



Cessna Single Engine High Wing Maintenance

Power Plant Systems



CESSNA SINGLE ENGINE HIGH WING MAINTENANCE**FOR TRAINING PURPOSES ONLY****Revision Record**

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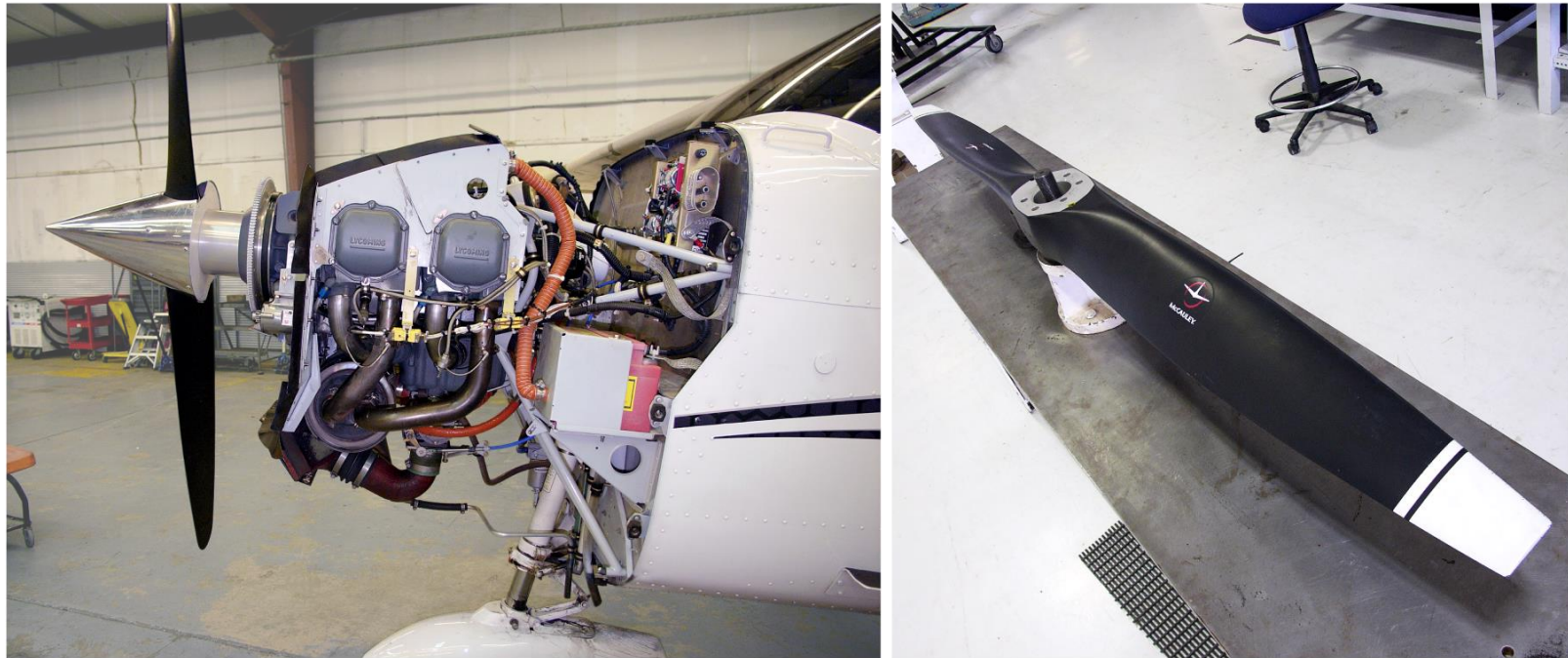
ATA61 - Propellers

Overview

LESSON OBJECTIVES

- Explain safety precautions related to the propellers.
- Explain maintenance practices important to the propellers.
- Explain inspection/checks important to the propellers.
- Explain propeller system indications.
- Explain special tooling and test equipment used with Cessna High Wing Series Aircraft.
- Explain procedures for replacement of unique components.

SYSTEM OVERVIEW



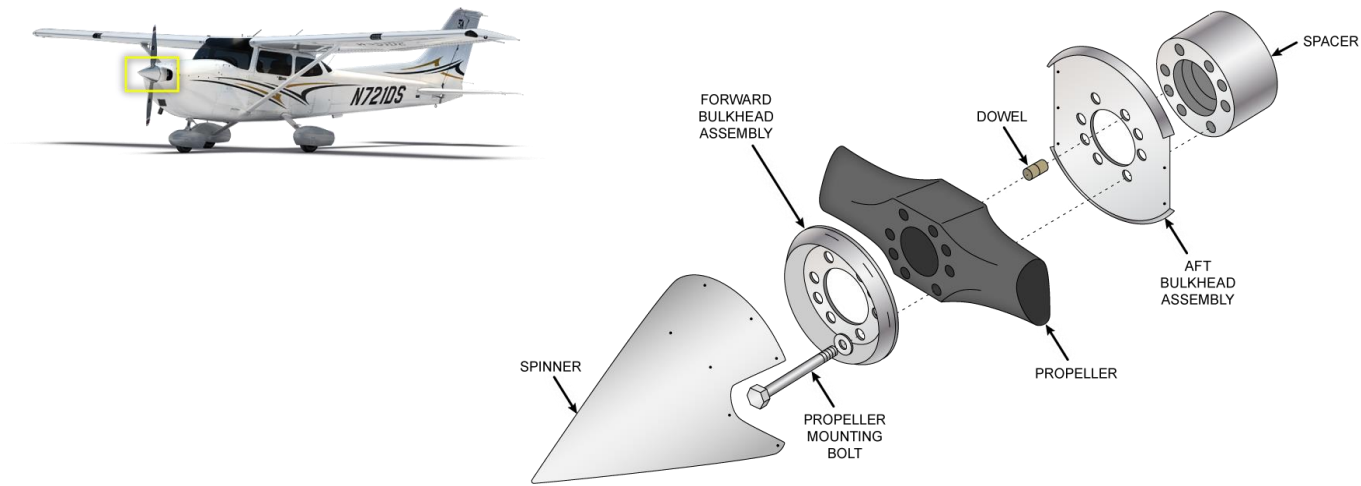
ATA Chapter 61 provides the maintenance practices of the propeller and spinner. Refer to the applicable McCauley service manual for information beyond the scope of the Cessna Maintenance Manuals.

General Information

The Skyhawk SP is equipped with a two bladed, fixed pitch metal propeller (model 1A170E).

Propeller Maintenance Practices

PROPELLER AND SPINNER (61-10-00)



Installation Parts for Fixed Pitch Propellers

BASIC PROPELLER MODEL NUMBER	SPACER P/N	DOWEL P/N	FIXED PITCH BOLT KIT						
			BOLT KIT P/N	BOLT DIA.	DRILLED HEAD	NO. BOLTS	BOLT P/N	WASHER P/N	NUT P/N
1A170E/JHA	C-7726	A-2973-6	B-4622-40	1/2	YES	6	A-2513-92	A-1638-2	NA

Removal/Installation

Refer to section 61-10-00, Figure 201 for the Removal and installation of the propeller and spinner.

PROPELLER AND SPINNER (61-10-00)**Removal/Installation****EXERCISE CARE**

Exercise care when working with the propeller. Ensure magneto switch is in the off position before turning propeller.

Refer to Cessna Maintenance Manual Chapter 71, Cowling - Maintenance Practices for the removal and installation of the cowling and nose cap.

Refer to McCauley Propeller Owner Operator Information Manual Table 1003 for Installation of Fix Pitch Propellers

**DOWEL PIN**

A dowel pin holds the propeller, aft bulkhead and spacer together when removed.

Refer to ASTM E-1444 Magnetic Particle Testing or ASTM E-1417 liquid penetrant inspection, for inspecting the propeller mounting bolts or replace at every overhaul.

PROPELLER AND SPINNER (61-10-00)

Removal/Installation

Replace the propeller mounting bolts in the event of a bird strike.



