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FM-250C/LFR-BNRM10 FUEL CONTROL

INSTALLATION, OPERATION & MAINTENANCE MANUAL

"PROPRIETARY"

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INTRODUCTION

This manual has been prepared and distributed by Airflow Performance, LLC. It is intended to be used by personnel responsible for the installation, adjustment, and maintenance of Fuel Injection Systems.

Periodic revisions will be made to this manual to incorporate the latest information and procedures. If the reader finds any information or procedures omitted, please direct your comments and suggestions to Airflow Performance, LLC, Attn.: Manager Technical Publications. An effort will be made to include this information in future revisions.

NOTE

It is the user's responsibility for using aircraft approved installation methods and materials to insure correct and safe operation of the engine and aircraft. **Information in this manual DOES NOT supersede any published airframe/engine manufacture's publications. Conflicting information should be directed to Airflow Performance, LLC, Attn.: Manager Technical Publications.**

NOTE

ALL PICTURES ARE FOR REFERENCE ONLY



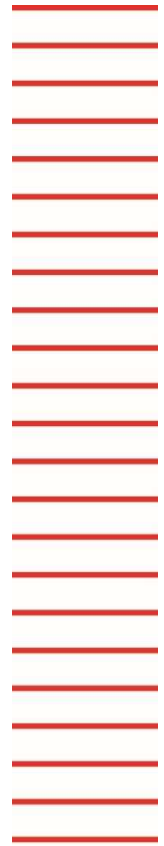
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AIRWORTHINESS LIMITATIONS

1. General

This Airworthiness Limitations chapter sets forth each mandatory replacement time, inspection interval, and related procedure required for continued airworthiness. The Airworthiness Limitations section is FAA approved and specifies maintenance required under 14 CFR §§ 43.16 and 91.403 of the Federal Aviation Regulations (FAR) unless an alternative program has been FAA-approved.

2. Currently there are no Airworthiness Limitations issued.



SECTION 1

DESCRIPTION AND PRINCIPLES OF OPERATION

1.1. GENERAL

The FM-series fuel injection system is comprised of three basic components, a fuel control, a flow divider and fuel nozzles (a nozzle in each cylinder intake port). This fuel metering system operates on a proven principle of delivering fuel in proportion to the amount of air consumed by the engine.



Figure 1.1 FM-250C Fuel Control

1.2. SYSTEM DESCRIPTION

The fuel control is an airflow device designed to meter fuel in proportion to the volume of air being consumed by the engine. This is done by employing a venturi to generate a signal which is proportional to engine airflow. Metered fuel is routed from the fuel servo to the flow divider through a flexible fuel line. At the flow divider, the fuel is divided among the cylinders and routed to fuel nozzles located in each cylinder intake port via individual steel fuel lines. The FM-250C is of a modular design which incorporates three main parts, throttle body assembly, valve body assembly and regulator assembly.

1.3. FUEL CONTROL

The operation and function of the fuel control can be described in terms of two basic sections: the Air Section and the Fuel Regulator Section.

1.3.1. AIR SECTION

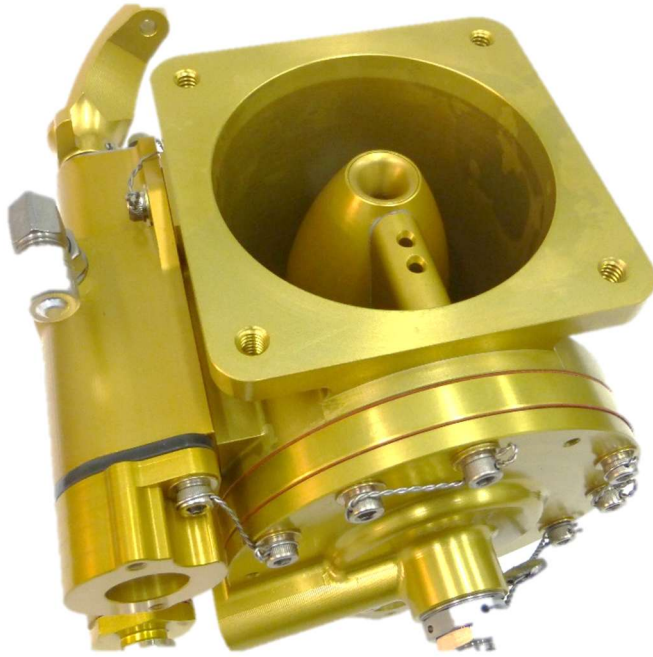


Figure 1.3 Throttle Body with Venturi Installed



Figure 1.4 High Gain Venturi

The air section consists of a throttle body containing the air control throttle valve, a regulator mounting pad and a center mounted, bullet type venturi. Measurement of engine airflow is accomplished by sensing inlet air pressure (impact pressure) and venturi throat pressure (boost venturi suction) in the throttle body. These pressures are vented to two sides of the air diaphragm. This pressure signal is called metering suction differential (MSD). By movement of throttle valve, a change in the engine air consumption occurs that will change the velocity of the air through the venturi, which will reflect an immediate change in the MSD. The FM servo utilizes a “high gain” venturi, which incorporates an internal boost venturi. By employing this type of venturi, a strong pressure signal can be generated at low airflows. This in turn provides good fuel metering response at low engine speeds.

1.3.2. FUEL REGULATOR SECTION

The Fuel Regulator Section consists of the regulator and jetting systems. The regulator consists of an air diaphragm and a fuel diaphragm connected by a solid regulator valve stem. The MSD is applied across the air diaphragm to produce a force to open the fuel regulator ball valve. The fuel flowing through the metering jet takes a pressure drop (metering head, MH), and this pressure differential is applied across the fuel diaphragm to produce an equal and opposite force across the fuel diaphragm which tends to close the regulator ball valve. The regulator will thus find an equilibrium condition from these forces. Since the laws of flow apply to both air and fuel systems, the fuel flow generated by the regulator is proportional to airflow. Fuel air ratio is varied by changing the area of the metering jet.



Figure 1.5 Fuel Regulator Section

1.3.3. IDLE SYSTEM

Fuel flow is controlled below approximately 20% power by a rotary idle valve linked to the throttle valve. In the idle regime, the venturi signal is negligible, and the MSD generated is not sufficient to accurately operate the regulator. To create a positive MH, a constant effort spring is used to generate the required force. Engine idle airflow is controlled by an idle speed adjustment screw located on the throttle stop lever. Idle mixture is set by use of an adjustable idle linkage. Off idle fuel mixture is controlled by the idle valve slot contour.



Figure 1.6 Valve Body
Idle Valve and Manual Mixture Control

1.3.4. MANUAL MIXTURE CONTROL

The manual mixture control valve produces a full rich condition when the lever is against the full rich (R) stop. A progressively leaner mixture is attained as the lever is moved to the “ICO” (idle cut-off) position. Moving the mixture control lever to the ICO position will effectively shut off fuel flow and stop the engine. (However, the manual mixture control is not an absolute fuel shut off valve. Three to seven cc/min “leakage” is typical in the idle cut off position.

1.3.5. TPS AND MPS SENSOR

The FM-250C incorporates mounting pads and “D” dives for TPS (Throttle Position Sensor) and MPS (Mixture Position Sensor) sensors. 8-32 UNC threaded holes are provided in the pads for attachment of the sensors. Airflow performance, LLC does stock or service these sensors. All maintenance inquiries pertaining to these components should be directed to Lycoming Engines.

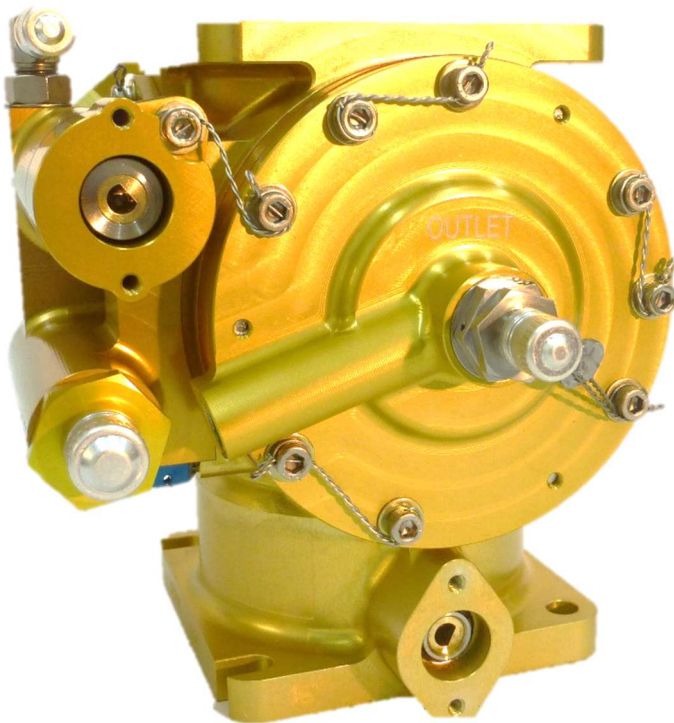


Figure 1.7 TPS and MPS mounting pads.

