Fuel System Installation, Operation & Maintenance Manual (Principal Manual)

Models LFR-NNSS5, LFR-NMLH10, LFR-NNLH10, LFR-NNLS10, LFR-NNSH10 & LFR-NNSM10 Servo Fuel Injectors with Air Bleed Injection Nozzles & Flow Divider

May 27, 2022

Part No. AFS-IOM-02

Fuel System Installation, Operation & Maintenance Manual

AVStar Part Number: AFS-IOM-02

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RECORD OF REVISIONS

Revision	Revision Date	Revised By	Revision Description
Original	5/27/2022	CES	Original Release of Manual - Part No. AFS-IOM-02

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SERVICE DOCUMENT LIST

NOTICE: The following is a list of service documents referenced in, incorporated into, or applicable to the information in this manual. Always refer to the latest revision of any service document (including any supplements) for changes or additional information.

Document Number	Subject
AVStar AFS-IOM-02	Fuel System Operation & Maintenance Manual (Principal Manual)
AVStar AFS-IPC-04	LFR-NNSS5 Illustrated Parts Catalog
AVStar AFS-IPC-05	LFR-NNSH10 Illustrated Parts Catalog
AVStar AFS-IPC-06	LFR-NMLH10, -NNLH10, -NNLS10 Illustrated Parts Catalog
AVStar AFS-IPC-07	LFR-NNSM10 Illustrated Parts Catalog
AVStar AFS-IPC-08	Air Bleed Nozzles Illustrated Parts Catalog
AVStar AFS-IPC-09	Fuel Flow Divider Illustrated Parts Catalog
FSM LFR-NNSS5	AVStar LFR-NNSS5 Overhaul Manual
FSM LFR-NNSH10	AVStar LFR-NNSH10 Overhaul Manual
FSM LFR-L10	AVStar LFR-NMLH10, -NNLH10, -NNLS10 Overhaul Manual
FSM LFR-NNSM10	AVStar LFR-NNSM10 Overhaul Manual
FSM ABN	AVStar Air Bleed Nozzles Overhaul Manual
FSM FD	AVStar Fuel Flow Divider Overhaul Manual
AVStar AFS-SB6	Fracture of a Fuel Diaphragm stud in Fuel Servos
AVStar AFS-SB9	Adjustment of Servo Regulators fitted with AVStar Diaphragms
AVStar AFS-SB10	Fuel Servos Installed in an Updraft Configuration
AVStar AFS-SB12	Service Limits for AVStar Fuel Servos
AVStar AFS-SB13	Flow Divider – Manufacturing Defect
AVStar AFS-SIL-01	AV2581500 Servo Installed on Lycoming IO-390 Engines
AVStar AFS-SIL-02	Servo – Fuel Inlet Strainer
Lycoming S.B. 342	Fuel Line & Support Clamp Inspection & Installation
Lycoming S.B. 398	Recommended Corrective Action for Use of Incorrect Fuel
Lycoming S.I. 1009	Overhaul, Recommended Time Between (TBO)
Lycoming S.I 1070	Specified Fuels for Spark Ignited Gasoline Aircraft Engine Models
Lycoming S.I 1079	Filters, Fuel Line Servo, Periodic Maintenance
Lycoming S.I 1080	Maintenance Items for Special Attention
Lycoming S.I. 1132	Magneto Drop-Off
Lycoming S.I. 1301	Primer and Fuel Injector Lines, Identification
Lycoming S.I. 1427	Engine Break-In and Oil Consumption Test Limits
Lycoming S.I. 1484	Carburetor or Fuel Injector Servo Unit Hold Down Nuts, Installation Torque for Fuel Metering Device
Lycoming S.I. 1498	Recommended Engine Procedures for Purging Vapor
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Document Number	Subject
Lycoming S.I. 1530	Engine Inspection in Particulate-Laden Environments
Lycoming S.I. 1532	Approved Fuel Injectors, Fuel Manifold Assemblies, and Fuel Nozzle Assemblies for Lycoming Engines
Lycoming S.I. 1566	Lycoming Approves the Use of Safety Cable
Lycoming S.L. L114	Engine and Accessory Maintenance Publications
Lycoming S.L. L247	Shelf Life Requirements
Lycoming S.L. L253	Warranty repair of AVStar Fuel System
Lycoming S.L. L279	Lycoming Model Designation for Fuel Injectors
Lycoming SSP-110	Certificated Aircraft Engines
Lycoming SSP-112	Service Bulletins Letters and Instructions Index
Lycoming SSP-475	Reciprocating Engine Trouble Shooting Guide
Lycoming SSP-1776	Service Table of Limits and Torque Value Recommendations

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LIST OF TABLES

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ABBREVIATIONS AND ACRONYMS

C	
CHT	Cylinder Head Temperature
F	
FAA	Federal Aviation Administration
FAR	Federal Aviation (and Space) Regulation
FOD	Foreign Object Debris
G	
GAMA	General Aviation Manufacturers Association
I	
ICAs	Instructions for Continued Airworthiness
in-lbs.	Inch Pounds (torque)
IOM	Installation, Operation and Maintenance Manual
IPC	Illustrated Parts Catalog
L	
lb.	Pound
M	
MEK	Methyl-Ethyl-Ketone
O	
OM	AFS-OM: AVStar Overhaul Manual
P	
P/N	Part Number
psi	Pounds per square inch
S	
SB	Service Bulletin
SI	Service Instruction
SL	Service Letter
T	
TBO	Time Between Overhaul

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INTRODUCTION

The AVStar Product Line consists of Models LFR-NNSS5, NNSH10, NMLH10, NNLH10, NNLS10, & NNSM10 as well as applicable Flow Divider (manifolds) and Air Bleed Nozzles. All applicable servo fuel injectors listed fall within the model designations identified in Lycoming Service Letter L279, with the designations noted below for reference.

Prefix	LFR=	**L**ycoming **F**uel Servo with In-Line **R**egulator
Fuel Management	N=	**N**on-Automatic Mixture
Enrichment Type	N=	**N**on-Enrichment
	M=	**M**echanical Enrichment w/Two Hole Jet
Airflow Management	S=	**S**mall Regulator
	L=	**L**arge Regulator
Unique Configuration	S=	**S**tandard Configuration (Flanged)
	H=	**H**ose Interface
	M=	**M**irror Image Body
Bore Size	5, 10 – size designation	

Refer to the latest Revision of Lycoming Service Instruction S.I. 1532 for a cross reference of applicable engines and Lycoming Service Letter S.L. L114 for the applicable Engine Parts Catalog, as well as any applicable data provided by the Airframer.

The AVStar fuel injection system is based on the principle of measuring air flow using the air flow signal in a stem type regulator to convert the air force into a fuel force. This fuel force when applied across the fuel metering section makes fuel flow proportional to air flow. This is accomplished through the use of a venturi which uses the impact pressure and throat pressure to generate a differential pressure across the venturi. Each of these two signals is directed to opposite sides of the air diaphragm within the servo regulator. This differential pressure generates a force which moves the air diaphragm. The fuel diaphragm works to oppose this air diaphragm force. The unmetered fuel pressure (inlet fuel pressure) and metered fuel pressure (pressure after the main metering jet) creates a differential pressure force across the fuel diaphragm. When these two forces become balanced, the output fuel flow of the servo remains stable and steady. Fuel flow increases or decreases when the differential pressure across the venturi changes in response to throttle movements.

In most installations the flow divider is fed with metered fuel from the fuel injection servo - fuel is then supplied to each nozzle. The flow divider ensures that equal amounts of fuel are fed to the nozzles at engine idle. The flow divider maintains fuel pressure, and this guarantees positive fuel shutoff when the servo is switched to idle cutoff. After entering the flow divider, fuel flows through the central bore of the flow divider spool valve to the diaphragm's lower side. At idle, fuel pressure from the servo, acting on the lower side of the diaphragm, generates a force to overcome the flow divider spring. This lifts the spool permitting fuel to flow through the precisely machined outlet ports in the valve bushing. Fuel then flows directly to the nozzles. The fuel injection servo sends a fixed amount of fuel to the flow divider in response to airflow through the servo; hence, the valve opens only far enough to allow that amount of fuel to the nozzles. At idle, the spool valve opens only very slightly and the discharge pressure from the flow divider is negligible. Therefore, the fuel to

individual cylinders at idle is divided by the flow divider. When fuel flow increases in response to engine demand, fuel pressure rises in the nozzle lines, and the flow divider valve is fully open. At this point, fuel distribution to the cylinders becomes a function of the pressure drop in each fuel line.

The air bleed nozzles incorporate a calibrated jet to discharge the fuel into an air chamber at ambient pressure. The jet size is determined by the maximum fuel flow requirement of the engine and the upstream fuel supply pressure. Nozzles are individually calibrated so that all nozzles flow the same as all others with the same part number. They can therefore be interchanged between applicable cylinders and engines as required. After discharge from the nozzle, fuel is drawn into individual intake valve ports and then into the engine cylinder. Fuel pressure upstream of a nozzle is in direct proportion to fuel flow. Therefore, a simple pressure gauge calibrated in gallons per hour (gph) can be used as a flow meter. On most turbocharged engines the nozzle fuel air chamber is vented to the top deck of the main throttle body (above the throttle) due to the fact that the turbocharger outlet pressure is always greater than manifold pressure. It is thus necessary to vent nozzles on turbocharged engines to a common air pressure greater than manifold pressure. If this is not done, the manifold pressure (which is above ambient) will blow the fuel in the nozzle air chamber through the vent and into the engine nacelle.

The table on the following page identifies the applicable Part Numbers covered by this manual.

Table 1 - Part Number Applicability			
APPLICABLE P/N	APPLICABLE MODEL	APPLICABLE IPC	APPLICABLE OVERHAUL MANUAL
AV2524054-11	LFR-NNSS5	AFS-IPC-04	FSM LFR-NNSS5
AV2524171-11			
AV2524213-11			
AV2524291-11			
AV2524335-10			
AV2524450-9			
AV2524590-8			
AV2524592-8			
AV2524752-7			
AV2524939-2			
AV2524979-1			
AV2576524-2			
AV2576536-2			
AV2576544-3			
AV2576558-1			
AV2576568-1			
AV2576586-1			
AV2576592-2			
AV2576608-1			
AV2581000			
AV2581100			
AV2581600			
AV2581700			
AV2524318-10	LFR-NNSH10	AFS-IPC-05	FSM LFR-NNSH10
AV2576630-4			
AV2524500-9	LFR-NMLH10	AFS-IPC-06	FSM LFR-L10
AV2524273-12	LFR-NNLH10		
AV2524556-9			
AV2524422-9	LFR-NNLS10		
AV2549038-4			
AV2576546-3			
AV2576554-3			
AV2576562-4			
AV2576642-1			
AV2581800			
AV2581500	LFR-NNSM10	AFS-IPC-07	FSM LFR-NNSM10
AV2582100			
AV2524864-2	AIR BLEED NOZZLES	AFS-IPC-08	FSM ABN
AV2524917-1			
AV2524923-1			
AV2524926-1			
AV2524232-2	FLOW DIVIDER	AFS-IPC-09	FSM FD
AV2576526-1			
AV2576564-1			
AV2576624-1			

Servo Fuel Injector & Flow Divider Serial Number

Every fuel injector and flow divider sent from the factory (new or overhaul) is identified by a unique serial number. The serial number is identified on the data plate. Refer to Appendix A for data plate locations. The data plate is only to be removed during overhaul. Any field modifications made would only indicate compliance with applicable Service Bulletins or Instructions.

Scope of this Manual

This manual provides instructions (in compliance with FAR 33.4) for maintenance of AVStar servo fuel injectors, flow dividers and nozzles. The information includes airworthiness limitations, fault isolation guidelines and procedures for component replacement, removal, and installation. Refer to the applicable ***AFS-IPC Illustrated Parts Catalog*** to identify spare parts.