CAUTION

SPACERS AND PROPELLERS

The spacer and propeller are balanced as a pair and must be installed together. Do not exchange spacers or propellers from other airplanes.



NOTE

DOWEL LOCATION

Final dowel location will be made when spacer is installed in propeller hub.

PROPELLER AND SPINNER (61-10-00)**Removal/Installation****NOTE****AFT BULKHEAD**

The aft bulkhead may need to be pushed forward slightly to engage spinner screws. It may be necessary to rotate the spinner 180 degrees for the best spinner and screw attach alignment.

**NOTE****FORWARD BULKHEAD**

The mounting bolt holes in the forward bulkhead may be undersized due to the original torquing of the mounting bolts. This may cause the spinner to bulkhead screws holes not to align. The required hole diameter for the forward bulkhead is 0.516 inch diameter to 0.527 inch diameter. If necessary, remove the forward bulkhead and enlarge bolt hole using a 33/64th (0.516 inch diameter) drill.

PROPELLER AND SPINNER (61-10-00)**Removal/Installation****NOTE****SPINNER SCREW HOLES**

If necessary, the spinner screw holes in the aft bulkhead flanges may be increased to 0.205 inch diameter for adjustment.

**NOTE****TRIM SPINNER**

It is acceptable to trim the spinner a maximum of 0.08 inch. Trim spinner only if maximum adjustment does not allow adequate clearance. Trim as little as possible to obtain clearance. Apply corrosion protection. Refer to Chapter 20, Interior and Exterior Finish - Cleaning/Painting.

Propeller Inspection/Check

Fixed pitch propellers - 2000 hours or 72 calendar months, whichever occurs first.

Check the propeller mounting bolt torque at least once per year.

Torque the propeller mounting bolts as per McCauley Propeller Owner Operator Information Manual to the following torque value:

- Torque 1/2-Inch diameter fasteners to 55 to 65 Foot Pounds (660 to 780 Inch Pounds) per McCauley SB 227B.



Refer to ASTM E-1444 Magnetic Particle Testing or ASTM E-1417 liquid penetrant inspection, for inspecting the propeller mounting bolts.

Propeller mounting bolts must be replaced whenever the propeller is involved in a blade strike as defined in Necessary Actions Following Object Strike of Stationary Propeller, Blade Strike of Rotating Propeller, Birdstrike, or Sudden Engine Stoppage:

- For 1A170E/JHA[XXXX] propellers only, installed on Aircraft Operating as Pilot Schools in accordance with 14 CFR, Part 141, and all aircraft with 2000 or more cycles for every 1000 flight hours must be inspected in accordance with Service Bulletin 240[X] every 1000 hours or 72 calendar months whichever occurs first.

FIXED PITCH PROPELLER (61-10-00)

Limitations:

Corrosion other than small areas of light surface corrosion with no evidence of pitting may require propeller removal and reconditioning by an appropriately rated repair facility. Intergranular corrosion may be present when the corrosion protective coatings (paint, anodize, etc.) have been lost. Corrosion pitting should be removed as described in the overhaul manual and applicable ADs.

Unauthorized Straightening of Blades:

A bent propeller cannot be straightened without special processing in an FAA approved Part 145 Propeller Repair Station or international equivalent because bending may harden the aluminum and lead to catastrophic blade failure. Blades showing evidence of unapproved repairs require removal of the entire propeller and proper assessment by an FAA approved Part 145 Propeller Repair Station or international equivalent.

Blade Shortening:

Propeller tip damage will lead field maintenance personnel to consider removing damaged material from the blade tips.

Propellers certification is to the aircraft engine and airframe resonant frequency by designing it with a particular diameter to minimize vibration.

Shortening of the blades without reference to approved data could create a condition that is NOT airworthy.

Refer to the airplane type certificate data sheet, aircraft specification sheet, or supplemental type certificate data sheet as applicable, for the allowable propeller diameter for each propeller installation.

FIXED PITCH PROPELLER (61-10-00)

Preflight inspections consist of the following criteria:

- Oil and Grease Leakage
- Blade Inspection
 - Surface Damage
 - Erosion
 - Straightness
 - Looseness
- Spinner and Bulkhead
- General Condition
- Control System
- Maintenance records

FIXED PITCH PROPELLER (61-10-00)**100 Hour and Annual Inspection includes:**

Spinner removal

Inspection of all attaching hardware

Checking the propeller for corrosion, cracks, or other damage.

Inspect entire propeller system for oil leakage.

Repaint propeller blades, as necessary, in accordance with the instructions in Cleaning/Painting/Protective Treatments.

Examine all placards for legibility and security of installation.

Necessary Actions Following Object Strike of Stationary Propeller, Blade Strike of Rotating Propeller, Bird Strike, or Sudden Engine Stoppage includes the following:

Propellers with Blades Bent Beyond Repair

Object Strike of Stationary Propeller

Object Strike is defined as any impact of a non-rotating propeller by a substantial moving object, such as any personnel vehicle, aircraft tug, ground power unit, or similar.

- Inspect all blades for damage such as scrapes, gouges, etc. caused by the impact.
- Check the blade track and verify that all blades measure within the following limits:
 1. 0.0625 inch (1.6mm) of each other on piston engine propellers.
- Check blade twist

FIXED PITCH PROPELLER (61-10-00)**LOG BOOK**

The results of an object strike inspection should be noted in the propeller log book and, if required, note when the next inspection is due.

- If any propeller blade is damaged beyond field repair limits, the blade track or the propeller blade twist is beyond the limits, contact McCauley for disposition of the propeller assembly.

**DEFINITION**

The definition is for use as an example only. Determination as to whether or not an object strike actually occurred is ultimately the responsibility of the aircraft operator.

FIXED PITCH PROPELLER (61-10-00)

Blade Strike of Rotating Propeller

Blade Strike, sometimes referred to as "Ground Strike," is defined as any impact or suspected impact of the rotating propeller upon such items as, but not limited to, the ground, tow bars, landing lights, carts, snow banks, hedges, etc.



INTERNAL DAMAGE

Internal damage can occur without evidence of gross external damage.

Any McCauley propeller experiencing a blade strike must be removed from the aircraft and overhauled by an FAA approved Part 145 Propeller Repair Station or international equivalent in accordance with the applicable overhaul manual.

Bird strike:

A bird strike is the impact of any bird into the rotating propeller causing damage.

- Inspect all blades for damage such as scrapes, gouges, etc. caused by the impact. Refer to Blade Repair for field repair limits.
- Check the blade track and verify that all blades measure within the following limits:
 1. 0.0625 inch (1.6mm) of each other on piston engine propellers.

FIXED PITCH PROPELLER (61-10-00)**BIRD STRIKE INSPECTION**

The results of a bird strike inspection should be noted in the propeller logbook and, if required, note when the next inspection is due.

If any propeller blade is damaged beyond field repair limits or the blade track is beyond the limits, the propeller must be removed from the airplane and taken to and overhauled by an FAA approved Part 145 Propeller Repair Station or international equivalent.

Sudden Engine Stoppage:

Sudden Stoppage is any propeller experiencing a sudden decrease in RPM. This is commonly due to engine failure or seizure.

Any McCauley propeller experiencing a sudden stoppage must be removed from the aircraft and overhauled by an FAA approved Part 145 Propeller Repair Station or international equivalent in accordance with the applicable propeller overhaul manual.