1.3.6. VENT RETURN

The FM-250C incorporates an unmetered fuel vent return. This restricted fitting allows unmetered fuel to circulate through the fuel control, cooling the unit during operation and helping to eliminate hot fuel and vapor before hot restarts. An AN-4 hose can attach to the fitting.

Vent Return fitting.
#4 hose connection.
Torque hose connection 65-115 in.-lbs. Torque fitting lock nut 95-120 in.-lbs.

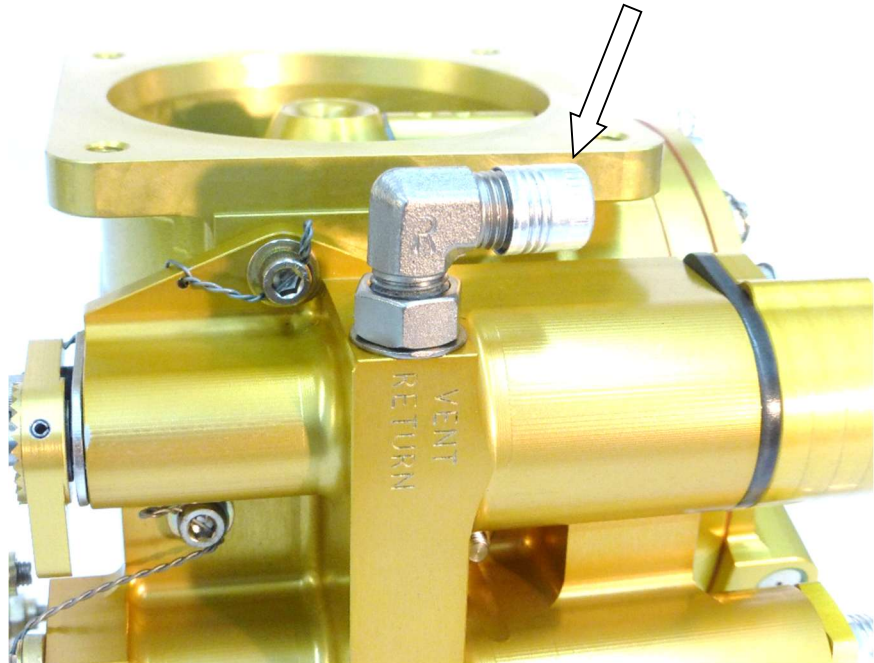


Figure 1.8 Vent Return Fitting

1.3.7. REQUIRED FUEL SYSTEM COMPONENTS

The FM-250C requires a fuel flow divider for idle fuel distribution to the engine. Current manufacturers of flow dividers used with mechanical fuel injection systems of this type are compatible for use with this fuel control. Fuel Injector Nozzles of the air bleed type are compatible for use with this fuel control. Contact Airflow Performance to ensure component compatibility.



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SECTION 2 INSTALLATION

2.1. FUEL FILTRATION

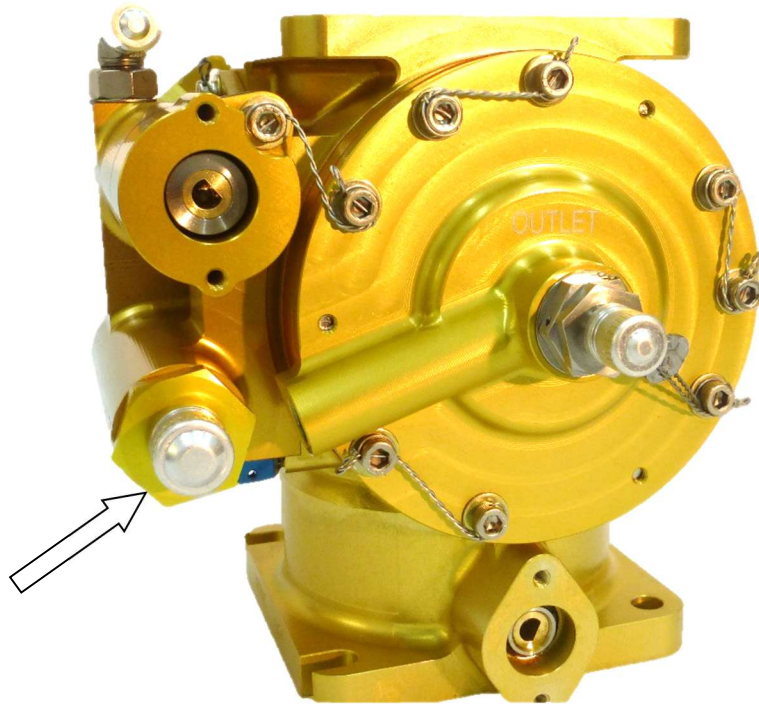
The fuel control incorporates a 70–75-micron nominal rated relieving fuel filter which can be removed for cleaning by removing the inlet fitting. The filter spring snaps on the end of the filter assembly. The spring is installed away from the inlet fitting.



Figure 2.1 Fuel Inlet Filter

2.2. FUEL INLET FITTING

The fuel inlet fitting is –6 AN.



Fuel Inlet Fitting
#6 Hose Connection
Torque Inlet Fitting 150-
200 in.-lbs. Torque -6
hose connection to 130-
150 in.-lbs.

Figure 2.2
Fuel Inlet Fitting

2.3. METERED FUEL OUTLET FITTING

The metered fuel outlet is -4 AN fitting.

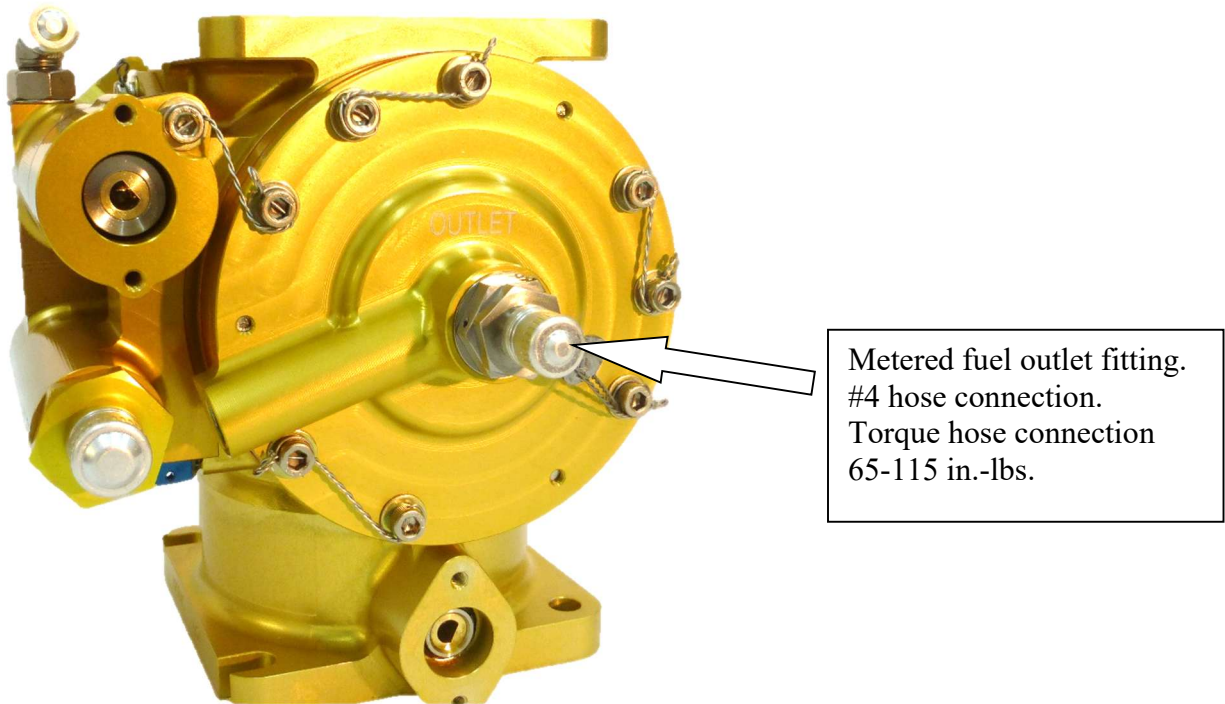


Figure 2.3 Fuel Outlet Fitting

NOTE:
The fitting under the outlet fitting is lock wired and factory sealed.
DO NOT remove this fitting.