Compliance Requirements

⚠WARNING: FOR CORRECT FUEL SYSTEM MAINTENANCE, COMPLETE THE NECESSARY MAINTENANCE PROCEDURES IN THIS MANUAL AND APPLICABLE SERVICE DOCUMENTS. AVSTAR FUEL SYSTEMS SERVICE DOCUMENTS WRITTEN AT A LATER DATE OVERRIDE PROCEDURES IN THIS MANUAL UNLESS OTHERWISE SPECIFIED.

PROCEDURES IN THIS MANUAL MUST BE PERFORMED BY QUALIFIED PERSONNEL WITH THE REQUISITE CERTIFICATIONS.

Before you perform maintenance on any of the applicable fuel systems, read this manual in its entirety. Obey all procedures and inspections in this manual.

NOTICE: If you do not comply with the maintenance procedures in this manual for the fuel system, you can void the warranty. Please consult your warranty for a full statement of your rights, limitations, and obligations that exist thereunder.

This manual provides fuel system description, preservation and storage, depreservation, installation requirements, installation, operation, fuels to be used, and operating specifications. This manual also provides universal required maintenance for all fuel systems applicable, routine time-interval inspections, routine service, and scheduled servicing procedures.

Refer to any of the latest revisions of the applicable AVStar ***Service Document List*** for additional service instructions, as well as any service documents issued by AVStar showing a date after the issue date or current revision date of this manual.

Refer to the latest revision of the applicable ***AFS-IPC Illustrated Parts Catalog*** for torque values.

⚠WARNING: OPERATE THIS FUEL SYSTEM IN ACCORDANCE WITH SPECIFICATIONS IN APPENDIX A OF THIS MANUAL. OPERATION OUTSIDE OF THE SPECIFIED OPERATING LIMITS CAN CAUSE PERSONAL INJURY AND/OR DAMAGE TO THE ENGINE.

Environmental Compliance

AVStar Fuel Systems recommends that owners and service personnel be in compliance with all federal, state, and local environmental regulations when solvents, fuel, oil, chemicals, or other consumables are used in service.

Warnings, Cautions, and Notices

Be sure to read and comply with the Warnings, Cautions, and Notices in this manual and all service documents. Although AVStar cannot predict all possible hazards or damages, it makes a reasonable effort to supply the best known guidance and recommended practices for safe operation and maintenance of its fuel systems.

The table below defines the four types of safety advisory messages used in this manual as per the American National Standard and ANSI Z535-6-2006.

Safety Advisory Conventions	
Advisory Word	**Definition**
DANGER:	Indicates a hazardous situation which, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations.
⚠ **WARNING:**	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
⚠ **CAUTION:**	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury. It also can be used without the safety alert symbol as an alternative to **"NOTICE."**
NOTICE:	The preferred signal word to address practices not related to personal injury.

NOTICE: In this manual, the word "recommend" refers to "best practices."

Service Bulletins & Manuals

As advancements in technological applications on this fuel system continue, AVStar will make future revisions to this manual. However, if more timely distribution is necessary, AVStar posts all pertinent documents to our website under 'Product Support'. Here you can find all active Service Bulletins (AFS-SB), Installation Operation & Maintenance Manuals (AFS-IOM), Illustrated Parts Catalogs (AFS-IPC), and instructions for acquiring Overhaul Manuals (AFS-OM).

Applicable information noted in the Service Document List from Lycoming Engines' should be obtained directly from Lycoming to ensure the latest revision is consulted. Any information related to the fuel system within the aircraft engine and/or airframe manuals would override the data provided with this and any other document AVStar has provided. If contradictions or discrepancies are observed, please contact AVStar directly so those details may be validated and revised as required.

Reminder: Unless otherwise specified, AVStar service documents (which have a later date than this manual) override procedures in this manual.

For reference, the Service Document List at the front of this manual shows the editions of the service documents referenced or included in this manual as well as applicable service documents from Lycoming Engines.

List of Publications

Refer to AVStar's website for a complete list of publications available.

Warranty & Liability Information

The warranty coverage on AVStar products is described in detail in the following documents. Refer to the AVStar website for the latest revision:

Certified New Fuel Systems	AFS900-F28, latest revision
Overhauled Fuel Systems	AFS900-F31, latest revision

Dismantling a fuel system or using unauthorized parts in any AVStar product voids all warranties. AVStar will not accept liability for units that contain unauthorized parts irrespective of the theory upon which any claim might be based including, but not limited to, breach of contract, warranty, negligence, or strict liability in tort. The customer specifically agrees that the party or parties responsible for installation and/or use of unauthorized parts shall bear sole and exclusive liability for all property damage or injury, including death, resulting from any malfunction of the unit in which unauthorized parts are installed. Use of grade fuels not authorized by Lycoming S.I. 1070 also voids all warranties.

Instructions for Continued Airworthiness (ICA)

This manual, together with the applicable latest revisions of the ***Illustrated Parts Catalog (IPC)*** and ***Overhaul Manual (OM)***, service documents, and related publications make up the complete set of Instructions for Continued Airworthiness (ICAs). The ICAs are prepared by AVStar Fuel Systems and are accepted by the Federal Aviation Administration (FAA).

Simplified Technical English

The text in the manual is written in the form of Simplified Technical English in compliance with FAA requirements and to make translation into other languages easier.

Format

Chapters in this manual are identified in General Aviation Manufacturers Association (GAMA) Specification format.

Figures

Figures in this manual are for illustration purposes only. Figures always start as Figure 1 in each chapter.

Copyright

Feedback

To supply comments, suggestions, or corrections to this manual, either make a call to customer service or use the AVStar website http://www.avstardirect.com/contact-us/

Customer Service

Additionally, AVStar has Customer Service to supply information and assistance to owners, operators, and maintenance personnel servicing AVStar Fuel Systems.

Phone:

Factory:	U.S. and Canada toll free - +1(866) 982-7287
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AVStar's regular business hours are Monday through Friday from 8:00 A.M. through 5:00 P.M. Eastern Time (-5 GMT)

Change of Address Notification

The owner of the manual is responsible for supplying a change of address to AVStar Fuel Systems.

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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.

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05-00 - MAINTENANCE - GENERAL

1. General

   A. For continued airworthiness, this manual includes AVStar's recommended service information for routine time-interval inspections, routine maintenance, maintenance for unusual conditions, scheduled and unscheduled servicing procedures, and guidelines for fault isolation.

   B. Fuel System features, descriptions and specifications can be found in Appendix A of this manual.

   C. List of Tools for maintenance. This list only includes maintenance and inspection procedures covered under this manual. Tools used for any other Major Repairs and for Overhaul can be found in the applicable overhaul manuals.

2. Fuel Systems can be purchased new directly from AVStar or its authorized distributors.

   A. All maintenance (overhaul, repair, inspection, replacement of parts, or preservation) identified in this manual and within the Service Document List requires persons to be fully trained, qualified, and authorized to approve for return to service.

3. Time Between Overhaul (TBO)

   NOTICE: The fuel system could require an overhaul or replacement before TBO.

   A. The TBO for all AVStar Servo Fuel Injectors, Flow Dividers, and Air Bleed Injection Nozzles carrying valid return to service documentation is the same as the TBO identified by the manufacturer of the engine for which it is specified.

   B. Alternatively, overhaul must be performed 12 years after ***first*** placed into service. Any applicable repairs do not serve as an extension of service life.

   C. Under circumstances where the servo fuel injector has been subjected to unusual or atypical environmental conditions, such as, but not limited to, water, fire, particulate contamination or unspecified fuel or liquid, then an immediate overhaul is required before returning to service.

   D. For AVStar fuel systems used on Lycoming Engines, refer to the latest revision of Lycoming Service Instruction S.I. 1009.

4. Safety Precautions

⚠WARNING: TURN OFF THE IGNITION SWITCH AND DISABLE ALL POWER TO THE ENGINE TO PREVENT ACCIDENTAL ENGINE START-UP WHILE WORKING ON THE FUEL SYSTEM. FAILURE TO DISABLE POWER COULD CAUSE ACCIDENTAL ENGINE START-UP, INJURY, OR DEATH. IF IT IS NECESSARY TO COMPLETE OPERATIONAL TESTS WITH THE POWER ON, KEEP ALL PERSONNEL AWAY FROM THE ROTATIONAL RADIUS OF THE PROPELLER TO PREVENT INJURY OR DEATH ON ENGINE START-UP.

⚠WARNING: DO NOT SMOKE OR HAVE AN OPEN FLAME OR ANY DEVICE THAT CAN MAKE SPARKS. SMOKING, FLAMES, OR SPARKS CAN CAUSE FUEL, OR OTHER FLAMMABLE FLUIDS, IGNITION WHICH CAN CAUSE SERIOUS BURNS, INJURY OR DEATH.

5. Maintenance Practices

   A. Obey all safety precautions

   B. DO NOT reuse any gasket. You must install a new gasket.

   C. It is considered best practice to replace any o-ring which has been removed.

   D. Be advised the opening of any fuel system voids all applicable AVStar warranties. AVStar cannot restrict certified repairman from performing any repairs, assuming the latest revisions of the proper manuals are followed.

   E. Remove all traces of dirt, dust, debris and accumulated matter from parts. All parts must be clean before they are installed.

   F. Prior to installing any part, a sound visual inspection should be made for burrs, damage, etc.

   G. AVStar recommends only using AVStar Fuel Systems replacement parts. Use of parts not authorized by AVStar voids all applicable warranties.

   H. If adhesive tape has been applied to any part, remove the tape and clean the part completely. Remove all tape and residue.

   I. If it is necessary to use a hammer, use only a plastic, rubber or rawhide hammer.

   J. Hardware

      (1) All lockwire and cotter pins must be made of corrosion-resistant steel and installed as a snug fit in holes in shafts and bolts/screws for correct locking.

      (2) The cotter pin head must install as a snug fit into the castellation of the nut where applicable. Unless otherwise specified, bend one end of the cotter pin back over the bolt, screw or shaft and the other end flat against the nut. Refer to AS567 for additional details.

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05-10 – TIME LIMITS

1. General

   A. Fuel System maintenance inspections are based on time intervals as shown in the Inspection Schedule. All inspections must be completed no later than 10 hours after the specified time interval for the inspection.

2. Fuel System Inspection Schedule

   A. The Inspection Schedule shows the inspections that must be done for fuel systems in this manual. The scope of inspections includes visual observations during engine servicing or maintenance as well as inspections based on progressive time intervals after the fuel system is put into service. Inspections start from 10 hours and go to 25, 50, and 100 hour/annual inspections.

FUEL SYSTEM INSPECTION SCHEDULE	
When to Perform	**Reference**
During engine servicing or maintenance	"Visual Inspection" in Chapter 05-20
As Instructed by applicable Service Document	Latest Revision of any applicable Service Bulletin or Document
Initial 10-hour inspection (for new, overhauled, or repaired Fuel System)	"10-Hour Initial Inspection" in Chapter 05-20
After 25 hours of initial operation of new, overhauled, or repaired Fuel System **OR** **First 6 months** since the fuel system was placed back into service (whichever occurs first)	"25-Hour Initial Inspection" in Chapter 05-20
25 hours after 25-hour Initial Operation Inspection **OR** After every 50 hours of operation or every 4 months (whichever occurs first)	"50-Hour Inspection" in Chapter 05-20
After every 100 hours of operation or annually*	"100-Hour Inspection" in Chapter 05-20
Time Between Overhaul (TBO)	Refer to the latest revision of Lycoming Service Instruction S.I. 1009 for any change to the recommended TBO
*More frequent inspections could be necessary for engines operated in particulate-laden or extremely humid, cold, or damp environments.	
NOTICE: An engine operational ground check must be completed prior to and after each inspection, after maintenance, and after fuel system overhaul. Refer to the applicable Engine Manual for these instructions.	

NOTICE: Inspections in this manual apply to the fuel system and not the engine or aircraft. Refer to the applicable manufacturer's maintenance manual for inspection information on all other components.

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05-20 – SCHEDULED MAINTENANCE CHECKS

NOTICE: Inspection checklists and instructions in this chapter are recommended and are a supplement to any additional maintenance guidelines from the engine and airframe manufacturer or component manufacturers that have a Supplemental Type Certificate (STC).