System Review

PROPELLER SYSTEM REVIEW



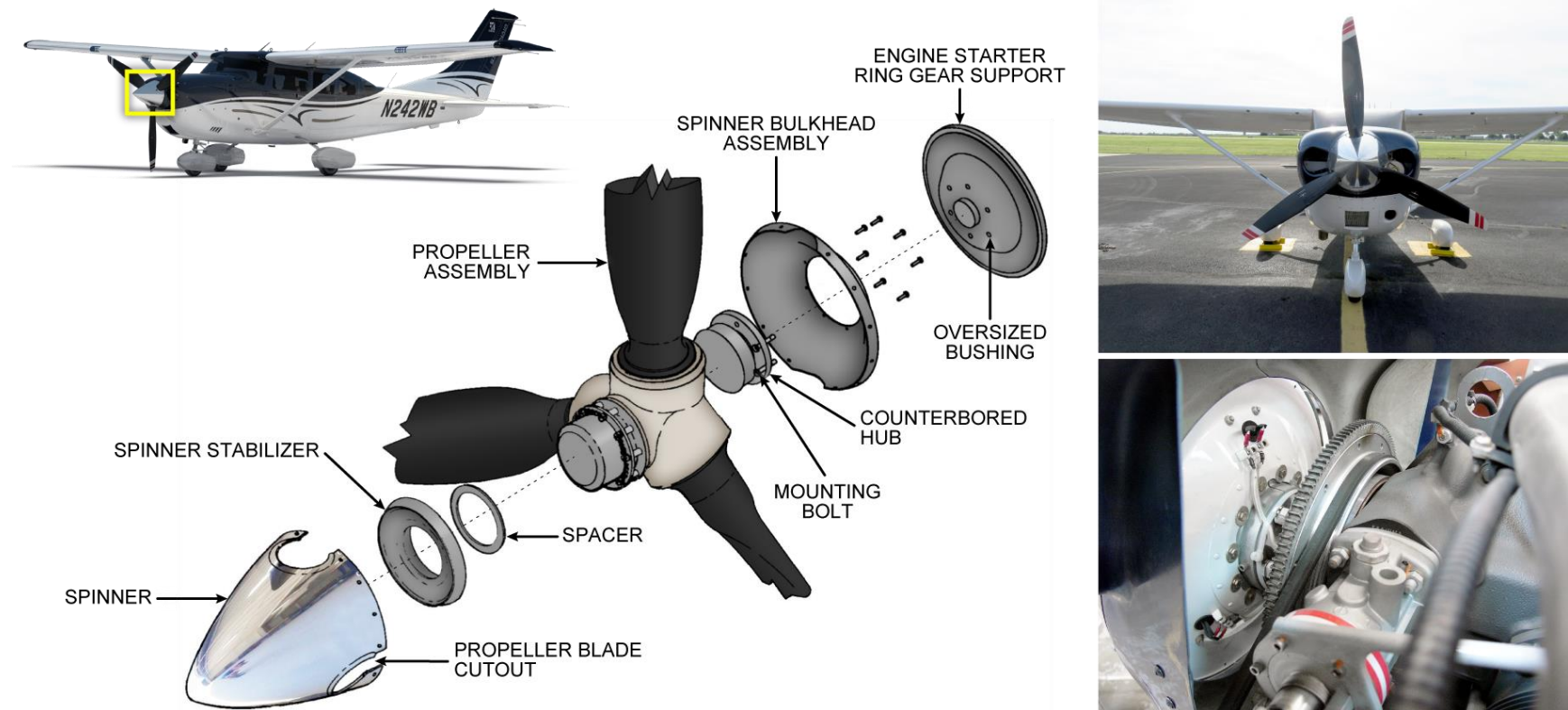
When dressing the propeller, conduct visual inspections at normal inspection intervals.

Damage or suspect damage found during an inspection, refer to McCauley Owners and Operators Manual MPC26 for inspecting the propeller.

If damage is beyond the limits, as per MPC26, the propeller must be removed from service and sent to an approved propeller repair station.

Model Differences

206 DIFFERENCES - PROPELLER - MAINTENANCE PRACTICES (61-10-00)



The 206 has a three-bladed, constant-speed metal propeller. The maintenance practices that follow include the removal and installation procedures of the spinner and propeller.

SPINNER REMOVAL/INSTALLATION**STANDING NEAR THE PROPELLER**

Do not stand or let anyone stand close to the propeller. Do maintenance as if the power to the propeller is always on.

**SPINNER MATERIAL REMOVAL**

Make sure you remove minimal spinner material as necessary to give minimum clearance between the spinner and the propeller blades.

PROPELLER REMOVAL/INSTALLATION



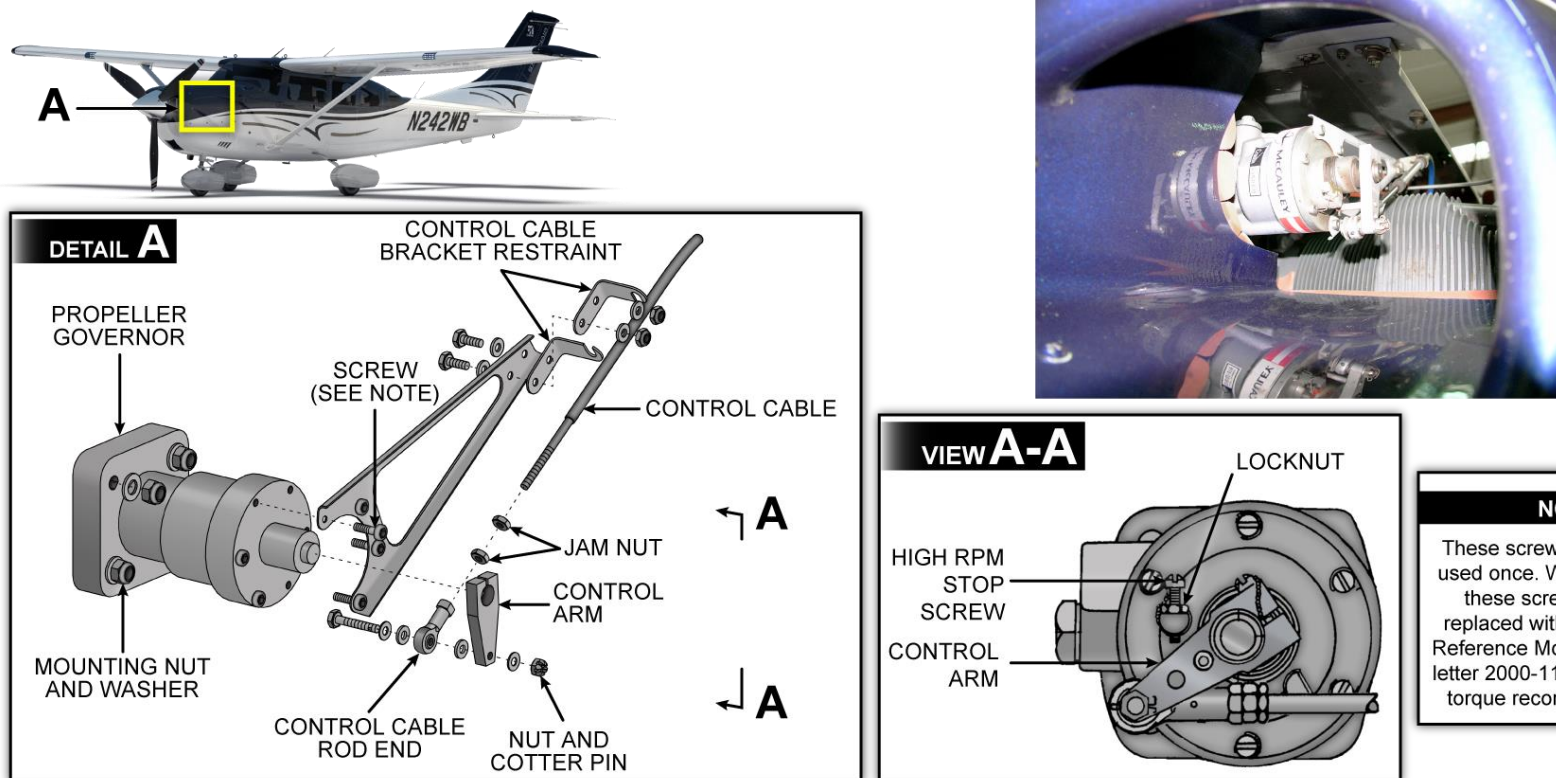
PROPELLER ASSEMBLY

As the propeller assembly is separated from the engine crankshaft, oil will drain from the propeller and engine crankshaft cavities.