2.4. MANUAL MIXTURE CONTROL

The fuel control is fitted with a manual mixture control. In the full rich position, the “R” stamped on the mixture control stop lever is against the plastic stop. Rotating the control to the “ICO” position will lean the mixture. “ICO” is stamped on the opposite side of the mixture control stop lever. When “ICO” is against the plastic stop, the fuel flow is shut off to the engine. There is approximately 3-7 cc/min. leakage in this position. The mixture control lever can be indexed in 15 degree increments to facilitate the linkage hook up. Make sure that the teeth on the two levers mesh correctly before tightening the lock nut. Use a 5/16-inch socket to loosen and tighten the ¼-28 lock nut. Torque the lock nut to 45-55 in.-lbs.



Figure 2.4 Mixture Control shown in ICO Position

Mixture Lever installed. After rigging tighten the ¼-28 locknut 45-55 in.-lbs. Ensure the teeth on the lever and stop lever are engaged properly.

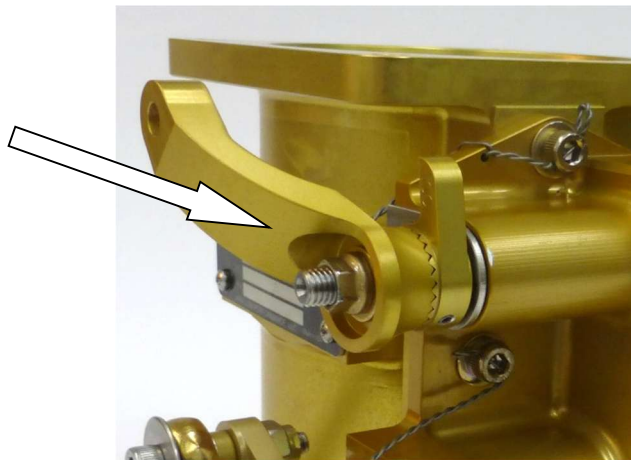


Figure 2.5 Mixture Control

NOTE:

The manual mixture control is not intended to be used as an aircraft fuel shut off valve. If the fuel supply is near or above the level of the injector nozzles, fuel may seep into the engine or seep out the injector nozzle vents. A zero-leak fuel shut off valve should be used on these installations.

2.5. THROTTLE LEVER

The throttle lever is installed against the throttle stop lever. Like the mixture control lever, the throttle lever has clutch teeth that mesh with the throttle stop lever to give the throttle lever 15-degree increments of adjustment. Make sure that the teeth on the two levers mesh correctly before tightening the lock nut. Use a ½ inch socket to loosen and tighten the 5/16-24 castle nut. Torque the 5/16-24 castle nut to 50-60 in.-lbs. Install the cotter key to secure the castle nut. If the hole does not line up on the castle nut, continue to tighten the castle nut to the next slot. Do not exceed 150 in.-lbs.

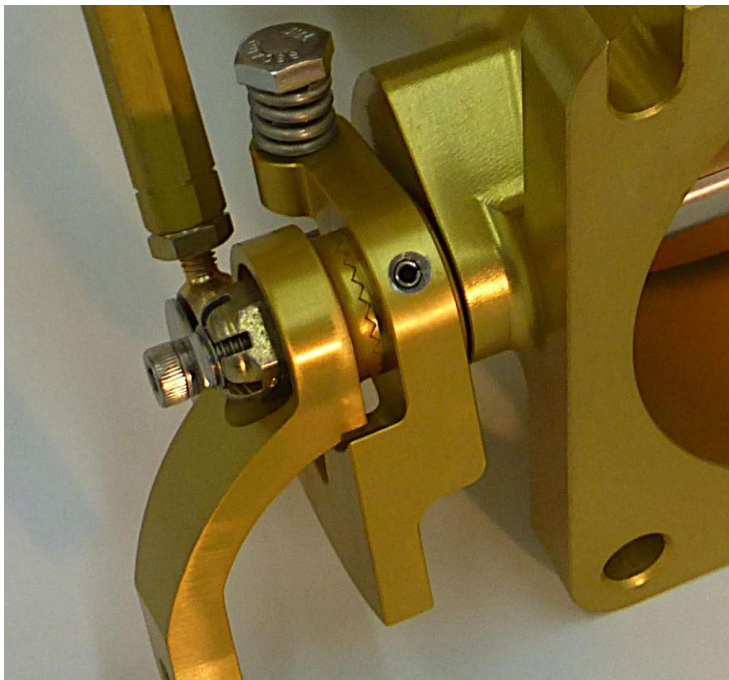


Figure 2.6 Correctly Meshed Throttle Lever Clutch Teeth with Throttle Stop Lever



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2.6. CONTROLS

A mechanical stop on the aircraft throttle and mixture control should be used to set wide-open throttle (WOT). Rig the throttle stop lever to have .030 to .060 clearance to the stop pin when the throttle control in the cockpit is at the wide-open throttle stop. This will eliminate premature wear of the throttle stop lever.

The control rods and levers used to operate the throttle and mixture control should be of rugged construction so that positive operation may be obtained. The levers are drilled to accept 3/16" bolts. Spherical bearing rod ends are recommended for attachment from the control cable to the levers. The use of clevis connection is not recommended as this will give premature wear of the lever hole. The system should be designed and built so that full movement of the fuel controller throttle and mixture levers is obtained, and the movement is in the proper direction. Insure that "G" loads encountered in flight will not change the position of the throttle or mixture control set by the pilot.



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SECTION 3

GENERAL OPERATING INFORMATION

3.1. GENERAL

Several phases of ground operation are adversely affected by fuel vaporization in the fuel lines. Fuel vaporization may be experienced under hot conditions of ambient and/or nacelle temperatures. Starting, idle operation, and engine shut down procedures must be modified to obtain optimum results under these conditions.

3.2. STARTING

In cold weather, the engine compartment (nacelle) temperature drops off rapidly following engine shut down and the nozzle lines stay nearly full of fuel. Cold weather starting procedures are therefore simple with highly predictable results. However, in extremely hot weather, nacelle temperatures increase rapidly following engine shut down, and the fuel in the lines vaporizes and escapes out into the manifold. Hot weather 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 quits. After a 20-30-minute wait, the vaporized fuel in the manifold will have nearly disappeared and some slight priming may be required to refill the nozzle lines and keep the engine running after first firing.

3.3. STARTING PROCEDURE

The following starting procedure has proven successful.

A. Cold Starts

1. Mixture control in the 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 an indication of fuel flow is seen, then immediately return the mixture control to the cut-off position.
6. Boost pump switch -OFF-.

On installations where a fuel flow indicator is not used, allow 4 to 5 seconds in place seeing an indication of fuel flow, or turn the boost pump on until an indication of fuel pressure is observed on the inlet fuel pressure gage (15-20 PSI), put the mixture to cut-off position, then turn the pump off.

NOTE:

With the mixture manual control in the rich position, fuel will flow into the engine if the boost pump is left on.



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7. Crank engine. When engine fires, put mixture to FULL-RICH and throttle to idle.

B. Warm Starts

1. Use the same procedure as for cold starts except the boost may be left “off” and step 4, 5 and 6 eliminated. DO NOT PRIME.

NOTE:
If high under cowl temperature exists, it may be necessary to turn on the boost pump after the engine has started.

C. Flooded Starts

1. Mixture to cut-off position
2. Throttle to full open
3. Crank engine
4. When engine starts, close throttle and slowly put mixture to full rich.

3.4. IDLING

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

A. Keep nacelle temperature as low as possible by:

1. Avoiding excessive ground operation.
2. Keep cooling air flow up by keeping engine RPM as high as possible.
3. Place cowl flaps in the wide-open position whenever practical.
4. Upon restarting of a hot engine, operate the engine at elevated RPM'S (1200-1500 RPM) several minutes to reduce the residual heat in the engine compartment.