NOTICE: Do not exceed inspection intervals by more than 10 hours. Refer to FAR-91-409 for additional requirements.

1. Visual Inspection

   A. Complete the visual inspection, usually with the fuel system installed on the engine, before each routine 50 and 100-hour inspection and every time you service or do maintenance on the engine.

⚠ WARNING: BEFORE ANY MAINTENANCE INSPECTION IN THE AREA OF THE PROPELLER RADIUS, MAKE SURE THE IGNITION SWITCH IS SET TO OFF AND THAT ALL POWER TO THE ENGINE IS DISCONNECTED. DO NOT STAND (OR ALLOW ANYONE ELSE TO STAND) CLOSE TO THE ARC OF THE PROPELLER BLADE. IF POWER IS ON A LOOSE OR BROKEN WIRE CAN CAUSE THE ENGINE TO START AND THE PROPELLER TO ROTATE WHICH CAN LEAD TO DEATH OR SERIOUS INJURY.

   B. Required tools:

   - Basic aviation mechanic's tools
   - Flashlight
   - Mirror

   C. Complete the visual inspection as follows:

   (1) Set all ignition and electrical switches to the OFF position.

   (2) Remove the engine cowling from the aircraft for access to the engine and its compartment.

   (3) Look for unwanted dirt, dust, volcanic ash, sand, or particles on the exterior of the fuel system. If particulate contamination is suspected to have entered the air intake of the fuel injector, further removal and repair or overhaul is recommended.

   (4) Carefully examine the exterior of the fuel injector for any signs of a fuel leak. Refer to Appendix A for potential leak locations (identified as 'Leak Inspection Point'). If any leaks are found complete the necessary repairs to make sure the fuel injector is operating correctly.

   (5) Examine any fuel hose connection to any fuel injector fitting for secure attachment, signs of leaks, or wear. Also examine all fuel line connections to the flow divider fittings and nozzles where applicable.

   (6) While unlikely, examine the exterior of the fuel injector for cracks and any surface damage.

   NOTICE: If you find any cracks contact AVStar immediately.

(7) Inspect all lockwiring and cotter pins where used and verify they are attached correctly and tightly.

(8) Make sure that the induction system is in satisfactory condition.

(9) In accordance with the airframe manufacturer's instructions, examine the induction air filter for cleanliness, security, and indications of damage. Replace the air filter if it has holes or is torn in accordance with the aircraft manufacturer's instructions.

NOTICE: After it has been operated in dusty conditions, clean the induction filter. For servicing procedures refer to the airframe manufacturer's instructions.

(10) Examine all engine controls for general condition, full travel, and freedom of operation in accordance with the airframe manufacturer's instructions. Examine both throttle and mixture control connections for proper hardware and tightness in accordance with the airframe manufacturer's instructions.

(11) Examine and ensure the throttle and mixture control travels provide complete "stop to stop" travel, from full throttle to idle and Full Rich to Idle Cut-Off. Ensure the plastic stops on the applicable throttle and mixture stop locations are intact.

(12) Before flight, make sure that all leaks and problems have been corrected or repaired.

(13) Complete all other required inspections in accordance with the Engine or Airframe manufacturer's instructions prior to installing the cowling on the aircraft.

2. 10-Hour Initial Fuel System Inspection

   A. Complete this inspection after the first 10 hours of initial operation on the engine.

   B. Complete the 10-Hour Initial Fuel System Inspection Checklist for this inspection.

⚠WARNING: BEFORE THIS INSPECTION, MAKE SURE THAT THE IGNITION SWITCH IS OFF AND THAT POWER TO THE ENGINE IS DISCONNECTED. AS A PRECAUTION, DO NOT STAND OR ALLOW ANYONE TO STAND WITHIN THE ROTATIONAL ARC RADIUS OF THE PROPELLER.

NOTICE: Copy the blank checklist and complete this checklist as a record of engine maintenance. Put the completed checklist in the engine logbook.

10-HOUR INITIAL FUEL SYSTEM INSPECTION CHECKLIST			
Engine Model Number: _____		**Engine Serial Number: _____**	
Date Inspection Performed: _____		**Fuel Injector Part Number: _____**	
Inspection Performed By: _____		**Fuel Injector Serial Number: _____**	
Inspection Item	**Comments**	**Results / Notes**	**Done**
Complete the Visual Inspection.	Refer to the section "Visual Inspection" in this Chapter.		
General			
Correct any discrepancies found before returning to service.			
Obey all applicable Airworthiness Directives and Service Bulletins.			
Record all findings and corrective action in the engine logbook.			
⚠WARNING:	CORRECT ALL LEAKS. IF FUEL LEAKS ARE NOT CORRECTED BEFORE FLIGHT, THE ENGINE CAN HAVE LOSS OF POWER OR ENGINE FAILURE CAN OCCUR.		

3. 25-Hour Initial Fuel System Inspection

   A. Complete this inspection after ***25 hours*** of initial operation on the engine ***OR*** after the ***first 6 months*** since the fuel system was placed back into service, whichever occurs first.

   B. Complete the 25-Hour Initial Fuel System Inspection Checklist for this inspection.

⚠ WARNING: BEFORE THIS INSPECTION, MAKE SURE THAT THE IGNITION SWITCH IS OFF AND THAT POWER TO THE ENGINE IS DISCONNECTED. AS A PRECAUTION, DO NOT STAND OR ALLOW ANYONE TO STAND WITHIN THE ROTATIONAL ARC RADIUS OF THE PROPELLER.

NOTICE: Copy the blank checklist and complete this checklist as a record of engine maintenance. Put the completed checklist in the engine logbook.

25-HOUR INITIAL FUEL SYSTEM INSPECTION CHECKLIST			
Engine Model Number: _____		**Engine Serial Number: _____**	
Date Inspection Performed: _____		**Fuel Injector Part Number: _____**	
Inspection Performed By: _____		**Fuel Injector Serial Number: _____**	
Inspection Item	**Comments**	**Results / Notes**	**Done**
Complete the Visual Inspection.	Refer to the section "Visual Inspection" in this Chapter.		
Clean fuel strainer. Refer to Chapter 05-30.	If any FOD identified in strainer find and correct source.		
Check fuel injector air intake ducts for leaks, security, obstructions, and filter damage.	Evidence of dust or other solid material in the ducts is indicative of inadequate filter care or damaged filter.		
General			
Correct any discrepancies found before returning to service.			
Obey all applicable Airworthiness Directives and Service Bulletins.			
Record all findings and corrective action in the engine logbook.			
⚠ WARNING:	CORRECT ALL LEAKS. IF FUEL LEAKS ARE NOT CORRECTED BEFORE FLIGHT, THE ENGINE CAN HAVE LOSS OF POWER OR ENGINE FAILURE CAN OCCUR.		

4. 50-Hour Fuel System Inspection

   A. Complete this inspection ***25 hours after*** the 25-Hour Initial Fuel System Inspection ***OR*** after ***every 50 hours of operation or every 4 months***, whichever occurs first.

   B. Complete the 50-Hour Fuel System Inspection Checklist for this inspection.

⚠WARNING: BEFORE THIS INSPECTION, MAKE SURE THAT THE IGNITION SWITCH IS OFF AND THAT POWER TO THE ENGINE IS DISCONNECTED. AS A PRECAUTION, DO NOT STAND OR ALLOW ANYONE TO STAND WITHIN THE ROTATIONAL ARC RADIUS OF THE PROPELLER.

NOTICE: Copy the blank checklist and complete this checklist as a record of engine maintenance. Put the completed checklist in the engine logbook.

50-HOUR FUEL SYSTEM INSPECTION CHECKLIST			
Engine Model Number: _____		**Engine Serial Number: _____**	
Date Inspection Performed: _____		**Fuel Injector Part Number: _____**	
Inspection Performed By: _____		**Fuel Injector Serial Number: _____**	
Inspection Item	**Comments**	**Results / Notes**	**Done**
Complete the Visual Inspection.	Refer to the section "Visual Inspection" in this Chapter.		
Clean fuel strainer. Refer to Chapter 05-30.	If any FOD identified in strainer find and correct source.		
Place one drop of engine oil on the end of the throttle shaft where it meets the shaft bushings.	See Appendix A for location		
Place one drop of engine oil at each clevis pin connecting the idle mixture linkage. Check for loose connections and excessive movement.	See Appendix A for locations. See also 72-00, Paragraph I		
If required lubricate all other linkage/attachment points as directed by the airframe manufacturer	Refer to the applicable Airframe maintenance manual		
Check fuel injector air intake ducts for leaks, security, obstructions, and filter damage.	Evidence of dust or other solid material in the ducts is indicative of inadequate filter care or damaged filter.		
General			
Correct any discrepancies found before returning to service.			
Obey all applicable Airworthiness Directives and Service Bulletins.			
Record all findings and corrective action in the engine logbook.			
⚠WARNING:	CORRECT ALL LEAKS. IF FUEL LEAKS ARE NOT CORRECTED BEFORE FLIGHT, THE ENGINE CAN HAVE LOSS OF POWER OR ENGINE FAILURE CAN OCCUR.		

5. 100-Hour Fuel System Inspection

   A. Complete this inspection ***every 100 hours or during each annual aircraft inspection*** (whichever occurs first).

   B. Complete the 100-Hour Fuel System Inspection Checklist for this inspection.

⚠ WARNING: BEFORE THIS INSPECTION, MAKE SURE THAT THE IGNITION SWITCH IS OFF AND THAT POWER TO THE ENGINE IS DISCONNECTED. AS A PRECAUTION, DO NOT STAND OR ALLOW ANYONE TO STAND WITHIN THE ROTATIONAL ARC RADIUS OF THE PROPELLER.

NOTICE: Copy the blank checklist and complete this checklist as a record of engine maintenance. Put the completed checklist in the engine logbook.

100-HOUR FUEL SYSTEM INSPECTION CHECKLIST

Engine Model Number: _____ **Engine Serial Number: _____**

Date Inspection Performed: _____ **Fuel Injector Part Number: _____**

Inspection Performed By: _____ **Fuel Injector Serial Number: _____**

Inspection Item	Comments	Results / Notes	Done
Complete the Visual Inspection.	Refer to the section "Visual Inspection" in this Chapter.		
Complete the 50-Hour Fuel System Inspection	Refer to the "50-Hour Fuel System Inspection Checklist" in this Chapter		
Injection Nozzle Cleaning	Refer to Chapter 05-30 "Injection Nozzle Cleaning"		
Check Injection Nozzles for looseness. Tighten to 60 in-lbs torque. Check fuel line for dye stains at connections (indicating leakage) and security of lines.	Refer to the applicable Engine and/or Airframe maintenance manual(s) for proper fuel line attachment. Refer to Chapter 73-10 "Injection Nozzle Installation"		
Check that the fuel injector is securely mounted with a tight connection to the engine and applicable induction system. Verify no gaps are present at applicable gaskets.	Refer to the applicable Engine and/or Airframe maintenance manual(s) for proper mounting torque values. If found unsecure or with gaps, replace gasket(s) and applicable hardware as required.		
General			
Correct any discrepancies found before returning to service.			
Obey all applicable Airworthiness Directives and Service Bulletins.			
Record all findings and corrective action in the engine logbook.			
⚠ WARNING:	CORRECT ALL LEAKS. IF FUEL LEAKS ARE NOT CORRECTED BEFORE FLIGHT, THE ENGINE CAN HAVE LOSS OF POWER OR ENGINE FAILURE CAN OCCUR.		

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05-30 – CLEANING

1. Cleaning Guidelines

   A. Refer to **05-20** for Visual Inspection Checks

   B. After the Visual Inspection, should cleaning be required the following guidelines should be followed:

      (1) Cleaning of fuel system parts should only be undertaken using solvents that conform to Federal Specifications including P-D-680, Acetone or MEK available commercially from a number of sources. Great care must be taken to ensure parts do not move and damage each other during the cleaning process. Immerse parts in solvent for approximately 10 minutes and dry all parts thoroughly with compressed air at a pressure no greater than 30 psi.