Install the Propeller

- When installing the spinner lightly press the spinner against the spinner stabilizer.
- Examine the alignment of the mounting holes in the spinner with the holes in the spinner bulkhead assembly.
- Without an increase of pressure on the spinner, the mounting holes in the spinner must be set approximated 0.050 inch forward of the true center of the holes in the spinner bulkhead assembly.
- Add or remove spacers as necessary to set the holes in the correct position.
- Push on the spinner until the spinner mounting holes are aligned with the spinner bulkhead assembly holes and install four screws and washers equally spaced around the circumference of the spinner.

206 DIFFERENCES - PROPELLER GOVERNOR- MAINTENANCE PRACTICES (61-20-00)



The propeller governor is a single-acting, centrifugal type, which boosts oil pressure from the engine and directs it to the propeller where the oil is used to increase blade pitch.

The governor is on the forward, upper left side of the engine.

Maintenance practices include removal and installation of the propeller governor, high RPM stop adjustment, and rigging of the governor control.

On the 206, the max propeller speed is 2500rpm and the propeller governor turns at .947 to 1 of the propeller.

PROPELLER GOVERNOR REMOVAL AND INSTALLATION



PROPELLER GOVERNOR REMOVAL/INSTALLATION

- Exercise care when working with the propeller.
- Always treat the propeller as if the ignition switch were on.
- Do not stand, nor allow anyone else to stand, within the arc of the propeller.
- Ensure magneto switch is in the off position before turning propeller.



CONTROL CABLE WASHERS

Identify washers and position of washers for use when reconnecting control cable to control arm.

**MAGNETO**

Ensure magneto is grounded before turning propeller.

**SPLINE ENGAGEMENT**

Do not force spline engagement. Rotate crankshaft slightly and splines will mesh smoothly when properly aligned.

**CASTELLATIONS**

Do not exceed 50 in-lbs when tightening nut to line up cotter pin hole with castellations in nut.

HIGH RPM STOP SCREW ADJUSTMENT



RPMS ON THE GROUND

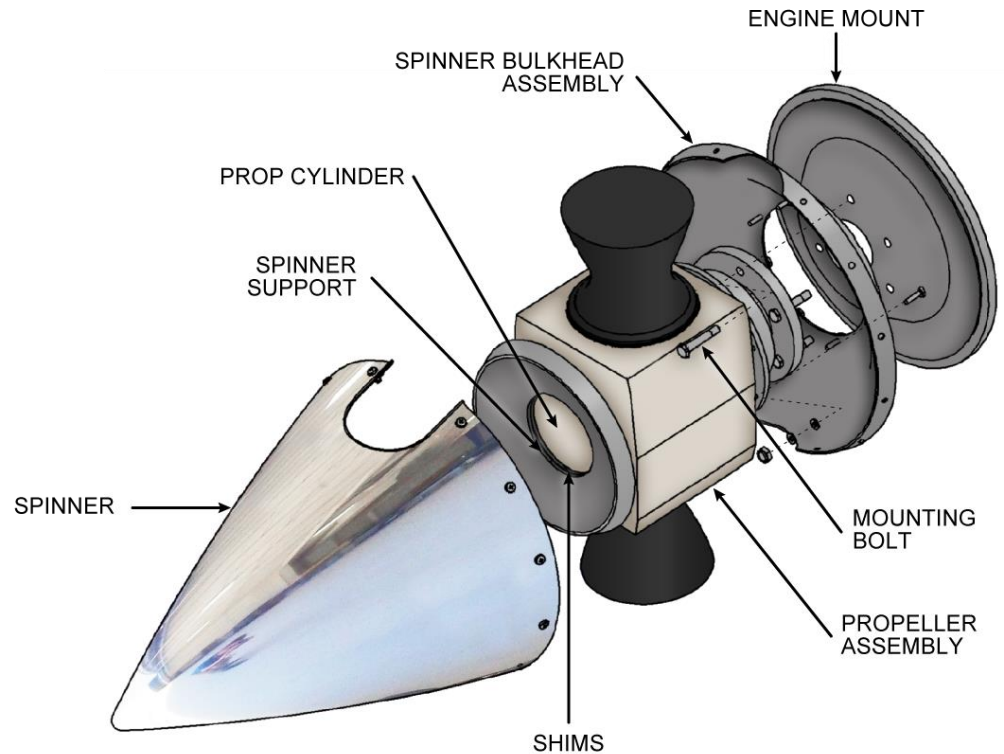
Due to climate conditions, field elevation, low pitch propeller blade angle, and other factors, an engine may not reach rated RPM on the ground. It may be necessary to read just the governor high RPM stop screw after test flying to obtain maximum rated RPM when airborne.

Propeller Control Cable



CONTROL CABLE

The control cable is not repairable and must be replaced at every engine overhaul.

182 DIFFERENCES - PROPELLER- MAINTENANCE PRACTICES MCCAULEY (61-10-00)

The 182 has a three bladed, constant-speed, metal propeller.

Maintenance practices consist of removal and installation of the:

- Propeller
- Spinner

The 182 uses the same method as the 206 for shimming the propeller spinner.

PROPELLER AND SPINNER REMOVAL AND INSTALLATION**PROPELLER REMOVAL/ INSTALLATION**

- Exercise care when working with the propeller.
- Always treat the propeller as if the ignition switch were on.
- Do not stand, nor allow anyone else to stand, within the arc of the propeller.
- Ensure magneto switch is in the off position before turning propeller.

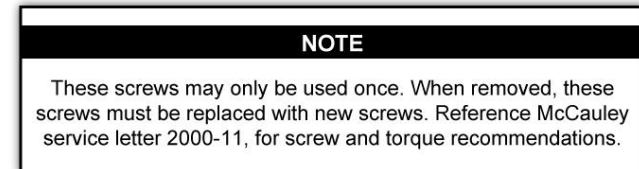
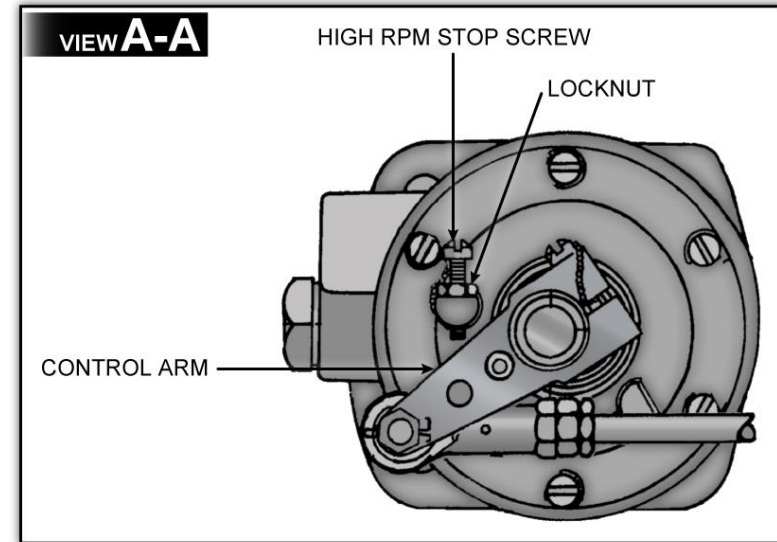
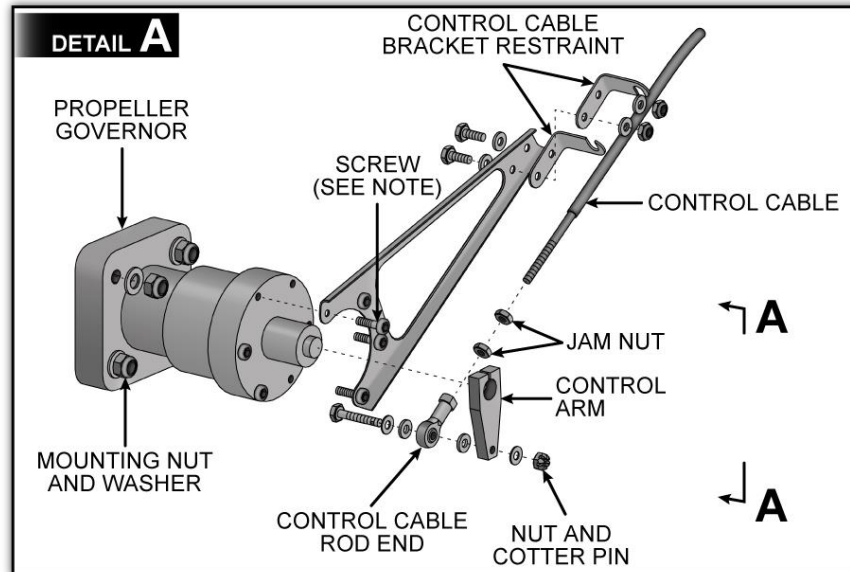
**SPINNER REINSTALLATION**