B. Keep fuel temperature 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.

1. After restarting a hot engine, turn on the boost pump. This will pressurize the engine driven fuel pump to prevent vapor lock.
2. The boost pump should be running during take-off, before letting down for landing approach, landing and aerobatics. Under high ambient conditions it may be advisable to leave the boost pump running during taxiing to parking.



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- 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 the idle speed to provide 700-750 RPM or as high as practical. The application the engine is used in will also determine the correct idle speed. A higher idle speed is sometimes objectionable due to its effect on landing and braking characteristics, both on roll-out and during taxiing.
 2. Adjust the idle mixture after the engine has reached the operating temperature as stated in the applicable engine manual. A slight RPM rise (10-40 RPM) may be observed when the mixture control is pulled slowly into idle cut-off.

3.5. SHUT DOWN

The idling procedure practiced just prior to engine shut down has considerable bearing on the "cleanness" or smoothness with which the engine stops. If the idling procedures above are not followed and the 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 the fuel supply by the mixture control.

- A. Make sure the electric boost pump is turned off before attempting to shut the engine off.
- B. If required, opening the throttle with the mixture control in the idle cut-off position will aid in a cleaner shut off.
- C. Allowing the engine to run at higher RPM after prolonged idle period (1200-1500 RPM) for 10 to 15 seconds then returning the throttle to idle and stabilizing before shutting down will aid in eliminating fuel vapor in the nozzle lines and improve engine shut down.
- D. Do not allow the engine to buck or "diesel" after the mixture is pulled in the ICO position. Open the throttle and turn off the mags.

3.6. SHUT DOWN PROCEDURE

1. Set propeller at minimum blade angle.
2. Idle until there is a decided decrease in cylinder head temperature.
3. Increase throttle to 1000 RPM. Maintain speed for approximately 20-30 seconds to ensure cooling of the nozzle lines and adequate scavenging of the turbocharger oil system if installed.
4. Move mixture to Idle Cut-Off.
5. When engine stops, turn ignition switch off.



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3.7. INDUCTION SYSTEM ICING

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 impact or atmospheric icing. The conditions that bring about these two ice formations are considerably different in their origin and, therefore, will be discussed separately.

3.8. VAPORIZATION ICING

Ice formation within carburetors due to fuel vaporization or refrigeration, is a result of a temperature drop at the point of fuel entering the air system. The rapid vaporization of gasoline at the point of discharge can result in a 40–70-degree 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 carburetor this ice will usually form on the venturi and throttle shaft, and if permitted to accumulate will restrict the induction system to such an extent as to cause complete engine failure.

One of the main advantages of the FM series of fuel injection system is its “non-icing” characteristics. As fuel is discharged under pressure directly into the valve port of the intake manifold, the heat in the cylinder head eliminates the possibility of ice formation. Ice will not form in the venturi area of the fuel control as no fuel is discharged in this area and the acceleration of the air across the venturi will not lower the temperature enough to cause ice to form.

3.9. ATMOSPHERIC ICING

Atmospheric (rime or impact) ice will usually form when flying through rain, freezing rain, snow, or ice when the temperature is in the vicinity of 32 degrees 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. Since this ice cannot be removed by application of heated air (alternate air), continued flight must be made on protected alternate air. If the system is running on unfiltered ram air, there is also the possibility of ice collecting on the venturi in the fuel control which will degrade the metering signal. In this instance heated or alternate air must be used to eliminate the ice buildup.

3.10. FLIGHT DURING ADVERSE WEATHER CONDITIONS

Flight under certain weather conditions can result in the accumulation of ice in the air induction system. Normal pilot precautionary and corrective measures, as well as the airframe manufacturer’s prescribed procedures, such as use of protected alternate air, must be adhered to whenever flying in icing conditions.



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SECTION 4

FIELD SERVICE

4.1. IDLE SPEED AND MIXTURE ADJUSTMENT

The following instructions deal with setting the idle mixture and speed on the engine. A preliminary idle adjustment has been set at the factory. This should be sufficient to get the engine started and running.

WARNING

THE FOLLOWING PROCEDURE IS PERFORMED WITH THE ENGINE RUNNING. THE AIRCRAFT SHOULD BE IN AN AREA THAT IS SAFE FOR RUNNING AND SECURELY TIED DOWN. USE EXTREME CAUTION WHILE WORKING AROUND RUNNING ENGINES. BE AWARE OF YOUR POSITION RELATIVE TO THE PROPELLER. IF YOU ARE UNSURE OF YOUR ABILITY TO WORK AROUND RUNNING AIRCRAFT ENGINES, DON'T ATTEMPT THIS PROCEDURE, FIND SOMEONE WHO IS QUALIFIED TO PERFORM IT FOR YOU. HAVE A QUALIFIED PERSON IN THE COCKPIT DURING THE ADJUSTMENT. DO NOT ATTEMPT THIS ADJUSTMENT ALONE. DO NOT LEAVE THE COCKPIT OR ENGINE RUNNING UNATTENDED.

- A. Warm the engine to obtain CHT and oil temperature within prescribed normal operating temperature.
- B. Make sure operating temperatures are not exceeded while running with the engine un-cowled as cooling air over the engine may be decreased during ground operation.
- C. Check magnetos in accordance with the instructions furnished in the aircraft or engine operational manual. If the "mag-drop" is normal, proceed with the idle adjustment.
- D. Set the idle speed with the speed stop bolt (on the throttle stop lever). Set the idle speed to the airframe manufacturer's specification or set the idle speed as high as practical. Normal idle speed for most applications is approximately 700-750 RPM. If the RPM changes appreciably after making an idle mixture adjustment during the succeeding steps, readjust the idle speed to the desired RPM.
- E. The optimum idle setting is one that is rich enough to provide satisfactory acceleration under all conditions and lean enough to prevent spark plug fouling or rough operation.

F. The actual idle mixture adjustment is made by lengthening (rich) or shortening (lean) the linkage between the throttle stop lever and the idle lever. When it is turned out of its block, the link becomes longer, and a richer idle mixture is provided. When it is turned into its block the linkage is shortened and leaner idle mixture is provided. There is a left- and right-hand jam nut to lock the linkage. The groove on the hex link designates left hand thread on that end. Use two $\frac{3}{8}$ inch wrenches to make the adjustments. The left-hand thread is on the throttle stop lever end. Loosen one jam nut but leave the other jam nut just snug. This will provide a little drag on the adjustment and make the adjustment easier and more accurate. Tighten both jam nuts 10-15 in-lbs. after the correct idle mixture is achieved. A locking Helicoil is provided in the right-hand thread of the idle link. This will provide some drag to the link adjustment while the jam nuts are loose.

NOTE
Idle adjustments will not affect the wide-open throttle mixture.