      (2) Metal parts that require further cleaning can be immersed in carbon remover that conforms to MIL-C-5546. Immerse parts at a temperature of 135-145°F for a period or 30 minutes. Remove parts and rinse thoroughly with water heated to a temperature of 160-180°F. Dry parts with compressed air at a pressure no greater than 30 psi.

      NOTICE: Non-metallic parts should never be cleaned using the cleaning fluids.

      NOTICE: Disassembly of the fuel system or any modification made by a party other than AVStar Fuel Systems or one of its approved Service Centers voids all applicable warranties. Refer to the AVStar website for a list of all currently authorized Service Centers.

      (3) By design, fuel system components have many small orifices and passages. The flow characteristics of these features are carefully created during manufacture and are critical to satisfactory performance. Even small changes in size or surface finish can be detrimental. Wire, cutting tools or abrasives of any kind should never be used in the cleaning of these parts.

      (4) Visual confirmation that small passageways are cleaned satisfactorily is difficult without the use of magnifying inspection equipment such as a bore scope.

      (5) Refer to the applicable Illustrated Parts Catalog for components which require replacement anytime they are removed from the fuel system.

      (6) Refer to the applicable Overhaul Manual for inspection techniques and wear limits of individual components.

2. Fuel Inlet Strainers

   A. Refer to **05-20** for scheduled cleaning intervals.

   B. Disconnect the fuel line from the servo inlet fitting. Remove the inlet fitting to gain access to the strainer.

      NOTICE: The strainer should ONLY be removed from the inlet fitting side. Removing from the opposite side can cause FOD to enter the Fuel Injector. Thorough inspection and overhaul may be required if FOD enters the Fuel Injector.

   C. Carefully remove the strainer for cleaning and inspection. Check the screen for distortion or openings in the strainer. The strainer should be replaced for either of these conditions.

   D. Remove the O-ring positioned at the inlet of the strainer. This O-ring must be discarded and replaced.

   E. The fuel inlet strainer can be cleaned in a solvent such as MEK or acetone. The strainer can also be cleaned in an ultrasonic cleaner if available. After cleaning, dry the strainer using compressed air, not to exceed 30 psi.

      NOTICE: If the Fuel Inlet Strainer cannot be thoroughly cleaned or if there is any damage to it, the strainer should be replaced.

   F. Refer to AVStar Service Information Letter AFS-SIL-02 for additional details.

   G. Once the fuel inlet strainer has been cleaned and dried, install a new O-ring onto the strainer. Install into the servo inlet port, spring side first. Inspect the O-ring on the inlet fitting for any damage or cuts. If in question, replace the O-ring. Install and tighten the inlet fitting to 65-70 in-lbs. Reattach the fuel inlet line in accordance with the engine manufacturers recommended torque.

   H. For convenience, refer to the table below for part number information should any of these components require replacement.

Table 2 – Fuel Strainer O-Ring Identification

Model	Size	Fuel Inlet Strainer P/N	O-ring P/N Fuel Strainer	O-ring P/N Inlet Fitting
LFR-NNSS5	5	AV2537608	AV953541-10	AV951789
LFR-NMLH10	10	AV2537610	AV951392	AV951790
LFR-NNLH10				
LFR-NNLS10				
LFR-NNSH10				
LFR-NNSM10				

3. Injection Nozzle Cleaning

   A. Remove the injection nozzle per the "Injection Nozzle Removal" procedure in Chapter 73-10.

   B. For turbocharged and deck vent type injection nozzles, disassemble as shown in the applicable ***AFS-IPC-08 Illustrated Parts Catalog***. The applicable O-rings should not be soaked in the cleaning solutions described below.

   C. Using MEK or Acetone:

      (1) Soak the nozzles in MEK or Acetone for 1 hour.

      (2) Rinse the nozzles with clean hot water and blow dry with compressed air, not to exceed 30 psi

   D. Assemble and install the injection nozzle per "Injection Nozzle Installation" procedure in Chapter 73-10.

   E. At a minimum, fuel restrictors (nozzle inserts) are recommended to be cleaned annually. Based on aircraft or engine service history more frequent cleaning might be required but should not exceed 100 hours operation time. The entire injection nozzle assembly is recommended to be removed annually to prevent the possibility of seizure within the engine cylinder.

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05-50 – UNSCHEDULED CORRECTIVE MAINTENANCE

1. Unusual Conditions

Unscheduled maintenance is necessary when the following conditions occur:

- Incorrect fuel or fuel contamination
- Water damage
- Engine on fire or near fire
- Volcanic ash/particulate contamination

A. Incorrect Fuel or Fuel Contamination

(1) Actual damage to the fuel system from incorrect fuel could be in a range from unnoticeable to severe damage or failure. Primary damage caused by incorrect fuel occurs at the engine, with contaminated fuel having a greater effect on the fuel system. There are a number of critical flow components and orifices which are only intended to be functional with approved fuel types. Refer to the latest revision of Lycoming Service Instruction S.I. 1070 for the most current list of approved fuels.

(2) Because of many variables, it is impossible to be sure of the airworthiness of a fuel system which has been exposed and operated with incorrect or contaminated fuel – except by detailed inspection of the fuel system by qualified personnel. Therefore, after the fuel system has been operated with incorrect or contaminated fuel, regardless of time of operation:

(a) Do not continue operation with incorrect or contaminated fuel.

(b) Drain the fuel injection servo and, where applicable, the flow divider and remove from service in accordance with this manual and the aircraft manufacturer's instructions.

(c) AVStar recommends returning the applicable components to our facility or one of our service centers for detailed evaluation to determine if repair or overhaul is necessary.

B. Water Damage

⚠ WARNING: WHEN A FUEL SYSTEM HAS BEEN SOAKED IN WATER OR EXPOSED TO EXCESSIVE AMOUNTS OF WATER IN THE FUEL, MOISTURE AND UNWANTED MATERIALS CAN CAUSE DAMAGE TO ALL AIR AND FUEL FLOW CIRCUITS. DO NOT OPERATE A FUEL SYSTEM THAT HAS BEEN EXPOSED TO OR IMMERSED IN WATER.

(1) Disassemble, examine and overhaul the fuel system in accordance with the applicable overhaul manual.

C. Engine or Fuel System on Fire or Near a Fire

(1) The fuel system requires replacement or complete overhaul.

D. Volcanic Ash/Particulate Contamination

(1) Follow the applicable instructions and guidelines in the Engine Maintenance Manual for additional instructions regarding the engine.

⚠WARNING: INLET AIR WHICH CONTAINS VOLCANIC ASH OR OTHER PARTICULATES CAN CAUSE DAMAGE AND OBSTRUCT ANY OF THE INTERNAL CIRCUITS OF THE FUEL SYSTEM. EVEN IF NO OBVIOUS SYMPTOMS OF ABNORMAL PERFORMANCE OR OPERATION ARE WITNESSED, FOD WITHIN ANY OF THE INTERNAL CIRCUITS WITHIN THE FUEL SYSTEM CAN SUBSEQUENTLY BECOME DISLODGED AND AFFECT PERFORMANCE.

(2) The fuel system requires replacement or complete overhaul.

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12-30 – UNSCHEDULED SERVICING

1. General

   A. Fault Isolation:

      (1) Refer to the section "Fault Isolation Guide" in this chapter.

      (2) Review maintenance logs and use applicable indicators to eliminate simple and inexpensive solutions. A quick visual inspection of the fuel system can show indications of obvious problems such as induction leaks, fuel stains, etc. See Chapter 05, Section 20 for further details on inspections.

      (3) Discuss the problem with the pilot for more details.

      (4) Take note of the last satisfactory performance of the fuel system and how it operated. Identify any occurrences whether maintenance or otherwise which may indicate an obvious problem.

2. Fault Isolation Guide

   A. The Fault Isolation Guide in Table 3 shows the more common and recurring problems, causes, and corrective actions. Continue from the simplest to the most complex possible causes.

Table 3
Fault Isolation Guide

Problem	Cause	Corrective Action	Additional Ref.
Engine will not start or starts with difficulty	No fuel flow or lack of sufficient fuel flow: Blockage in fuel hose	1. Disconnect the fuel hose. 2. Complete the check of the fuel flow. 3. Examine for evidence of leaks and correct as required. 4. Clean the filters, strainers, lines, or fuel valves.	Engine/Airframe Maint. Manual(s)
	No fuel flow or lack of sufficient fuel flow: Incorrect Fuel Pressure	Verify the observed pressure to the fuel system falls within the limits indicated in Appendix A. Correct as required.	Appendix A & Engine/Airframe Maint. Manual(s)
	Throttle valve open too far	Set throttle for appropriate idle speed.	Engine Maint. Manual
	Insufficient prime (could be accompanied by backfire)	Increase prime. Examine priming system for leaks.	Engine/Airframe Maint. Manual(s)
	Flooded engine (overpriming)	Follow instructions in engine manual.	Engine/Airframe Maint. Manual(s)
	Water in fuel injector	Drain fuel injector and fuel lines.	Engine Maint. Manual
Rough Idle or Failure of Engine to Idle Properly	Leaks in induction system	Tighten all connections in the induction system. Replace any parts that are defective including gasket(s) as necessary.	Engine/Airframe Maint. Manual(s)
	Incorrect Idle Mixture or Idle Adjustment	1. Adjust the idle mixture per instructions in the section "Idle Speed Mixture Adjustment" in Chapter 72-00. 2. Readjust idle speed.	72-00
	Low Fuel Pressure	Adjust fuel pressure if applicable. Check fuel pump and drive and/or replace fuel pump or fuel pressure regulator.	Engine Maint. Manual

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Table 3
Fault Isolation (Contd.)

Problem	Cause	Corrective Action	Additional Ref.
Rough Idle or Failure of Engine to Idle Properly	Leak in air bleed nozzle balance line	Check connection and replace if necessary.	Engine Maint. Manual
	Plugged fuel injector nozzle	Clean or replace nozzle.	05-30 "Injection Nozzle Cleaning"
	Flow divider fitting plugged	Clean fitting.	Engine Maint. Manual
	Oil in air chamber of regulator	See AFS-SB-10	Fuel System Overhaul Manual / Authorized Repair Station
	Fuel vaporization	Refer to Lycoming Service Instruction 1498	
Low Power and Uneven Running	Mixture too rich; indicated by sluggish engine operation, red exhaust flame at night. Extreme cases indicated by black smoke from exhaust	Readjustment of fuel injector by authorized personnel is indicated.	Fuel System Overhaul Manual / Authorized Repair Station
	Mixture too lean; indicated by overheating or backfiring	Check fuel lines for dirt or other restrictions. Readjustment of fuel injector by authorized personnel is indicated.	Fuel System Overhaul Manual / Authorized Repair Station
	Leaks in induction system	Tighten all connections in the induction system. Replace any parts that are defective including gasket(s) as necessary.	Engine/Airframe Maint. Manual(s)
	Improper fuel	Fill tank with fuel of recommended grade.	Engine Maint. Manual
	Plugged fuel injector nozzle	Clean or replace nozzle.	05-30 "Injection Nozzle Cleaning"
Failure of Engine to Develop Full Power	Leaks in induction system	Tighten all connections in the induction system. Replace any parts that are defective including gasket(s) as necessary.	Engine/Airframe Maint. Manual(s)
	Decreased air flow in the air induction system	1. Examine the system and remove all blockages. 2. Make sure that the airbox is installed in accordance with the airframe manufacturer's specifications.	Airframe Maint. Manual
	Air filter dirty	Replace air filter in accordance with airframe manufacturer's instructions.	Airframe Maint. Manual
	Too much air dropped through a new air filter. Defective air filter	1. Put the engine on test stand, in a dust-free area. 2. Remove the air filter. 3. Operate the engine to full throttle. 4. If the engine operates at full rpm, replace the air filter with a new air filter.	Engine Maint. Manual
Failure of Engine to Develop Full Power	Alternate air door not rigged properly	Rig so door goes from full open to full closed.	Airframe Maint. Manual
	Plugged fuel injector nozzle	Clean or replace nozzle.	05-30 "Injection Nozzle Cleaning"
	Throttle lever out of adjustment	Adjust in accordance with the airframe manufacturer's instructions. Adjust lever for full travel.	Airframe Maint. Manual

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Table 3
Fault Isolation (Contd.)