Note number of shims for use during reinstallation of spinner.

PROPELLER AND SPINNER REMOVAL AND INSTALLATION**PROPELLER AND SPINNER**

- If equipped with prop deice system, remove brush block assembly before removing propeller, to prevent possible brush damage.
- As the propeller assembly is separated from the engine crankshaft, oil will drain from the propeller and engine crankshaft cavities.
- Without increasing pressure on spinner, the mounting holes in spinner need to be positioned approximated 0.050 inch (1.27 mm) forward of the true center of holes in spinner bulkhead assembly.
- Use only the number of shims that will allow just enough alignment for screws to be installed while pushing hard against spinner.

182 DIFFERENCES - PROPELLER GOVERNOR - MAINTENANCE PRACTICES (61-20-00)



The propeller governor is a single-acting, centrifugal type, which boosts oil pressure from the engine and directs it to the propeller where the oil is used to increase blade pitch.

The governor is on the forward, upper left side of the engine.

The Max rpm for the propeller is 2400rpm and the propeller governor turns at .947 to 1 of the propeller.

Maintenance practices include removal and installation of the propeller governor, high RPM stop adjustment, and rigging of the governor control.

182 DIFFERENCES - PROPELLER GOVERNOR - MAINTENANCE PRACTICES (61-20-00)**General Precautions****GROUND THE MAGNETO**

Make sure you ground the magneto before you turn the propeller.

Propeller Governor Removal**WASHER POSITION**

Identify washers and position of washers for use when reconnecting control cable to control arm.

182 DIFFERENCES - PROPELLER GOVERNOR - MAINTENANCE PRACTICES (61-20-00)**Propeller Governor Installation****SPLINE ENGAGEMENT**

Do not force the spline engagement. Rotate the crankshaft slightly and the splines will mesh smoothly when properly aligned.

**PROPELLER GOVERNOR INSTALLATION**

Do not exceed 50 inch-pounds.

182 DIFFERENCES - PROPELLER GOVERNOR - MAINTENANCE PRACTICES (61-20-00)

High RPM Stop Screw Adjustment



RPM

Due to climate conditions, field elevation, low pitch propeller blade angle, and other factors, the engine may not reach rated RPM on the ground. It may be necessary to readjust the governor high RPM stop screw after test flying to obtain maximum rated RPM when airborne.

Propeller Control Cable

Governor Control Rigging

- During rigging, you must pull the governor control back approximately 0.125 inch and lock in this position.



GOVERNOR CONTROL RIGGING

This allows cushion, which will make sure there is full contact with the governor high RPM stop screw.

182 DIFFERENCES - PROPELLER GOVERNOR - MAINTENANCE PRACTICES (61-20-00)**RPM STOP SCREW**

Do not exceed 50 inch-pounds.

ATA71 - Power Plant

Overview

LESSON OBJECTIVES

- Explain safety precautions related to power plant
- Explain maintenance practices important to the engine
- Explain engine operations
- Explain power plant indications Explain special tooling and test equipment used with Cessna High Wing Series Aircraft
- Explain procedures for replacement of unique components

POWER PLANT SYSTEM OVERVIEW

Cessna's Maintenance Manual Chapter 71 provides description, troubleshooting and maintenance practices on the power plant and associated components.

The Lycoming IO-360-L2A provide the power plant for the Skyhawk series airframe. For engine related information not found in this chapter, refer to applicable Textron Lycoming maintenance manuals.

This section will cover the following procedures:

- Power Plant Standard Practices
- Power Plant Description and Operation
- Power Plant Troubleshooting
- Power Plant Maintenance Practices
- Engine Cowl Maintenance Practices
- Engine Mount & Isolator Maintenance Practices
- Air Induction Removal and Installation



Power Plant Standard Practices

The Lycoming Operators Manual Chapter 70 Standard Practices provides the guidelines for removal and installation, inspection, cleaning and repairs. This chapter consists of the following sections:

- Description
- Specification
- Operating Instructions
- Periodic Inspections
- Maintenance Procedures
- Troubleshooting

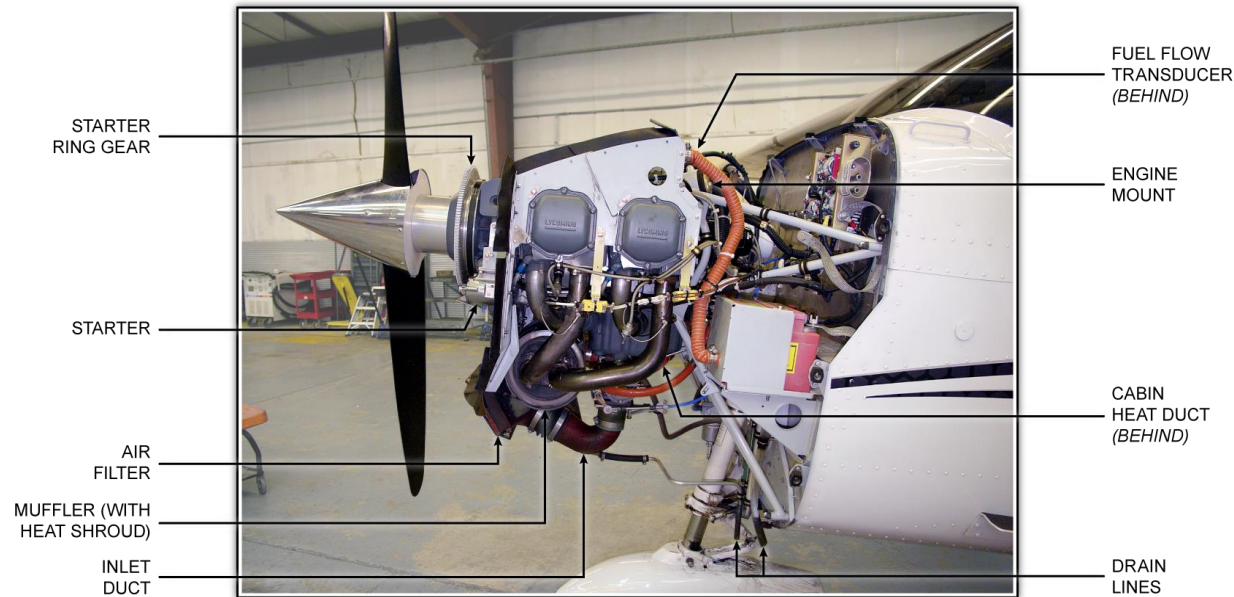
For more information, refer to the Lycoming Manuals

IO-360-L2A* Specifications	
FAA Type Certificate	1E10
Rated Horse Power	160
Rated Speed, RPM	2400
Bore, Inches	5.125
Stroke, Inches	4.375
Displacement, Cubic Inches	361.10
Compression Ratio	8.5:1
Firing Order	1-3-2-4
Spark Occurs, Degrees BTC	25
Valve Rocker Clearance (Hydraulic Tappets Collapsed)	028 - .080
Propeller Drive Ratio	1:1
Propeller Driven Ratio (Viewed from Rear)	Clockwise

**This engine has an alternate rating of 180 HP at 2700 RPM.*

Power Plant Description and Operation

DESCRIPTION (71-00-01)



The Lycoming IO-360-L2A engine is direct drive, four cylinder, fuel injected, horizontally opposed, and air cooled.