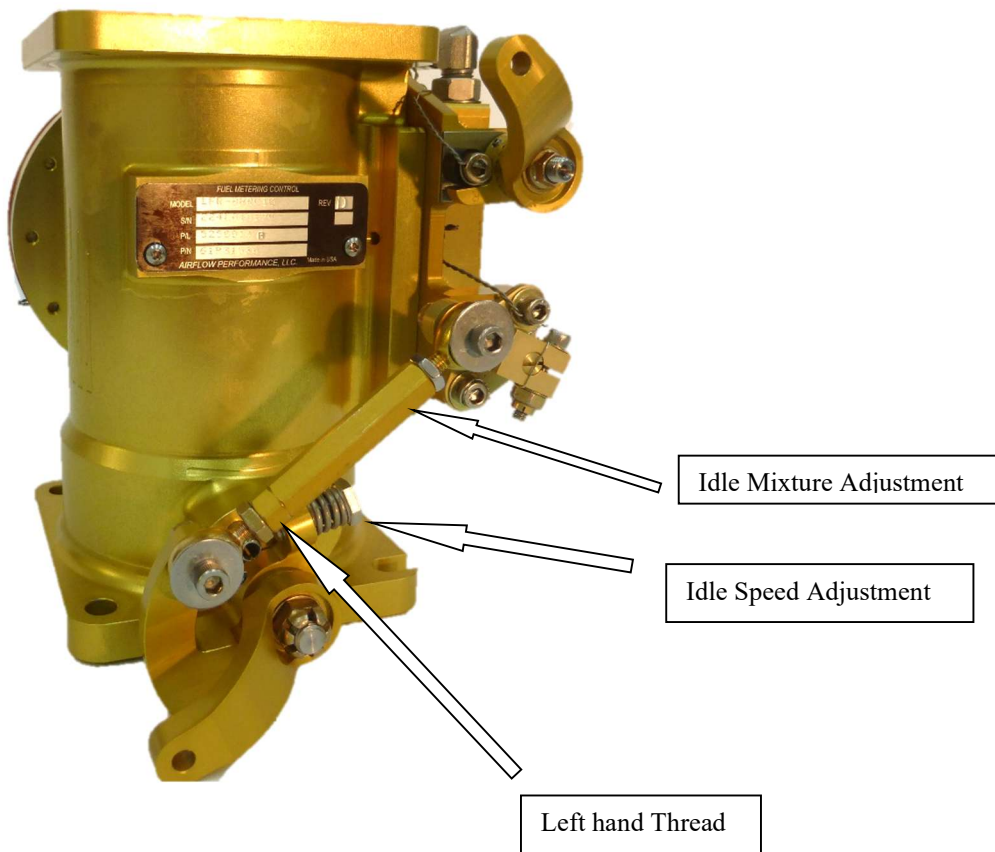


Figure 4.1 Idle Mixture and Speed Adjustment



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- G. The idle mixture adjustment is sensitive. Adjust the idle mixture adjustment one to two flats at a time.
- H. Another method for finding correct idle mixture is to check RPM rise. When the idle speed has been stabilized, move the cockpit mixture control with a very slow, smooth, steady pull into the IDLE CUT-OFF position and observe the tachometer for any change during the leaning out 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 in RPM while leaning out indicates the idle mixture is on the rich side of best power. An immediate decrease in RPM (if not preceded by a momentary increase) indicates that the idle mixture is on the lean side of best power. A rise of 10-40 RPM is typical with a properly adjusted mixture.
- I. Each time an adjustment is made, clear the engine by running it up to 1/2 to 3/4 throttle then back to idle before making a mixture check.
- J. Changing the idle speed will affect the idle mixture. Work between the two adjustments to get the best operation.
- K. Make the final idle speed adjustment to obtain the desired idling RPM with the throttle closed.

NOTE

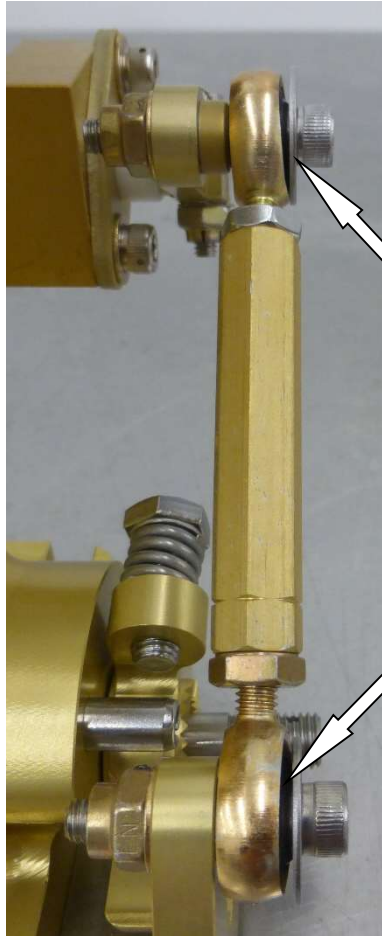
The idle mixture adjustment is sensitive. Do not adjust more than one to two flats at a time. Normal adjustment should not be more than one full turn in either direction.

- L. If the setting does not remain stable, check the idle linkage; any looseness in this linkage will cause erratic idling. In all cases, allowances should be made for the effect of weather conditions upon idling adjustments. 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 cross-wind.
- M. Idle speed and mixture adjustments made according to this method should require little attention except for extreme variations in temperature and altitude.
- N. Erratic idle may be encountered under prolonged idle or high under cowl temperatures. Running the engine up briefly will clear the hot fuel from the nozzle lines.
- O. If while adjusting the idle mixture it seems that the idle mixture is erratic or the adjustment seems to be chased, try running the boost pump, clear out the engine and continue with the idle mixture adjustment procedure with the boost pump on.

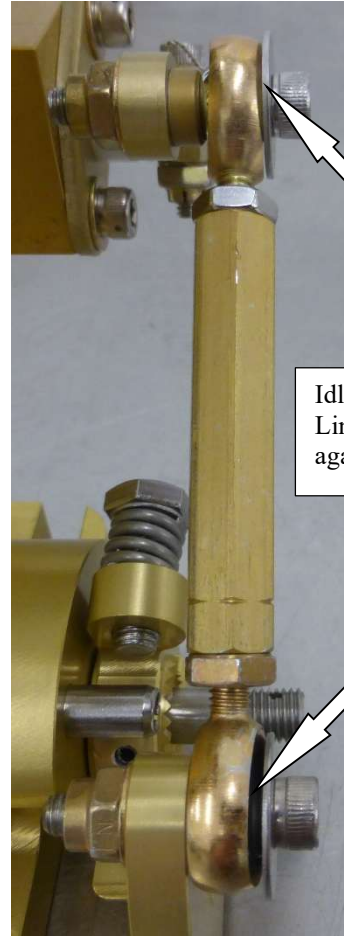


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- P. If a manifold pressure gauge is a cockpit instrument, it can be used to set optimal idle mixture. Lean the idle mixture using the cockpit mixture control until the lowest manifold pressure is obtained at idle speed. A typical idle mixture is .3" to .5" MAP richer than the lowest reading at 750 RPM. This will also give the best idle mixture. Using this information adjust the idle mixture adjustment on the fuel control to duplicate the results.
- Q. On new installations it may be found that the idle performance is unstable, or the idle mixture seems to change after starting and stopping the engine. This is not uncommon. Preserving oil in the engine and fuel control make engine operation a bit unstable until the engine is run sufficiently to flush the fuel system and clean the spark plugs. The fuel control settings will also settle after an hour or so of flight time. After the initial first start and adjustment of the idle mixture on the ground it may be found that a slight adjustment after a flight is required to fine tune the operation. Idle mixture will need to be re-adjusted from summer to winter operation if ambient temperatures change 50-70degrees F. Typically, ½ to 1 flat adjustment is all that is necessary.



Idle linkage
adjusted correctly.



Idle adjusted incorrectly.
Linkage is jammed
against large area washers

NOTE:

Ensure the idle linkage rod ends are not twisted after adjusting the idle mixture and snugging the idle mixture link jam nuts. Having the linkage twisted will cause excess throttle actuation force. After adjustment the link should be able to twist back and forth by grasping the idle link.



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SECTION 5

MAINTENANCE, LUBRICATION, AND STORAGE

5.1. PERIODIC MAINTENANCE

In general, very little attention is required between fuel control overhauls (appx. 2000 hours). It is recommended that the following items be checked during 100-hour inspections and/or annual inspections of the engine and airframe. More frequent removal of components and/or hoses is discouraged since there is more chance of contamination getting into the system.

- A. Inspect inlet filter every 50 hours of operation or at annual inspection, whichever comes first.
- B. Check all fuel lines for tightness and evidence of leakage.
- C. Check tightness and lock wiring of all nuts, screw, and fasteners on the fuel control and attaching hardware to the engine.
- D. Check the throttle and mixture control rod ends and levers for wear and tightness. Also inspect the idle linkage jam nuts for tightness and rod ends for wear.
- E. Periodic cleaning of the venturi assembly is necessary when operating under severe dirty conditions or engine operation warrants inspection and cleaning. It should be inspected at 100-hour inspections and or annual inspections. It is not necessary to remove the fuel control from the engine. Remove the air inlet from the body to gain access to the venturi. Wipe the outside of the venturi with a clean rag damp with mineral spirits, Brake Kleen or Lacquer thinner. Clean the boost venturi using a Q-tip wet with the same solvent. Do not insert sharp objects into the boost venturi. Ensure that none of the Q-tip is left in the choke area of the boost venturi.
- F. There is very little need for lubrication of the injector in the field. Place a drop or two of engine oil on each end of the throttle shaft so that it will work into the throttle shaft bushings. Recommended lubrication of these bushings is every 50 hours.
- G. The inlet fuel filter should be inspected and cleaned if suspected fuel contamination is found or at annual inspections. Remove the inlet fitting to gain access to the inlet filter. Inspect and clean with mineral spirits or sonic clean with soap and water. Blow dry and inspect the filter element. If the filter element is damaged, replace the element. Inspect O-rings, replace if damaged or nicked. Use only engine oil on the O-ring when reinstalling the fitting.



