8181 for consultation.

LUBRICATION

8-4. There is very little need for lubrication of the injector in the field between regular overhauls. However, the clevis pins used in connection with the throttle and manual mixture control levers should be checked for freedom of movement and lubricated, if necessary, as directed in the airplane manufacturer's manual.

8-5. Place a drop of engine grade oil on the end of the throttle shaft in such a manner that it can work into the throttle shaft bushings.

8-6. Follow the aircraft manufacturer's instructions for cleaning and oiling the air filter element. A filter element replaced with an excessive amount of oil clinging to it can cause fuel metering difficulties as the excess oil will be drawn into the scoop and will settle on the venturi tube of the injector. This can greatly affect the metering characteristics of the injector.

PREPARATION FOR STORAGE

8-7 Units taken out of service for less than 28 days may be left filled with clean fuel or calibration fluid. Any units taken out of service for a period of 28 days, or longer, or units being returned to overhaul must be flushed with preserving oil. Any good grade of clean No. 10 nondetergent oil is satisfactory. Use the following procedure for preserving units.

CAUTION

Exercise caution when handling or working around the injector to prevent oil or fuel from entering the air section of the injector. Fluid can easily enter the air section of the injector through the impact or the suction passages of the venturi. Although no permanent damage will result to the parts in the regulator if oil or fuel is exposed to them for short periods of time, it may affect the air signals from the venturi to the regulator by blocking the air passages. This effect will be more noticeable in extremely cold environments.

A. Remove plugs and/or caps from fuel ports and drain all residual fuel from the unit.

B. eplace all plugs and caps except those for the fuel inlet and outlet.

C. Introduce oil from a filtered source (10 micron) into the fuel inlet by gravity pressure only until oil flows from the outlet port.

D. Dump the oil from the unit. A film of oil on internal parts of the fuel section is sufficient to preserve the control.

E. Replace caps and/or plugs in the fuel inlet and outlet.

F. After oil flushing the unit with preserving oil, it should be protected from dust and dirt, and in addition, given such protection against moisture as climatic conditions at the point of storage require. In most cases, storing the unit in a dry area will be sufficient. If the unit is to be stored near or shipped over salt water, the following precautions should be observed.

1. Deleted

2. Pack in a dustproof container, wrap the container with moistureproof and vaporproof material, and seal. Pack the wrapped unit in a suitable shipping case. Pack a one-half pound bag of silica gel crystals in the dustproof container with injector. The bag must not touch the injector.