The cylinders, numbered from front to rear and stagger to have individual throws on the crankshaft for each connecting rod.

The right front cylinder is number 1 and cylinders on the right side of the engine are identified by odd numbers 1 and 3.

The left front cylinder is number 2 and the cylinders on the left side are identified as 2 and 4.

ENGINE – INTERNAL (71-00-01)

The Lycoming IO-360-L2A engine includes the following internal components and system:

Valve Operating Mechanism

Valve Operating Mechanism is a conventional type camshaft located above the crankshaft.

The camshaft actuates hydraulic tappets, which operate the valves through push rods and valve rockers.

The valve rockers are supported on full floating steel shafts. The valve springs bear against hardened steel seats and are retained on the valve stems by means of split keys.

Crankshaft

The crankshaft is made from a chrome nickel molybdenum steel forging.

Connecting Rods

The connecting rods are made in the form of “H” sections from alloy steel forgings. They have replaceable bearing inserts in the crankshaft ends and bronze bushings in the piston ends. Two bolts and nuts through each cap retain the bearing caps on the crankshaft ends.

Pistons

The pistons are machined from an aluminum alloy.

The piston pin is of a full floating type with a plug located in each end of the pin.

Depending on the cylinder assembly, pistons may be machined for either three or four rings and may employ either half wedge or full wedge rings.

Consult the latest revision of Service Instruction No. 1037 for proper piston and ring combinations.

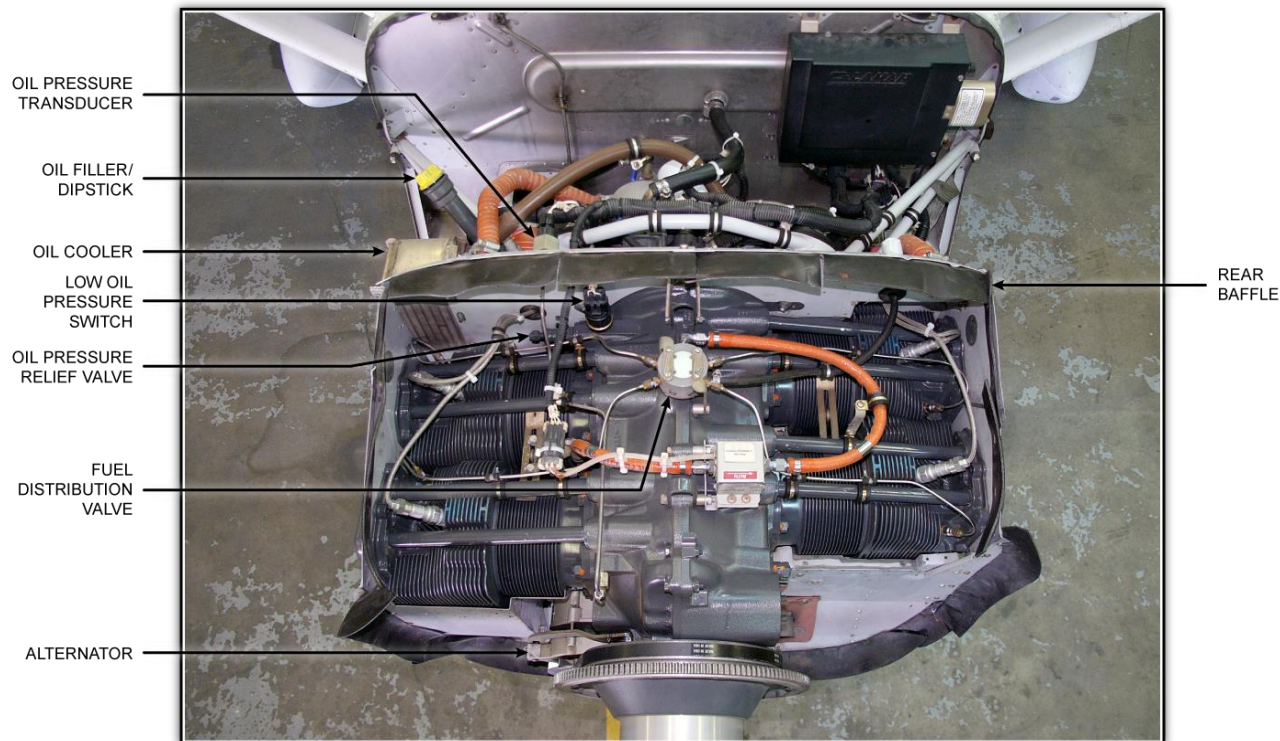
ENGINE – INTERNAL (71-00-01)

Oil Sump

The sump incorporates an oil drain plug, oil suction screen, mounting pad for carburetor or fuel injector, the intake riser and intake pipe connections.

Lubrication System

The lubrication system consist of an impeller type pump contained within the accessory housing actuates the full pressure wet sump lubrication system.



ENGINE – EXTERNAL (71-00-01)

The Lycoming IO-360-L2A engine includes the following external components:

Cylinders

The cylinders are of conventional air-cooled construction with the two major parts, head and barrel. The heads are made from an aluminum alloy casting with a fully machined combustion chamber. Rocker shaft bearing supports are cast integral with the head along with housings to form the rocker boxes. The cylinder barrels have deep integral cooling fins and the inside of the barrels are ground and honed to a specified finish.

Crankcase

The crankcase assembly consists of two reinforced aluminum alloy castings, fastened together by means of studs, bolts and nuts. The mating surfaces of the two castings are joined without the use of a gasket, and the main bearing bores are machined for use of precision type main bearing inserts.

Accessory Housing

The accessory housing is made from an aluminum casting and is fastened to the rear of the crankcase and the top rear of the sump. It forms a housing for the oil pump and the various accessory drives.