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5.2. AIR CLEANER

Follow the aircraft manufacturer's, or air cleaner manufacturer's instructions for cleaning or replacing the filter element.

5.3. PRESERVATION FOR STORAGE/SHIPPING

Gasoline becomes stale due to prolonged storage. This stale oxidized gasoline acquires a very distinctive odor similar to varnish. This forms a gummy deposit on internal metal parts. This condition will not occur during normal operation of the engine, as fresh fuel will be circulating through the fuel control.

If the aircraft will not be used or run for more than three months, the fuel control should be drained of fuel and filled with a good grade of No. 10 non-detergent oil. If this procedure is not followed then the engine should be run a minimum of 10 minutes every three months. Units taken out of service for more than three months should be removed from the engine and preserved. Use the following procedure for preserving the fuel control.

- A. Remove the fuel control from the engine. Drain all residual fuel from the fuel control.
- B. Introduce 10 weight oil by gravity or up to 20 PSI into the fuel inlet on the fuel control. Have the mixture control full rich and the throttle wide open. Use only clean filtered oil (10 weight, 10-micron filtration). Add oil until the oil runs out the outlet fitting. Exercise caution when adding oil to keep oil from entering the air section through the venturi.
- C. Operate the throttle and mixture control through their range of travel to ensure a film of oil is on the internal parts of the fuel section. This is sufficient to preserve the control.
- D. Install metal shipping caps with O-rings or metal AN pressure caps on the fuel inlet and outlet.
- E. Pack the fuel control in a dust proof container.
- F. If the fuel control is to be stored or shipped over salt water, the following should be observed:
 1. Spray the external surfaces of the fuel control with clean preserving oil. Do not spray oil in the venturi or impact port.
 2. Pack the fuel control in clean dust-proof packing; wrap the packing with moisture-proof material and seal. Pack the fuel control in a suitable shipping case.



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SECTION 6

TROUBLE-SHOOTING

6.1. GENERAL

To be able to pinpoint the problem or problems causing the malfunction is effective trouble-shooting. Removing and replacing components on a trial-and-error basis is “shotgun” trouble-shooting in its worst form. Shotgunning is expensive, time consuming, and nothing can be learned from it. To be effective, trouble-shooting must be an analysis of the problem, its probable causes, and the necessary actions to correct the problem, and if possible, prevent it from happening in the future.

6.2. TROUBLE-SHOOTING PROCEDURES

There are several points to keep in mind in developing an effective trouble-shooting procedure for engines, their systems, and components. A complete understanding of basic engine principles and theory of operation is necessary to determine the path to follow to solve the problem. A suggested method, which, with minor changes, can be adapted to almost any engine, consists of five basic steps. These are:

1. STUDYING THE SYMPTONS
2. ISOLATING THE SYSTEM AFFECTED
3. DETERMINING THE PROBABLE CAUSES
4. CHECKING AND REPAIRING
5. TESTING AND DOCUMENTING THE RESULTS

The following trouble-shooting charts list possible causes for problems and the recommended remedies. The text sections following the charts provide a variety of tests and methods for determining the correct operation of individual components, without resorting to “change the part and see if that fixes the problem”.

The fuel control in itself is a fairly simple device. There are many engine symptoms that may mimic a fuel injection problem, but upon understanding the operation of the fuel control system these symptoms can be isolated. An intermittent problem is usually not caused by the fuel control itself due to the simple nature of its operation.



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TROUBLE-SHOOTING CHART

PROBLEM	PROBABLE CAUSE	REMEDY
Hard Starting.	Technique.	Refer to sections 3.3., also aircraft and engine manufacturer's recommended starting procedure.
	Flooded.	Refer to Sections 3.3.
	Throttle valve open too far.	Open throttle to 1/8 or less. Amount may vary for given application.
	Insufficient prime (usually accompanied by a backfire).	Increase amount of priming.
	Slow cranking speed. Ignition timing. Weak spark.	Inspect starter motor, battery, associated wiring and components. Ignition may also be affected by slow cranking speed.
Rough Idle.	Mixture too rich or too lean.	Confirm with manual mixture control. Adjust idle mixture as per Section 4.1.
	Restricted nozzle. High take-off fuel flow may also be indicated on a fuel flow gauge which measures nozzle back pressure.	Flow test and clean nozzles manufacturer's instructions.
	Sheared nozzle restrictor. Caused by over torquing nozzle line B-nut.	Replace Injector Nozzle Assembly. Torque nozzle line B-nut to 20-30 in.-lbs.
	Restricted flow divider port. (If flow divider is used.)	Flow test and clean per manufacturer's instructions.
	Slight air leak into induction system through manifold drain if used.	Confirm by temporarily plugging drain valve. Repair or replace valve as necessary.
	Slight air leak into induction system through loose intake pipes or damaged seals or gaskets.	Repair as necessary.
	Incorrect ignition timing.	Set to engine manufacturer's specifications.
	Incorrect valve lash. Sticking valves.	Set to engine manufacturer's specifications.
	Restricted bleed air supply to injector nozzles. Pinched hoses connecting bleed air rail to nozzles. (turbo charged engine)	Make sure bleed air rails and hoses are not restricted. Bleed air rail hoses must be connected to high pressure area in intake manifold (turbo discharge).
	Loose Nozzle Shield.	Replace Injector Nozzle.
	Stuck Flow Divider valve.	Check for contamination and correct. Refer to manufacturer's instructions.



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TROUBLE-SHOOTING CHART (CONT.)

PROBLEM	PROBABLE CAUSE	REMEDY
Rough Idle (Cont.).	Air in fuel supply.	Test per instructions in Section 6.3.
	Fuel vaporizing in nozzle lines or flow divider. Encountered under high ambient temperature conditions or following prolonged operation at low RPM'S.	Refer to Section 3.4.
	Baffling hitting cowling.	Make sure only rubber seal strips contact cowl.
Unable to Lean Idle Mixture.	Sticking fuel control regulator. (Foreign material in regulator.)	Return fuel control for repair.
	Clogged air bleeds on injector nozzles. Restricted bleed air rail (turbo engines).	Inspect and repair as necessary.
		.
Off Idle Stumble.	Idle mixture too lean.	Reset idle mixture. Refer to Section 4-1.
	Intake manifold leak.	Inspect and repair as necessary.
	Incorrect ignition timing.	Reset to engine manufacturer's specifications.
	Air in fuel supply.	Test per instructions in Section 6-3.
	Fuel vaporizing in nozzle lines, or flow divider. Encountered under high ambient temperature conditions or following prolong operation at low RPM'S.	Refer to Section 3.4.
	Fuel pump leaking fuel into reference line. (turbo charged engine)	Repair fuel pump.
Engine Hangs on First Acceleration of the Day.	Air in fuel control.	A brief hesitation is common on first start-up. This symptom should clear after the engine is run up.
	Oil or fuel contamination in the air section of the fuel control.	Normally this is an indication of a turbocharger seal leak. Return fuel control for repair.



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TROUBLE-SHOOTING CHART (CONT.)

PROBLEM	PROBABLE CAUSE	REMEDY
Engine is Slow to Transition Mid-Range to Full Throttle Power and Runs Rich.	Propeller (constant speed).	Low pitch stop incorrectly set. Possible prop governor problem.
	Propeller (fixed pitch).	Incorrectly pitched propeller.
	Turbo system.	Differential pressure control, waste gate, or waste gate control malfunction.
	Ignition.	Make sure ignition is operating correctly and is timed to the engine manufacturer's specs.
Low Take-Off Fuel Flow. Lean Engine Operation.	Insufficient inlet fuel pressure.	Confirm fuel pressure requirement for maximum HP.
	Plugged inlet filter.	Remove filter fitting, clean and reinstall. Back flush screen. Refer to Section 2-1 and 6.9.
	Restricted fuel supply to fuel pump. Problem can sometimes be confirmed by turning on the boost pump.	Test for restriction in aircraft fuel system plumbing, filters, valves, fittings, etc.
	Stuck flow divider valve.	Flow divider valve must move freely. Check for contamination and correct. Refer to manufactures instructions for field service or return to manufacture for repair.
	Air in fuel supply.	Test per instructions in Section 6.3.
	Induction system air leaks.	Inspect and repair as necessary. Pressure test induction system. (Disconnect M.A.P. gauge before performing pressure test.)
	Leaks or restrictions at nozzle lines.	Check nozzle lines for loose fitting or B-nuts. Check for kinks in line and cracks at braze joints.