Problem	Cause	Corrective Action	Additional Ref.
Failure of Engine to Develop Full Power	Improper fuel flow	Look for blocked fuel filters. Check strainer (see 05-30), gage and flow at the fuel line.	
	Restriction in air scoop	Examine air scoop and remove restrictions.	Airframe Maint. Manual
	Improper fuel	Drain and refill tank with recommended fuel.	Engine/Airframe Maint. Manual(s)
Rough Engine	Plugged fuel injector nozzle	Clean or replace nozzle.	05-30 "Injection Nozzle Cleaning"
	Mixture too lean or rich	Troubleshoot with mixture control, if symptoms diminish upon leaning, mixture is too rich. If symptoms amplified with leaning, mixture is too lean. Readjustment of fuel injector by authorized personnel is indicated.	Fuel System Overhaul Manual / Authorized Repair Station
High Fuel Flow Indication on Fuel Gage	Plugged fuel injector nozzle	Clean or replace nozzle.	05-30 "Injection Nozzle Cleaning"
High Manifold Pressure at Idle	Air leak in induction system	Examine the induction system for leaks and repair as necessary. NOTICE: If the induction system has leaks, the engine will idle rough.	
Poor Idle Cut-Off	Incorrect rigging of mixture control linkage	Adjust in accordance with the airframe manufacturer's instructions.	Airframe Maint. Manual
	Scored or damaged mixture control valve or plate in fuel injection servo	Flow rate in idle cut-off should be 5cc/minute or less with wide open throttle and boost pump on. If greater than 5cc/minute, remove for repair.	Fuel System Overhaul Manual / Authorized Repair Station
Engine will not idle unless the boost pump is on	Low Fuel Pressure	Replace fuel pump or fuel pressure regulator.	Engine Maint. Manual
	Very Lean Idle Mixture	1. Enrich the idle mixture per instructions in the section "Idle Speed Mixture Adjustment" in Chapter 72-00. 2. Readjust idle speed.	72-00
	Pressure too low at idle speed (engine could also lose fuel pressure as the aircraft climbs)	Look for loose fuel fitting. Tighten loose fuel fitting.	
Engine will not idle unless the boost pump is on	Fuel pressure is set too high	Adjust engine fuel pump	Engine Maint. Manual
	Fuel vaporizing in lines	Follow instructions in engine manual. Refer to Lycoming Service Instruction 1498.	Engine Maint. Manual
	Broken fuel pump drive	Replace the fuel pump in accordance with airframe manufacturer's instructions.	Engine/Airframe Maint. Manual(s)
Low Fuel Pressure	Wrong fuel pressure regulator settings	Make sure the fuel pressure regulator is operating correctly.	Engine Maint. Manual
Low Fuel Flow	Dirty fuel filter or strainer	1. Remove and replace fuel filter. 2. Remove, inspect and clean as required fuel inlet strainer (see 05-30)	Engine Maint. Manual
Engine surges	Cause not typically associated with the fuel system.	See Engine Manual	Engine Maint. Manual

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Table 3 Fault Isolation (Contd.)			
Problem	**Cause**	**Corrective Action**	**Additional Ref.**
High CHT or High Oil Temperature	Insufficient air cooling	Check air inlet and outlet for deformation or obstruction. Correct as necessary.	Airframe Maint. Manual
	Fuel Lines with incorrect diameter installed	Verify proper fuel lines and sizes are installed.	Engine Maint. Manual
	Engine is operating excessively lean	1. Refer to Engine Manual for minimum fuel flows for various power settings and never lean below minimum fuel flows. 2. Examine the combustion chamber for carbon deposits. The absence of carbon deposits is evidence of operating the engine too lean. 3. If confirmed that fuel system is running lean and no other causes can be found, remove from service for repair.	Engine Maint. Manual
	Mixture control is incorrectly installed	Make sure that full travel of the cockpit mixture control lever is calibrated to the correct FULL RICH and IDLE CUT-OFF stops.	Airframe Maint. Manual
Turbocharged (when applicable - see below)			
Rough Engine and/or Poor Idle Cut-Off	Injection nozzles and/or vent lines clogged or dirty	Clean or replace nozzle. Inspect or replace vent lines.	05-30 “Injection Nozzle Cleaning”
Excessive noise or vibration	Leak in engine intake or exhaust manifold	Tighten loose connections or replace manifold gaskets as necessary.	Engine Maint. Manual
Engine will not deliver rated power	Clogged manifold system	Clear all ducting.	Engine Maint. Manual
	Leak in engine intake or exhaust	Tighten loose connections or replace manifold gaskets as necessary.	Engine Maint. Manual
	Linkage between wastegate and fuel system out of adjustment (when applicable)	Readjust as described in Engine Maintenance Manual	Engine Maint. Manual

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71-60 – AIR INTAKE

1. Refer to the applicable section of the Aircraft Maintenance Manual for Airbox and Carburetor Heat/Alternate Air connection details and maintenance.

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72-00 – ENGINE

1. Idle Speed and Mixture Adjustment:

   A. Start the engine and warm up in accordance with the Engine and Airframe Maintenance Manuals. Prevailing winds can affect the load of the propeller and the resulting engine RPM. Therefore, AVStar recommends setting the Idle Speed and Mixture with the aircraft in a crosswind orientation.

   B. Mag-Drop checks should be made in accordance with the applicable Engine Service Documents, refer to Lycoming Service Instruction 1132. Once satisfactory, proceed with idle adjustment.

   C. Set the Throttle Stop Screw, sometimes referred to the Idle Speed screw, so that the engine idles at the airframe manufacturer's recommended idling speed with a closed throttle. Refer to Appendix A for location.

   D. Once the idling speed has stabilized, move the cockpit mixture control lever with a smooth and steady motion 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 Full Rich before the RPM drops 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. A rise of approximately 10-50 RPM is considered satisfactory.

   E. Should the Idle Mixture require adjustment after performing the previous steps, adjust the idle mixture wheel in the direction required. The "R" engraved on the clevis along with the arrow indicates the direction to turn the wheel to richen the mixture. The opposite direction will lean the mixture. Refer to Appendix A for location.

   F. Anytime an adjustment is made, the engine should be run up to approximately 2000 RPM to clear the engine. Upon returning to idle, it may be necessary to readjust the Idle Speed prior to performing the next mixture rise check.

   G. The procedure described above targets an idle mixture that will obtain maximum RPM with minimum manifold pressure. Whenever this check is performed, allowance and consideration should be made for the effect of weather and altitude conditions upon idling adjustment.

   H. Idle speed and mixture adjustments should not require frequent attention, aside from cases of large variations in ambient temperature or altitude of operation. Frequent idle adjustments may indicate or mask another issue, which may or may not be fuel system related.

   I. If the idle speed setting is not stable after repeated attempts, complete a check of the idle linkage. Look for loose connections which could cause erratic idling.

   J. AVStar *DOES NOT* recommend re-indexing or taking apart the idle linkage clevis assembly. Idle fuel flows are initially set when tested on a qualified test bench, with specific throttle positions and fuel flows. The orientation of the idle linkage is also critical to the functionality of the internal idle valve (metering jet). If the orientation or clocking is incorrect engine operation and performance can be affected.

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73-10 – ENGINE FUEL SYSTEM

⚠WARNING: DO NOT SMOKE OR HAVE AN OPEN FLAME OR ANY DEVICE THAT CAN MAKE SPARKS. SMOKING, FLAMES, OR SPARKS CAN CAUSE FUEL OR OTHER FLAMMABLE FLUIDS IGNITION WHICH CAN CAUSE SERIOUS BURNS, INJURY OR DEATH.

NOTICE: If this fuel system removal or installation is completed with the engine installed in the airframe, refer to the airframe manufacturer's instructions for shutting off the fuel and grounding the aircraft.

1. Servo Fuel Injector Removal Prerequisites:
   A. Shut off the fuel supply in accordance with the appropriate maintenance practice.
   B. Make an appropriate entry into the logbook indicating the reason for removal, and the applicable number of hours on the fuel system.
   C. As necessary, disconnect the throttle and mixture control attaching hardware from their respective levers in accordance with the Airframe's Maintenance Manual. Inspect for any signs of abnormal or excessive wear and correct those issues prior to reinstalling the fuel system.
   D. As necessary, remove the applicable intake components attached to the fuel injector in accordance with the Airframe's Maintenance Manual. AVStar recommends discarding any mating gasket and installing a new gasket upon reinstallation. Should the fuel injector be removed for maintenance by an outside repair facility, any engine or airframe fittings not shown in the applicable ***AFS-IPC Illustrated Parts Catalog*** installed on the fuel injector should be removed. These components are part of the airframe installation and will NOT be reinstalled as they are not applicable to the parts list of the fuel injector. This includes but is not limited to additional inlet fittings or adapters, pressure fittings, and airframe outlet fittings. AVStar has no authorization to deem these components airworthy or qualified for return to service. Refer to the applicable maintenance manuals directing their installation for qualification of return to service. Inspect for any signs of debris or other particulate contamination and correct those issues prior to reinstalling the fuel system.
2. Servo Fuel Injector Removal Procedure:
   A. Put a fuel collection container under the fuel injector.
   B. Apply an identification label to each fuel line and disconnect the fuel lines attached to the fuel injector.
   C. Let fuel drain out of the fuel injector and fuel hoses into the fuel collection container.
   D. Hold the fuel injector, depending upon the model to be removed, either four 1/4-20 or 5/16-18 nuts and their applicable lock washers and washers will need to be removed. The torque of these nuts is 96 in-lbs. (for 1/4-20) or 204 in-lbs. (for 5/16-18). Discard the lock washers.
   E. Remove the fuel injector, gaskets, and adapter/spacer (if applicable). Discard the gaskets.

F. Remove the fuel collection container and dispose of the fuel in accordance with environmental regulations.

3. Servo Fuel Injector Installation Preparation Requirements:

A. Where applicable, verify the fuel injector being installed is qualified for return to service by referring to the Return to Service documentation provided. Refer to Section 05-00 for further details as to the work performed on the fuel injector.

B. If there is not absolute certainty that the part number of the fuel injector being installed on the engine is applicable, consult the appropriate Engine Manufacturer or Airframe documentation for applicability.

NOTICE: EXTREME CAUTION SHOULD BE EXCERCISED WHEN HANDLING OR WORKING AROUND THE INJECTOR TO PREVENT OIL OR FUEL FROM ENTERING THE AIR SECTIONS OF THE INJECTOR. DAMAGE TO THE AIR DIAPHRAGM WILL RESULT. FLUID CAN EASILY ENTER THE AIR SECTION OF THE INJECTOR THROUGH THE ANNULAR GROOVE AROUND THE VENTURI, THROUGH THE BULLET VENTURI (WHERE APPLICABLE) OR THE IMPACT TUBES. FOR THIS REASON, SOME PROTECTIVE PLATE SHOULD BE INSTALLED ON THE SCOOP MOUNTING FLANGE WHEN PERFORMING ROUTINE MAINTENANCE ON THE ENGINE, SUCH AS WASHING DOWN THE ENGINE AND AIR SCOOP, SERVICING THE AIR FILTER (SURPLUS OIL ON THE ELEMENT) OR WHEN INJECTING OIL INTO THE ENGINE PRIOR TO STARTING OR SHIPPING.

C. Typically, a fuel injector has been preserved with preservative oil if it is to be out of service for 30 days or more. If not certain as to the status of the fuel injector being installed and if it has been preserved, AVStar recommends the following procedure as a best practice, best performed with the fuel injector removed from the engine:

(1) Remove the fuel inlet and strainer and clean the strainer in accordance with Chapter 05-30 of this manual.