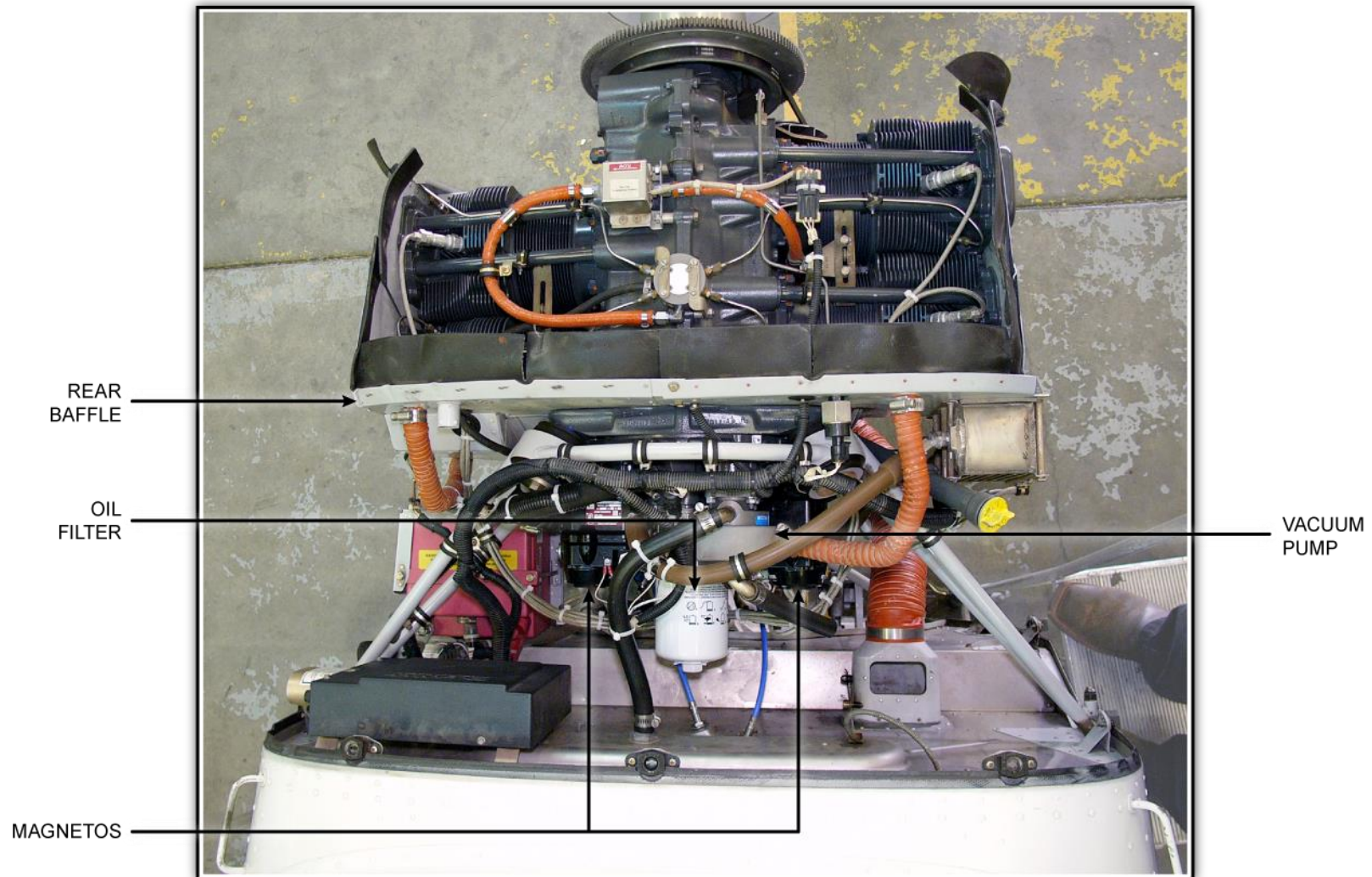
Cooling System

These engines are designed to be cooled by air pressure. Baffles are provided to build up a pressure and force the air through the cylinder fins. The air is then exhausted to the atmosphere through a low pressure outlet located at the rear of the cowling.

Induction System

Lycoming O-360 and HO-360 series engines are equipped with either a float type or pressure type carburetor, refer to Lycoming Operator Manual Table 1 for model application. Particularly good distribution of the fuel-air mixture to each cylinder is obtained through the center zone induction system, which is integral with the oil sump and is submerged in oil, insuring a more uniform vaporization of fuel and aiding in cooling the oil in the sump. From the riser the fuel-air mixture is distributed to each cylinder by individual intake pipes.

ENGINE ACCESSORIES (71-00-01)



ENGINE SPECIFICATIONS (71-00-01)



IO-360-L2A Technical Description	
172S* Rated Horsepower at 2700 RPM	180 MPH
Number of Cylinders	4 Horizontally Opposed
Displacement	361.0 Cubic Inches
Bore	5.125
Stroke	4.375
Compression Ratio	8.5:1
Firing Order	1-3-2-4
Dry Weight - without Alternator or Vacuum Pumps	278 lbs
MAGNETOS:	
Right Magneto	Slick Model No. 4371 (fires at 25° BTDC)
Left Magneto	Slick Model No. 4371 (fires at 25° BTDC)
Spark Plugs	18MM
Torque	420 In lbs
Valve Rocker Clearance (Hydraulic Tappets Collapsed)	0.028 to 0.080 Inch
Fuel Injector	RSA-5AD1
Tachometer	Mechanical Drive
Oil Capacity	8.0 Quarts
OIL PRESSURE:	
Minimum Idling	20 PSI
Normal	50 to 90 PSI
Maximum	115 PSI
OIL TEMPERATURE:	
Normal	100° F to 245° F
Maximum	245° F

Cessna's Maintenance Manual Section 71-00-01 Table 1 provides the engine information pertaining to the IO-360-L2A engine.

Refer to the Lycoming and Cessna Engine Manuals for more information pertaining to the IO-306-L2A engine.

Lycoming IO-360-L2A Facts

- Produces 2700 RPM's
- Weighs 278 LBS including the fuel injection, ignition systems, starter, alternator and baffling.
- Magneto Slick Model No. 4371 (fires at 25° BTDC)
- Aviation grade fuel is 91/96 and 100 LL
- Maximum oil consumption at 2400 RPM is .52 quarts per hour

ENGINE – TROUBLESHOOTING (71-00-01)

The troubleshooting charts listed in the Lycoming Troubleshooting Guide provides the proper procedures for troubleshooting engine malfunctions or failures and should be used in conjunction with Cessna's Maintenance Manual Chapter 73, Fuel Injection System - Troubleshooting and Chapter 74, Ignition System

The use of turbochargers and automatic controllers can complicate the troubleshooting procedures, always start by discussing the problem with the pilot and the facility management.

Information from the crew will help narrow the problem by eliminating some of the probable causes.

After collecting all the information observe the external condition of the engine for any indication of the problem. For example, look at are the intake and exhaust pipes for leaks, the ignition harness, breather, and the engine compartment for excessive oil stains, gas stains or exhaust stains.

ENGINE – TROUBLESHOOTING (71-00-01)

Some procedures can contain more information for example:

- A compression check to locate any low compression cylinders
- A bore-scope inspection determines the condition of the combustion chamber and provide information such as:
 - The presence of excessive carbon deposits that may indicate high oil consumption
 - The lack of carbon deposits may indicate continuous lean engine operation or detonation and scratched or scored cylinder walls may indicate broken rings.
 - When inspecting the combustion chamber it may require to remove the spark plugs
- Spectrometric oil analysis measures is a good trouble-shooting tool to measure engine effectiveness

For the spectrometric oil analysis to be effective the engine must be in the analysis program for an extended period of time to develop a history of periodic samples of oil that were analyzed.

Refer to applicable engine manuals and publications listed in Introduction for information beyond the scope of this chapter.

Align airplane 90 degrees to the right of wind direction for static run-ups. Follow the procedures outlined in the Pilot's Operating Handbook and FAA Approved Airplane Flight Manual for running the engine at full throttle.



NOTE

PISTON PIN PLUGS

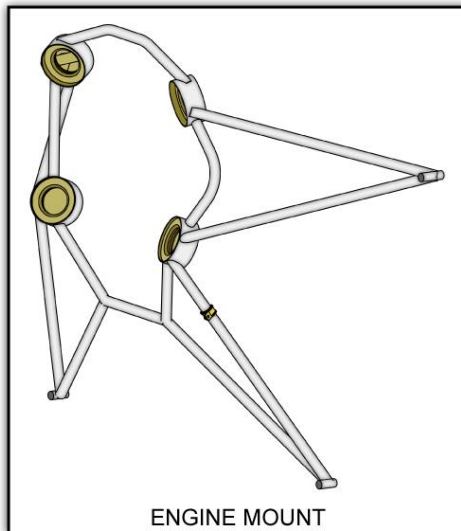
Always keep track of which piston pin plugs came out of which cylinder. During reassembly the piston pin plugs must be matched up with the cylinder they came out of.

ENGINE – TROUBLESHOOTING (71-00-01)**LOW POWER**

If low power is suspected, the following static run-up procedures may be used in conjunction with the troubleshooting chart to develop a diagnosis:

**ATMOSPHERIC PRESSURE VARIANCE**

Variances in atmospheric pressure, temperature and humidity can have a significant impact on run-up RPM. Low static run-up RPM information should be used only in conjunction with other troubleshooting procedures to determine if a problem actually exists.