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TROUBLE-SHOOTING CHART (CONT.)

PROBLEM	PROBABLE CAUSE	REMEDY
Low Take-Off Fuel Flow. Lean Engine Operation (Continued).	Incorrect gage reading. (Accompanied by normal EGT.)	Ensure gage is calibrated for correct number and size of nozzles. (When using nozzle back pressure gauge for flow meter.)
		Ensure correct K factor is installed in turbine type flow meter computer.
High Take-Off Fuel Flow. Rich Engine.	Restricted nozzle. Accompanied by high fuel flow reading if pressure gauge type fuel flow gauge is used.	Remove and clean nozzles as per manufacturer's instructions.
	Incorrect full throttle fuel/air ratio. (Accompanied by low EGT.)	Return fuel control for repair.
	Incorrect gage reading. (Accompanied by normal EGT.)	Ensure gage is calibrated for correct number and size of nozzles. (When using nozzle back pressure gauge for flow meter.)
		Ensure correct K factor is installed into turbine type flow meter computer.
	Restricted air inlet.	Check for clogged air filter, collapsed or obstructed inlet duct.
Heated air inlet.	Pulling inlet air from inside the cowl area may result in rich operation and low power output due to low air density (heated air).	
Engine Will Not Accelerate Past a Given RPM properly.	Restricted nozzle if accompanied by high fuel flow reading on pressure type fuel flow gauge.	Remove and clean injector nozzles as per manufacturer's instructions.
	Improper internal engine timing or ignition problem.	Correct timing problem.
	Restricted exhaust system.	Refer to engine manufacturer for corrective action.
	Restricted intake manifold.	Ensure correct gaskets are used and are installed correctly on intake manifold.
	Incorrectly pitched propeller.	Ensure correct pitched propeller.



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TROUBLE-SHOOTING CHART (CONT.)

PROBLEM	PROBABLE CAUSE	REMEDY
Engine Will Not Accelerate Past a Given RPM properly.	Throttle control not rigged.	Ensure throttle on fuel control opens to wide open stop when throttle control is at full throttle. Rig per 2.6.
	Turbo system.	Differential pressure control, waste gate, or waste gate control malfunction.
	Turbo system.	Differential pressure control, waste gate, or waste gate control malfunction.
	Improper rigging of mixture control.	Adjust. ICO side of mixture control stop lever must be against plastic stop.
Poor Idle Cut-Off.	Vapor in nozzle lines.	Refer to Section 3.5 and 3.6.
	Scoring of mixture control valve. Note: 3 to 7 cc/min. leakage is normal for the mixture control in the ICO position. The purpose of the mixture valve is to shut the engine off in the ICO position, not to replace the aircraft fuel shut off valve.	Return fuel control for repair. Test for mixture control leakage as outlined in Section 6.4.
	Restricted nozzle air bleed.	Remove and clean nozzles as per manufacturer's instructions.
	Flow Divider stuck open.	Flow divider valve must move freely. Check for contamination and correct. Refer to manufacturer's instructions.
	Restriction on inlet side of fuel pump.	Check for clogged filters, restricted fittings or hoses, incorrect sized fuel supply lines.
Inlet Fuel Pressure Gauge Fluctuations.	Fuel boiling on inlet side of pump (vapor locking pump). This is common when using a vane type engine driven fuel pump with higher under cowl temperatures and low RPM.	Turn on boost pump before reducing power. Leave boost pump on during idle operation.



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TROUBLE-SHOOTING CHART (CONT.)

PROBLEM	PROBABLE CAUSE	REMEDY
Inlet Fuel Pressure Gauge Fluctuations (continued).	Air in fuel system.	Test per instructions in Section 6.3.
	No bleed or too large restrictor in gauge line.	Refer to airframe pressure gauge plumbing.
	Air in gauge line.	Purge air from line.
Engine Runs Rich and Rough Until Oil Temperature Reaches 130-140 Degrees.	The fuel injection system is not affected by oil temperature. Valve train problem, excessive oil pressure, malfunctioning hydraulic lifters, spalled lifters, incorrect valve lash.	Contact engine manufacturer.



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6.3. TESTING FOR AIR IN THE FUEL SYSTEM

WARNING

THE FOLLOWING PROCEDURE IS PERFORMED WITH THE ENGINE RUNNING. THE AIRCRAFT SHOULD BE IN AN AREA THAT IS SAFE FOR RUNNING AND SECURELY TIED DOWN. USE EXTREME CAUTION WHILE WORKING AROUND RUNNING ENGINES. BE AWARE OF YOUR POSITION RELATIVE TO THE PROPELLER. IF YOU ARE UNSURE OF YOUR ABILITY TO WORK AROUND RUNNING AIRCRAFT ENGINES, DON'T ATTEMPT THIS PROCEDURE, FIND SOMEONE WHO IS QUALIFIED TO PERFORM IT FOR YOU. HAVE A QUALIFIED PERSON IN THE COCKPIT DURING THE TEST. DO NOT ATTEMPT THIS ADJUSTMENT ALONE. DO NOT LEAVE THE COCKPIT OR ENGINE RUNNING UNATTENDED.

The following procedure can be used to determine if air is getting into the fuel supply. After determining if air bubbles are in the fuel, work backward through the fuel system, removing components one at a time until the cause is found.

- A. Clamp a 2 to 3 inch length of clear Teflon tube or equivalent between the two AN style fittings on the fuel control and the flow divider. Plastic hose must be capable of withstanding 15-20 PSI and be fuel resistant.
- B. Run the engine and watch for air bubbles. Bubbles may initially be observed at start up and at idle. Run the engine up to a mid-power setting. If bubbles are observed after 30 seconds or so then shut the engine down and proceed with step C. It is common to see some air in the metered fuel lines or nozzle lines after start up and during prolonged idle. The air should clear out when the engine is run up to full power.
- C. If air is observed during part and full throttle operation, proceed by disconnecting the fuel supply hose from the fuel control. Use a valve and pressure gauge to put back pressure on the system. Set the valve to give 15-20 PSI with the boost pump running. Flow the fuel into a suitable container and observe the fuel stream for air. Continue testing back through the fuel system, removing one component at a time until the air source is found. Primary sources are:
 1. Heat being transferred to flow divider.
 2. Fuel lines routed too close to exhaust system.
 3. Heat being transferred to fuel hoses under low flow conditions (idle power).
 4. Deteriorated main fuel (engine driven) pump seals.
 5. Airframe boost pump shaft seal leakage.
 6. Damaged cones and flares on fuel line fittings.



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7. Loose hose connections or fittings.
8. Flow restricting component on inlet side of fuel pump.
9. Restricted fuel tank vent.

NOTE

Fuel fittings and lines can leak air and not fuel if the line or hose is on the suction side of the fuel pump. If having the boost pump on improves operation, then a leaky fitting or hose is possible between the boost pump and the selector valve or boost pump and the engine driven pump. You will typically see fuel leakage when this area is pressurized.

6.4. MANUAL MIXTURE CONTROL LEAKAGE TEST

The following procedure will test for correct operation of the manual mixture control. The Manual Mixture Control on FM fuel control in the idle cut-off position will only reduce the fuel flow sufficiently to stop the engine. It is not a zero leak valve. It is not intended as a fuel shut off valve.

- A. Disconnect the hose that attaches to the flow divider (metered fuel hose). Leave the hose attached to the fuel control.
- B. Place the hose in a suitable container.
- C. Turn the boost pump on and put the mixture control to Full Rich. Open the throttle wide open.
- D. Observe the fuel flowing from the metered fuel hose; now close the throttle to idle. The fuel flow should decrease to a lower level. Ensure that all the air has been purged from the fuel control. There should be no air bubbles observed in the fuel stream.
- E. Put the manual mixture control in Idle Cut-Off (ICO).
- F. The fuel flow should decrease to a slow drip (3-7 cc's per minute).

If the fuel control does not perform as described in the above procedure, there is excessive leakage around the manual mixture control. Return the fuel control for repair.



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6.5. INTERMITTENT POWER LOSS

The most aggravating problem for a mechanic is trying to find the reason(s) for an intermittent power loss. Generally, this is not caused by the fuel control. Many times, it is caused by the interruption of either the fuel or air supply to the fuel control. This may be due to such things as air in the fuel supply, dropping fuel pressure or a restricted induction air duct.