(2) Drain as much preservative oil from the fuel injector as possible, keep the mixture control in the “Full-Rich” position and the throttle fully open. Rotate the fuel injector so that gravity allows the oil to drain from the outlet (facing down) and rotate the servo front to back and side to side.

(3) Reinstall the fuel inlet strainer and inlet fitting in accordance with Chapter 05-30 of this manual. If available, apply 10 to 15 psi air pressure to the fuel inlet, until all fuel and/or preservative oil is discharged from the injector.

(4) Inject or supply clean fuel into the fuel inlet connection with the fuel outlet uncapped until clean fuel flows from the outlet. Keep the mixture control in the “Full-Rich” position and the throttle fully open. Do not exceed 15 psi inlet pressure.

NOTICE: Dispose of used preservative and/or fuel in accordance with all applicable federal, state, and local environmental regulations.

D. Perform a visual inspection and functional check of the throttle and mixture control levers for ease of movement and complete travel from stop to stop.

E. Inspect the throat of the throttle body of the fuel injector, as well as the venturi to ensure they are clean and dry.

F. Install any additional required components onto the fuel injector as required. Refer to the appropriate Engine or Airframe Maintenance Manuals and Parts Catalogs for additional details.

G. Make an appropriate entry into the logbook indicating the reason for installation and the applicable status of the fuel system.

4. Servo Fuel Injector Installation:

A. Refer to the applicable Engine or Airframe Maintenance Manuals for installation specific requirements including, but not limited to spacers, adapters, and gaskets. Also refer to Lycoming Service Instruction 1484 for additional details.

B. Install the fuel injector and related components, including new gaskets and lock washers. Most installations make use of four nuts, each with a washer and lock washer. Install hand tight.

C. Torque the four nuts in a crisscross torque pattern to an initial torque of 48 in-lbs. for size 1/4-20 and 90 in-lbs. for size 5/16-18.

D. Torque the four nuts again in the same crisscross torque pattern to a final maximum torque of 96 in-lbs. for size 1/4-20 and 204 in-lbs. for size 5/16-18.

E. Rig and install the airbox and mixture/throttle controls in accordance with the applicable Airframe Maintenance Manual.

F. Reconnect the applicable fuel hoses and lines, refer to the applicable engine and/or airframe maintenance manuals for proper torque requirements.

G. Perform the applicable inspections, checks, warm-ups and ground runs required by the Engine or Airframe Maintenance Manuals. Prior to the first flight of the newly installed fuel system, perform the Visual Inspection listed in **05-20**.

⚠WARNING: CORRECT ALL LEAKS. IF FUEL LEAKS ARE NOT CORRECTED BEFORE FLIGHT, THE ENGINE CAN HAVE LOSS OF POWER OR ENGINE FAILURE CAN OCCUR.

5. Servo Fuel Injector Storage and Preservation:

A. Any fuel injector taken out of service, or being removed for overhaul or storage, must be flushed with preserving oil (Specification MIL-O-6081, Grade 1010), using the following procedure.

(1) Remove the fuel inlet and strainer and clean the strainer in accordance with Chapter 05-30 of this manual.

(2) Drain as much fuel from the injector as possible, keep the mixture control in the "Full-Rich" position and the throttle fully open. Rotate the fuel injector so that gravity allows the fuel to drain from the outlet (facing down) and rotate the servo front to back and side to side.

(3) Reinstall the fuel inlet strainer and inlet fitting in accordance with Chapter 05-30 of this manual. If available, apply 10 to 15 psi air pressure to the fuel inlet, until all fuel is discharged from the injector.

NOTICE: Dispose of used fuel in accordance with all applicable federal, state, and local environmental regulations.

(4) Inject or supply clean preservative oil filtered through a 10-micron filter into the fuel inlet connection with the fuel outlet uncapped until oil is discharged from the outlet. Keep the mixture control in the "Full-Rich" position and the throttle fully open. Do not exceed 15 psi inlet pressure. It is recommended the applicable outlet be facing up as to make the preservation oil work against gravity to fill and coat all applicable internal passages.

(5) After filling with preservative oil, the oil can be drained from the fuel injector as a film of preservation oil will satisfactorily preserve the fuel injector. Cap or plug all applicable fittings and ports. Refer to the applicable ***AFS-IPC Illustrated Parts Catalog*** for part numbers of available shipping caps, plugs and o-rings to be used for storage and shipment.

(6) The fuel injector should then be protected from dust and dirt and given such protection against moisture as climatic conditions at the point of storage required. In most cases, storing the unit in a dry area will be sufficient.

(7) If the fuel injector is to be stored near or shipped over salt water, the following precautions should be observed.

(a) Spray the exterior of the injector with an approved preservative oil, Socony "Avrex 901" or equivalent.

(b) Pack in a sealed dust proof container, wrap the container with moisture and vapor proof material, and seal. Pack the wrapped unit in a suitable shipping case. Pack a one-half pound bag of silica-gel crystals in the dust proof container with the injector. The bag must not touch the injector.

B. This procedure should be followed anytime the fuel injector is anticipated to be inactive for 30 days or more.

C. Repeat the process annually when in storage for more than one year.

6. Injection Nozzle Replacement:

⚠ WARNING: DO NOT SMOKE OR HAVE AN OPEN FLAME OR ANY DEVICE THAT CAN MAKE SPARKS. SMOKING, FLAMES, OR SPARKS CAN CAUSE FUEL OR OTHER FLAMMABLE FLUIDS IGNITION WHICH CAN CAUSE SERIOUS BURNS, INJURY OR DEATH.

NOTICE: Injection nozzles cannot be repaired. They can only be replaced. If this injection nozzle replacement procedure is completed with the engine installed in the airframe, refer to the airframe manufacturer's instructions for shutting off the fuel and grounding the aircraft.

A. Injection Nozzle Removal

NOTICE: If multiple injection nozzles are to be removed, apply a label to each fuel line and injection nozzle for reference on assembly. AVStar recommends installing a shipping cap over the nozzle once the fuel line is disconnected. This will secure the nozzle insert within the nozzle body and prevent the introduction of FOD during the removal and installation. Shipping caps are supplied with the nozzles and can also be procured, part number AV2522020.

(1) Disconnect the fuel line from the injection nozzle by loosening the union nut with a 3/8-inch wrench, thread on shipping cap finger tight if available.

(2) Remove the injection nozzle from the engine cylinder using a deep well 1/2-inch socket wrench.

B. Injection Nozzle Cleaning procedure is found in Chapter 05-30.

C. Injection Nozzle Installation

(1) Before installing the injection nozzle on the engine cylinder, as an option, complete the "Injection Nozzle Fuel Flow Check" in this chapter.

(2) For turbocharged and deck vent type injection nozzles, if disassembled, assemble in configuration shown in the applicable ***AFS-IPC-08 Illustrated Parts Catalog.*** The special hex nut adjacent to the shroud should only be torqued to between 5 to 10 in-lbs.

(3) Lightly lubricate the injection nozzle threads with engine oil mixture.

(4) Install the injection nozzle on the engine cylinder.

(5) Using a clean deep well 1/2-inch socket wrench torque to 60 in-lbs. Where applicable, for injection nozzles installed in a horizontal orientation, the letter "A" stamped on the nozzle should point downward, as this is opposite the air bleed hole in the nozzle body.

(6) Remove the shipping cap and connect the fuel injector line to the injection nozzle. Torque the fuel line union nut to between 35 to 50 in-lbs. using a 3/8-inch wrench. DO NOT EXCEED the maximum torque value of 50 in-lbs. as it could result in damage to the parts. For turbocharged and deck vent type injection nozzles, refer the applicable engine and/or airframe maintenance manual for required hose connection details.

(7) Following an operational ground check as described in the applicable Engine Manual and after all maintenance is completed, look for fuel leaks at the fuel injector lines and connections during engine operation. Identify and correct the cause of any fuel leak. There must not be any fuel leak when the engine is returned to service.

7. Injection Nozzle Fuel Flow Check:

A. Apply a label to each fuel injector nozzle and line according to cylinder number.

B. Disconnect the fuel injector line from the injection nozzle.

C. Remove the injection nozzle from the engine cylinder.

D. Connect the fuel lines to the injection nozzles according to the cylinder number. Torque the fuel line union nuts to between 35 to 50 in-lbs.

E. Put the injection nozzles into four or six clear containers of equal size on a flat surface.

F. Turn the boost pump on and move the throttle and mixture control full forward.

G. Examine the fuel flow from each injection nozzle to make sure the fuel stream is not scattered (which is an indication of blockage in the injection nozzle) identified as "Incorrect" in the Figure 1 below.

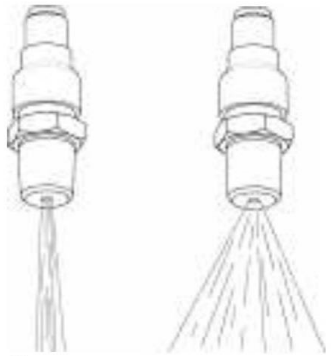

Figure 1

H. Let approximately 4 to 6 ounces (120 to 180 ml) of fuel to flow into each container. Close the throttle and mixture control and turn off the boost pump.

I. Measure the level of the fuel. All containers must have approximately the same amount of fuel. A container with less fuel is an indication of a fuel flow restriction, either within the injection nozzle, fuel line, or at the flow divider fitting.

NOTICE: If the fuel flow is incorrect, disconnect the injection nozzle and clean the nozzle according to the "Injection Nozzle Cleaning" procedure in Chapter 05-30. Repeat the fuel flow check. If cleaning does not correct the scattered stream, replace the injection nozzle. Fuel injection nozzles are not repairable.

J. Disconnect the fuel line from the injection nozzle.

K. Lubricate an acceptable injection nozzle threads with engine oil mixture.

L. Install the injection nozzle in the cylinder and connect the fuel injector line per the "Injection Nozzle Installation" procedure in this chapter.

8. Flow Divider (Fuel Manifold) Replacement:

⚠WARNING: DO NOT SMOKE OR HAVE AN OPEN FLAME OR ANY DEVICE THAT CAN MAKE SPARKS. SMOKING, FLAMES, OR SPARKS CAN CAUSE FUEL OR OTHER FLAMMABLE FLUIDS IGNITION WHICH CAN CAUSE SERIOUS BURNS, INJURY OR DEATH.

NOTICE: If this flow divider replacement procedure is completed with the engine installed in the airframe, refer to the airframe manufacturer's instructions for shutting off fuel and grounding the aircraft.

A. Flow Divider Removal

(1) Put a fuel collection container under the flow divider.

(2) Identify the fuel injector line ports on the flow divider.

(3) Apply a label and disconnect all fuel injector lines and the fuel line from the fuel injector attached to the flow divider, disconnect the gage port line if used.

(4) Let fuel drain out of the flow divider and fuel injector lines into the collection container.

(5) Remove the applicable bolts, washers, lock washers, and nuts that attach the flow divider bracket(s) to the crankcase. Discard the lock washers.

(6) Remove the applicable flow divider bracket(s) and flow divider from the crankcase.

(7) Remove and discard the safety wire/cable from the screws that attach the flow divider to the bracket(s).

(8) Remove the screws and lock washers that attach the flow divider to the bracket(s) and remove the bracket(s) from the flow divider. Discard the lock washers.

(9) Remove the fuel collection container and dispose of the fuel in accordance with environmental regulations.

B. Flow Divider Installation

(1) Install the flow divider bracket(s) on the flow divider with the screws and new lock washers. Torque the screws to 25 to 30 in-lbs. Refer to the applicable engine maintenance manual and/or parts catalog for configuration requirements.

(2) Safety wire/cable the screws on the bracket(s).

(3) Install the bracket(s) and flow divider on the crankcase with the applicable bolts, nuts, washers, and new lock washers. Torque the bolts in accordance with the latest revision of the Lycoming ***Service Table of Limits – SSP-1776***.

(4) Attach all fuel fittings with the fuel injector line to the corresponding identified ports on the flow divider. Torque the fuel line union nuts to between 35 to 50 in-lbs.