NOTE

The words “power loss” here refer to engine stoppage and the subsequent ability to restart the engine and obtain full power.

6.6. POWER LOSS ACCOMPANIED BY HIGH FUEL FLOW

If a power loss is accompanied by high fuel flow (measured by pressure gauge type flow meter), check the injector nozzles, nozzle lines, and flow divider for indications of a contamination problem.

6.7. INTAKE SYSTEM

Check the intake system, especially double wall ducting, for integrity. Also insure correct air flow into the fuel control inlet.

6.8. AIR FILTER

Check air filter condition, particularly after operating in rain or wet conditions. Also test the alternate air door for proper operation.

6.9. FUEL FILTERS

Check the fuel filters for contamination such as water, salt, sand, fiberglass hairs, etc. Also ensure the filter housing is installed properly to eliminate any possibility of air entering the fuel supply.

6.10. FUEL HOSES

Check the fuel hoses for deterioration or a flap of rubber near the fitting ends.

6.11. IGNITION SYSTEM

Check ignition and ignition components. Many times, failure of these components symptomize a fuel system problem to the extent that leaning the mixture improves engine operation.

6.12. VALVE TRAIN

Check for valve train problems, loose valve guides, insufficient valve lash, stuck valves, tight valve guides.



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6.13. EXHAUST SYSTEM

Check exhaust system, muffler baffles, cracks, restrictions, deterioration.

6.14. OIL PRESSURE

Insure correct oil pressure especially during aerobatics and unusual attitudes. Loss of oil pressure can cause constant speed propeller operation to go to maximum pitch, causing the engine to lose RPM.

6.15. AIR IN THE FUEL SYSTEM

Check for air in the fuel system, especially if the power loss is associated with a particular aircraft attitude.

6.16. FUEL VENT PRESSURE

Check for fuel vent pressure if power loss is associated with an increase in air speed and or altitude.



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SECTION 7

FIELD MAINTENANCE

On occasion, it may be necessary to perform field maintenance on the fuel control. This maintenance does not include any internal parts of the fuel control.

NOTE:

Any field maintenance that is performed on the fuel control should only be completed by an appropriately rated mechanic or technician.

7.1. FIELD MAINTAINABLE COMPONENTS

Field maintenance may only be performed on the following parts:

- A. Inlet, Outlet Fitting and 90 Degree Restrictor Fitting – maintenance is limited to inspection of the fitting and replacement of the O-ring, and fitting.
- B. Inlet Filter & O-Ring – maintenance is limited to inspection and cleaning of the inlet screen and replacement of the O-ring and filter.
- C. Throttle/Mixture Levers – maintenance is limited to replacement of the levers due to damage or excessive wear.
- D. Idle Linkage Assembly – maintenance is limited to inspection and/or replacement for excessive wear.
- E. Hardware - maintenance is limited to replacement of screws, nuts and washers used to secure Throttle/Mixture Levers and Idle Linkage Assembly.

7.2. Any maintenance that needs to be performed that goes beyond what is discussed in this section, should be performed at an authorized Airflow Performance fuel control service center for overhaul and/or recalibration.

7.3 O-rings are to be replaced when fittings are removed from the fuel control.



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FIELD REPLACEABLE PARTS

Fig. 1 - Item No.	Part Number	Description	Qty
1	1090088	#6 INLET FILTER FITTING	1
2	1090092	MIXTURE CONTROL STOP	1
3	1090267	COMPOSITE INLET SCREEN	1
4	1090321	#4 OUTLET FITTING	1
5	1090325	#72 AN4 90 DEGREE RESTRICTOR FITTING ASSY.	1
6	1090326	.37 OD X .203 ID X .15 L SPACER	1
7	1250323	FM-250C IDLE LINK ASSY	1
7-a	1250317	.FM-250C IDLE LINK	1
7-b	HW-3101	.10-32 ROD END	1
7-c	HW-0901-SS	.10-32 JAM NUT SS	1
7-d	HW-3102	.10-32 LH ROD END	1
7-e	HW-0902-N	.10-32 LH JAM NUT N	1
8	3090128	FM-250C THROTTLE LEVER	1
9	3090129	FM-250C MIXTURE LEVER	1
10	AN310-5	5/16-24 CASTLE NUT	1
11	AN960-10L	#10 FLAT WASHER THIN	2
12	AN960-416L	#4 WASHER THIN	1
13	AN960-516L	5/16 WASHER THIN	1
14	HW-0102-SS	1/4-28 X 3/4 HEX BOLT SS	1
15	HW-0307-ND	10-24 X 3/4 SHCS ND	1
16	HW-0321-SS	10-32 X 1 SHCS SS	1
17	HW-0348-SS	10-32 X 1 1/8 SHCS SS	1
18	HW-1303-SS	LARGE AREA WASHER SS (.498 OD X .198 ID X .030)	2
19	HW-2901	CONICAL SPRING	1
20	HW-2904	SPRING	1
21	MS21042-4	JET NUT	1
22	MS21045-3	10-32 LOCK NUT	2
23	MS24665-153	1/16 X 3/4 COTTER PIN SS	1
24	OR-904.7	O-RING	3
25	OR-908.7	O-RING	1



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TORQUE VALUES

Fig. 1 - Item No.	Part Number	Description	Torque Setting in-lbs
1	1090088	#6 INLET FILTER FITTING	150-200
4	1090321	#4 OUTLET FITTING	120-130
5	1090325	#72 AN4 90 DEGREE RESTRICTOR FITTING ASSY.	95-120
7-c	HW-0901-SS	10-32 JAM NUT SS	10-20
7-e	HW-0902-N	10-32 LH JAM NUT N	10-20
10	AN310-5	5/16-24 CASTLE NUT	50-60
15	HW-0307-ND	10-24 X 3/4 SHCS ND	25-35
21	MS21042-4	JET NUT	45-55
22	MS21045-3	10-32 LOCK NUT	25-35



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SECTION 8

OVERHAUL PERIOD

The FM-250C fuel control is not field overhaulable. Except for the field maintenance and troubleshooting described in the previous sections, the fuel control and components must be returned to Airflow Performance or an authorized Airflow Performance fuel control service center for overhaul and/or recalibration.

8.1. TIME BETWEEN OVERHAUL

The time between overhaul (TBO) for this fuel control is the same as recommended by the engine manufacture, but not to exceed 2000 hours in service or 12 calendar years in service or shelf time. Time between overhaul is also dependent upon the type of service and the installation the fuel control is subjected to. An installation subjected to hard aerobatics or flight school activities may not complete the full TBO due to higher vibration levels that are encountered in this type of service.

NOTE:

Regardless of time in service, overhaul is recommended based on an accumulated calendar time of 12 years. This is from the date of manufacture or last overhaul date.

8.2. NON-SCHEDULED OVERHAUL

A complete overhaul is required regardless of accumulated time in use when the fuel control or fuel system component has been subjected to severe environment such as but not limited to:

- A. Engine fire, external or prolonged air intake manifold fire, accident, or when service history of the fuel control is unknown.
- B. Contaminated fuel such as water, sand, rust, etc.
- C. Fuel that does not meet the engine manufacturer's requirement may be detrimental to engine operation. If a non-specified fuel (jet fuel) is inadvertently pumped into the aircraft fuel system and drained, fuel control overhaul is not required. The fuel control should be flushed with the correct type of fuel to remove all contamination before being returned to service.
- D. If uncertain that the fuel control or components require service or overhaul, contact Airflow Performance for consultation.



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8.3. PREPARATION FOR SHIPMENT

CAUTION

FEDERAL REGULATIONS CONCERNING SHIPMENT OF FUEL UNITS REQUIRE THAT THE FUEL SECTION BE SEALED WITH CAPS CAPABLE OF KEEPING FUEL FROM LEAKING. DO NOT USE MASKING TAPE OR OTHER NON-APPROVED MATERIAL FOR THIS PURPOSE.

Install metal shipping caps with O-rings or AN style pressure caps to the fuel inlet and outlet.

Place the fuel control in a clean plastic bag to protect the air section from packaging materials. Do not use tape to cover the inlet and outlet of the throttle body. Do not use tape to cover the inlet and outlet fittings.

Place the sealed fuel control in a suitable container with sufficient packaging material to prevent damage during shipment.