(5) Connect any other fuel lines to the fuel manifold.

(6) Torque all fuel lines and all fuel line fittings in accordance with the latest revision of the Lycoming ***Service Table of Limits – SSP-1776***.

NOTICE: TO ENSURE CORRECT ENGINE OPERATION AND FLIGHT SAFETY, THERE MUST NOT BE ANY FUEL LEAK AND ALL FUEL LINES MUST BE SECURED WITH CUSHIONED CLAMPS. REFER TO THE APPLICABLE ENGINE MAINTENANCE MANUAL FOR FURTHER DETAILS ON FUEL LINE CLAMPS AND APPLICABLE INSPECTIONS REQUIRED. IDENTIFY AND CORRECT THE CAUSE OF ANY FUEL LEAK.

(7) Following an operational ground check as described in the applicable Engine Manual and after all maintenance is completed, look for fuel leaks at the fuel injector lines and connections during engine operation. Identify and correct the cause of any fuel leak. There must not be any fuel leak when the engine is returned to service.

9. Flow Divider Storage and Preservation:

A. Any flow divider taken out of service for a period of one month or longer, or being removed for overhaul or storage, must be flushed with preserving oil (Specification MIL-O-6081, Grade 1010), using the following procedure.

(1) Drain any remaining fuel from the flow divider.

NOTICE: Dispose of used fuel in accordance with all applicable federal, state, and local environmental regulations.

(2) Fill the flow divider with clean preservative oil filtered through a 10-micron filter into the fuel inlet until the flow divider is filled.

(3) After filling with preservative oil, the oil can be drained and all applicable plugs, fittings and caps can be removed.

(4) Protect the flow divider from dust and dirt. Additionally, protect it from moisture as atmospheric conditions necessitate. Storage in a dry location will, in most cases, suffice.

(5) If the flow divider is to be stored near or shipped over salt water, the following precautions should be observed.

(a) Spray the exterior of the flow divider with an approved preservative oil, Socony “Avrex 901” or equivalent.

(b) Pack in a sealed dust proof container, wrap the container with moisture and vapor proof material, and seal. Pack the wrapped unit in a suitable shipping case

B. Repeat the process annually when in storage for more than one year.

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76-10 – ENGINE POWER CONTROL

1. Refer to the applicable section of the Aircraft Maintenance Manual for Throttle and Altitude Mixture Control connection details and maintenance.

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APPENDIX A

1. Servo Fuel Injector Pressure Limitations

   A. Fuel pressure requirements are established by the specific installation application. This information is provided in the applicable Lycoming engine manual as well as the engine type certification data sheet.

   B. The airframe installation may specify additional fuel pressure requirements, especially those which make use of return lines from the servo. AVStar encourages all operators to adhere to the requirements set forth by both the engine manufacturer and airframe where the fuel injection servo is installed. Not following these guidelines may have detrimental effects on the fuel system. All fuel injection servos delivered from AVStar or serviced using our instructions are tested for pressure sensitivity.

   C. In general, the fuel system should not be subjected to any fuel pressures exceeding the engine and airframe manufacturers requirements, this includes fuel pressures observed following an engine shutdown. Excessive fuel pressures have been observed on installations following engine shutdown, indicative of vapor related issues. Consult with the engine manufacturer for methods to alleviate this if observed in your airframe installation. Refer to Lycoming S.I. 1498 for recommended engine procedures for purging vapor.

2. Model LFR-NNSS5 Features:

   A. Not all Part Numbers will have all the features or components shown. Refer to the applicable IPC for further details. Fittings, levers and plugs will vary by part number. Some part numbers also make use of reverse throttle and mixture levers which rotate in the opposite direction of the standard configuration shown.

   B. Features or Components Indicated by * serve as an inspection point for potential fuel leaks.

      (1) *Fuel inlet connection should be inspected for any signs of a fuel leak or stain around the fitting and fuel line connection.

      (2) *The alternate fuel inlet (plug) should be inspected for any signs of a fuel leak or stain around the fitting.

      (3) *The pressure connection fitting, plug or return fitting should be inspected for any signs of a fuel leak or stain around the fitting and where applicable attached fuel line.

      (4) *Fuel outlet connection should be inspected for any signs of a fuel leak or stain around the fitting and fuel line connection.

      (5) *The alternate fuel outlet (plug) should be inspected for any signs of a fuel leak or stain around the fitting.

      (6) *The plug next to the primary fuel outlet should be inspected for any signs of a fuel leak or stain around the plug.

      (7) *The impact tubes should be inspected for fuel which would indicate a leaking regulator seal.

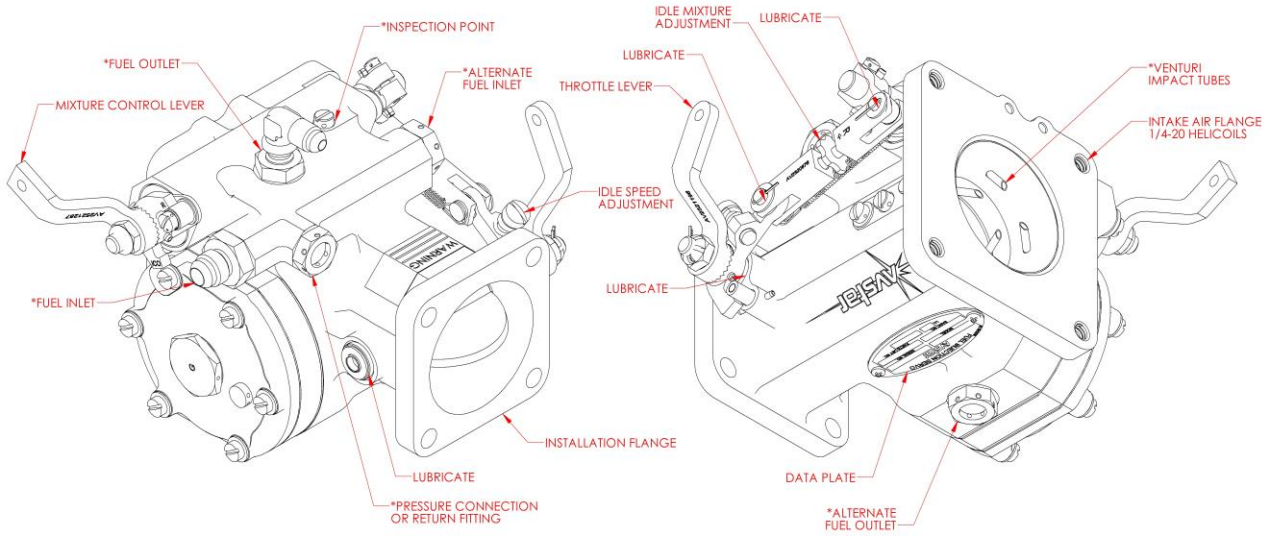

Figure A-1

Model LFR-NNSS5 Identification of Features

3. Model LFR-NNSH10 Features:

   A. Not all Part Numbers will have all the features or components shown. Refer to the applicable IPC for further details. Fittings, levers and plugs will vary by part number.

   B. Features or Components Indicated by * serve as an inspection point for potential fuel leaks.

      (1) *Fuel inlet connection should be inspected for any signs of a fuel leak or stain around the fitting and fuel line connection.

      (2) *The alternate fuel inlet (plug) should be inspected for any signs of a fuel leak or stain around the fitting.

      (3) *The pressure connection fitting or plug should be inspected for any signs of a fuel leak or stain around the fitting and where applicable attached fuel line.

      (4) *Fuel outlet connection should be inspected for any signs of a fuel leak or stain around the fitting and fuel line connection.

      (5) *The plug next to the outlet port should be inspected for any signs of a fuel leak or stain around the fitting.

      (6) *The plug next to the data plate should be inspected for any signs of a fuel leak or stain around the plug.

      (7) *The impact tubes should be inspected for fuel which would indicate a leaking regulator seal.

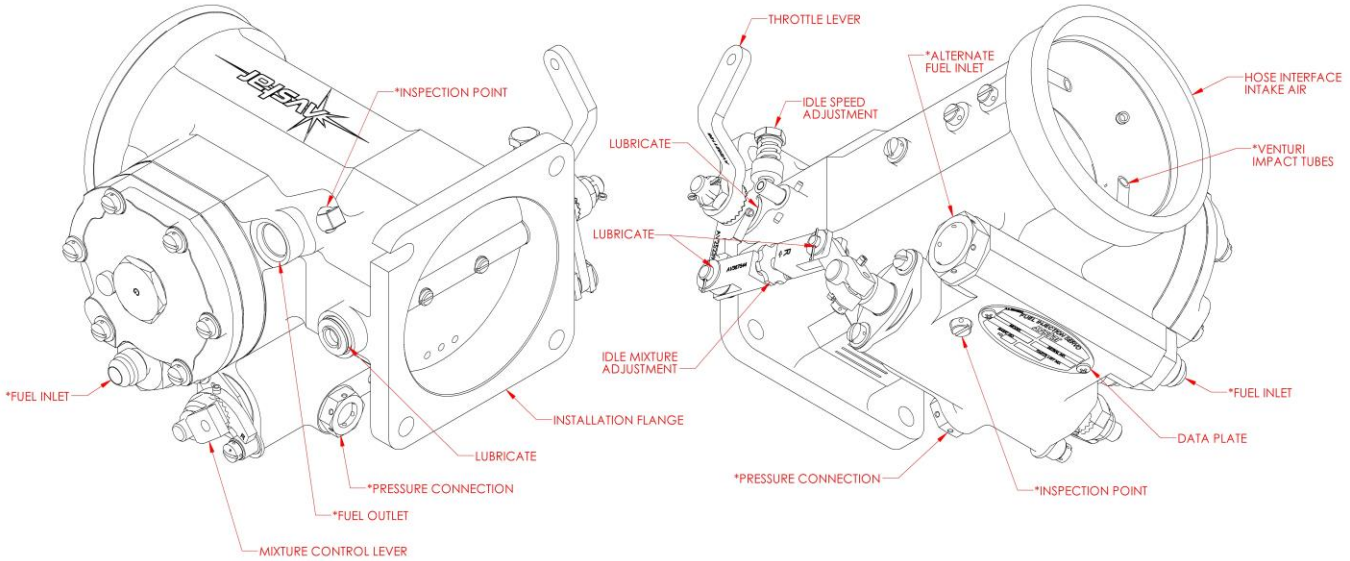

Figure A-2

Model LFR-NNSH10 Identification of Features

4. Model LFR-NMLH10, NNLH10 & NNLS10 Features:

   A. Not all Part Numbers will have all the features or components shown. Refer to the applicable IPC for further details. Fittings, levers, plugs and intake connection (flange or hose) will vary by part number.

   B. Features or Components Indicated by * serve as an inspection point for potential fuel leaks.

      (1) *Fuel inlet connection should be inspected for any signs of a fuel leak or stain around the fitting and fuel line connection.

      (2) *The alternate fuel inlet (plug or fitting) should be inspected for any signs of a fuel leak or stain around the fitting and where applicable attached fuel line.

      (3) *The pressure connection fitting or plug should be inspected for any signs of a fuel leak or stain around the fitting and where applicable attached fuel line attached fuel line.

      (4) *Fuel outlet connection should be inspected for any signs of a fuel leak or stain around the fitting and fuel line connection.

      (5) *The alternate fuel outlet (plug or fitting) should be inspected for any signs of a fuel leak or stain around the fitting and where applicable attached fuel line.

      (6) *The plug next to the alternate fuel outlet port should be inspected for any signs of a fuel leak or stain.

      (7) *The plug next to the AVStar logo should be inspected for any signs of a fuel leak or stain around the plug.

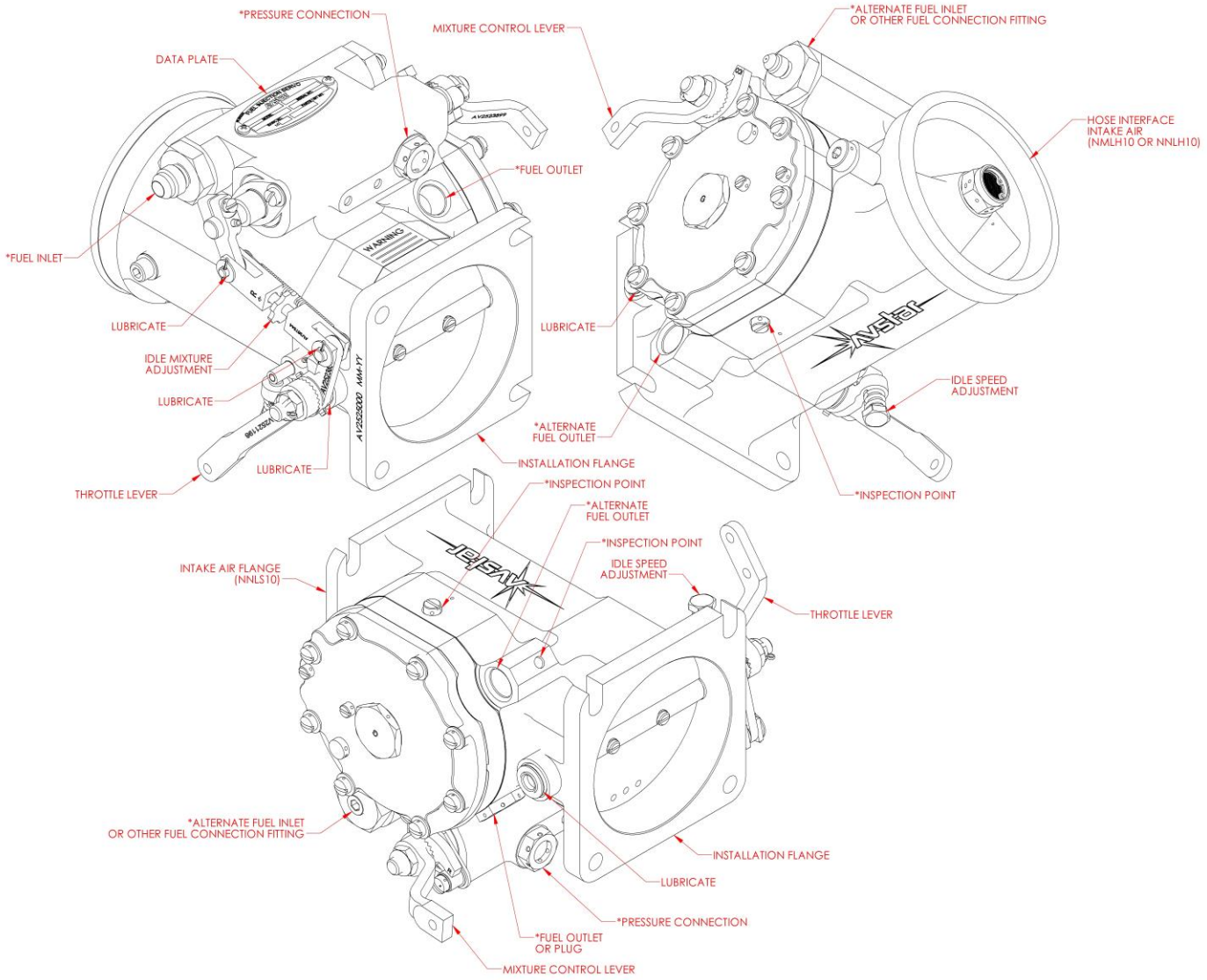

Figure A-3

Model LFR-NMLH10, NNLH10, NNLS10 Identification of Features

5. Model LFR-NNSM10 Features:

   A. Not all Part Numbers will have all the features or components shown. Refer to the applicable IPC for further details. Fittings, levers and plugs will vary by part number.

   B. Features or Components Indicated by * serve as an inspection point for potential fuel leaks.

      (1) *Fuel inlet connection should be inspected for any signs of a fuel leak or stain around the fitting and fuel line connection.

      (2) *The alternate fuel inlet (plug or return fitting) should be inspected for any signs of a fuel leak or stain around the fitting and where applicable attached fuel line.

      (3) *The pressure connection fitting or plug should be inspected for any signs of a fuel leak or stain around the fitting and where applicable attached fuel line.

      (4) *Fuel outlet connection should be inspected for any signs of a fuel leak or stain around the fitting and fuel line connection.

      (5) *The plug next to the outlet port should be inspected for any signs of a fuel leak or stain around the fitting.

      (6) *The plug next to the data plate should be inspected for any signs of a fuel leak or stain around the plug.

      (7) *The impact tubes should be inspected for fuel which would indicate a leaking regulator seal.

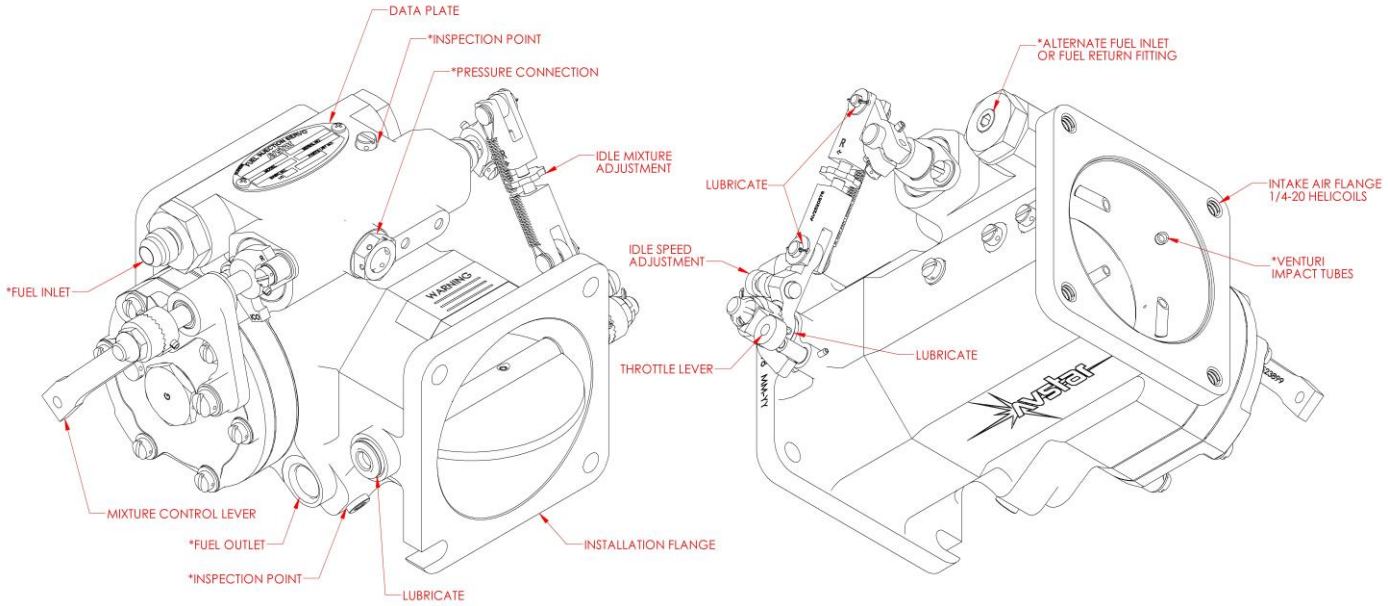

Figure A-4

Model LFR-NNSM10 Identification of Features

6. Air Bleed Injection Nozzle Features:

   A. Refer to Lycoming Service Instruction 1532 for applicability and the specific engine and/or airframe parts catalog for further details.

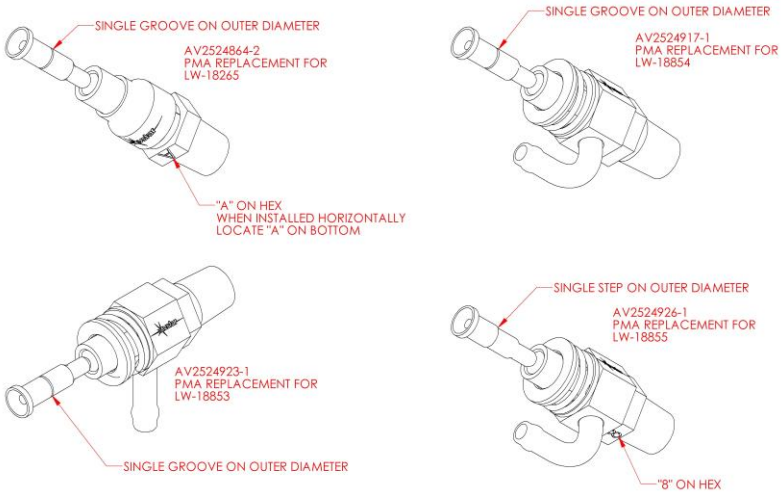

Figure A-5

Air Bleed Injection Nozzle Features

7. Flow Divider (Fuel Manifold) Features:

   A. Not all Part Numbers have the cover/vent orientation as shown, refer to the applicable IPC for further details. Fittings and plugs will vary by engine model. Refer to Lycoming Service Instruction 1532 for applicable assembly part numbers and the specific engine parts catalog for fitting requirements. Refer to the applicable airframe parts catalog for gage port fitting details if required.

   B. Features or Components Indicated by * serve as an inspection point for potential fuel leaks.

      (1) *Fuel Inlet port should be inspected for any signs of a fuel leak or stain around the fitting and fuel line connection.

      (2) *The Gage port (plug or fitting) should be inspected for any signs of a fuel leak or stain around the fitting and where applicable attached fuel line.

      (3) *All six outlet ports whether installed with a fitting or plug should be inspected for any signs of a fuel leak or stain around the fitting and where applicable attached fuel line.

      (4) *The vent tube or vent hole should be inspected for any signs of a fuel leak or stain.

      (5) *The lower cover should be inspected for any signs of a fuel leak or stain.

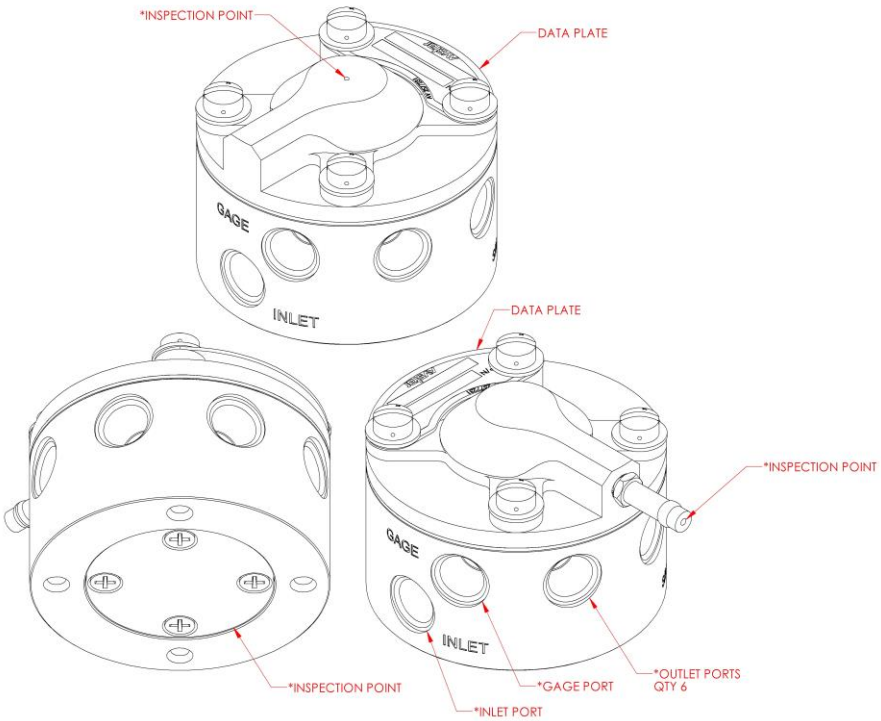

Figure A-6

Flow Divider (Fuel Manifold) Features