ENGINE – MAINTENANCE PRACTICES (71-00-01)**Engine removal and installation**

This section provides the instructions to remove and install the engine and mount from the firewall.

Refer to Cessna's Maintenance Manual applicable engine publications for more information pertaining safety precautions and the removal and installation of the Engine.

Refer to Cessna's Maintenance Manual Chapter 61, Propeller - Maintenance Practices for removing and installing the propeller.

Label the electrical wires on the low vacuum annunciator switches, low oil pressure transducer, and alternator.

ENGINE – MAINTENANCE PRACTICES (71-00-01)

On airplanes with Garmin G1000, disconnect and reconnect the electrical connector from the tachometer sending unit.

Engine Cleaning

Use Stoddard solvent or equivalent chemicals to clean the engine. Ensure all openings have caps or plugs to prevent solvent entry into the engine and electrical accessories (starter, alternator, etc.) must have covers before the solvent is applied.

Engine Storage

Refer to Cessna's Maintenance Manual Chapter 10, Storage - Description and Operation for preservation procedures



ENGINE MOUNT REMOVAL PROCEDURE

The procedures that follow remove the engine and mount from the firewall. If the engine is removed from the mount and the mount will stay attached to the firewall, some of the steps will not be necessary. To remove the engine from the mount, the four bolts that connect the four shock mounts to the engine mounting flange and the engine mount tube must be removed.

ENGINE – MAINTENANCE PRECAUTIONS (71-00-01)**P LEAD WIRE**

When the P lead wire is disconnected from the magnetos to remove the electrical ground from the magneto circuit, the magnetos become electrically active. A ground wire must be connected to the magnetos or the high tension wires removed from the spark plugs to prevent accidental engine start when the propeller is turned. An accidental engine start can cause injury to persons in the area of the propeller.

**GARMIN G1000**

Airplanes with Garmin G1000 have EGT probe at each cylinder.

**BOLT ACCESS**

It can be necessary to get access to the bolt heads from the inside of the cockpit.

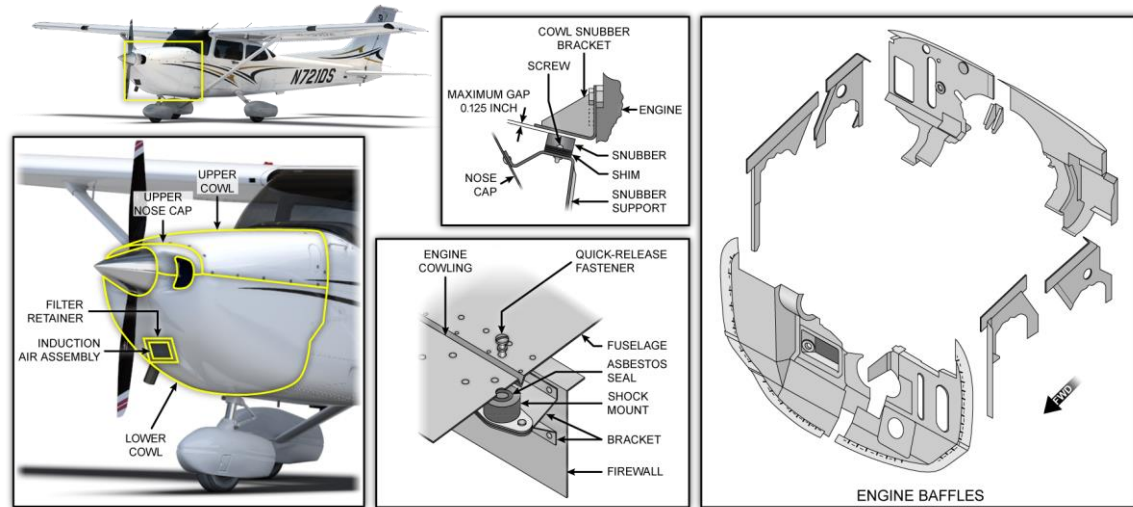
Cowl

DESCRIPTION (71-10-00)

The engine cowl consists of upper and lower sheet metal halves and upper and lower composite nose pieces.

Cowling shock mounts needs shimmed when installed. The maximum gap is .125 between the shock mount and the cowling.

The Shock mount (snubber) is design to absorb the vibrations from the engine and prevent them from transferring to the airframe. Thus they do fatigue and the rubber cracks out.



MAINTENANCE PRACTICES (71-10-00)

The cowl attaches to the shock mounts using quick release, quarter turn fasteners to allow for easy removal and installation.

The nose pieces are attached to each other using screws and nutplates.

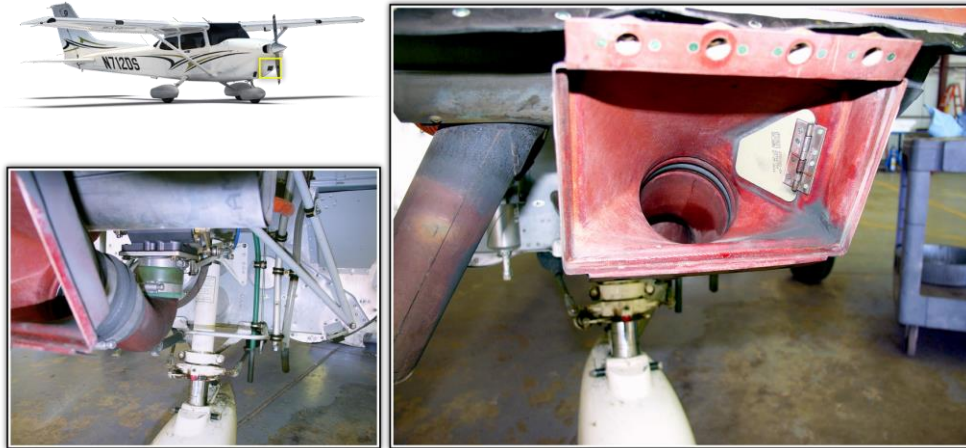
Refer to Cessna's Maintenance Manual Section 71-10-00 Figure 201 for removing and installing the cowls.

Refer to Cessna's Maintenance Manual Section 71-10-00 Figure 202 replacing the mount and adjusting the shims

For repair procedures to the cowl, refer to the Structural Repair Manual for repairing the cowl.

Air Induction System

DESCRIPTION (71-60-00)



Ram air to the engine goes into the induction air box through the induction filter in the forward part of the lower engine cowl. From the induction air box, the air is pointed to the inlet of the fuel/air control unit and through the intake runners of the related cylinders.

MAINTENANCE PRACTICES (71-60-00)

Refer to Cessna's Maintenance Manual Section 71-60-00 Figure 201 for the removal and installation of the air induction system components.

The induction air filter keeps dust and dirt from the induction system and must be kept in a good clean condition. More engine wear is caused through the use of a dirty or damaged air filter than is usually thought.

The frequency with which the filter must be removed, examined and cleaned will be given by aircraft conditions of operation.

The general practice is to remove, examine and clean the filter at least every 100 hours of engine operation time, and more frequently if given by the conditions of operation. Under very dusty conditions, daily servicing of the filter is recommended

MAINTENANCE PRECAUTIONS (71-60-00)**NOTE****FILTER ELEMENT CLEANING**

Be careful when the filter element is cleaned with compressed air.

**NOTE****FILTER CASE**

Arrows on the filter case show the direction of normal airflow.

**NOTE****FACE SCREEN**

The bond holds the paper pleats to the face screen and, if the bond is broken, the pleats are free to move and decrease filter operation. A face screen that is loose or has gaps shows that the bond is broken and the filter element must be replaced.

MAINTENANCE PRECAUTIONS (71-60-00)**SOLVENTS & CLEANING FLUIDS**

Do not use solvent or cleaning fluids to wash the filter. Use only a water and household detergent solution when washing the filter.

**FILTER ASSEMBLY**

The filter assembly can be cleaned with compressed air a maximum of 30 times or it can be washed a maximum of 20 times.

FILTER REPLACEMENT

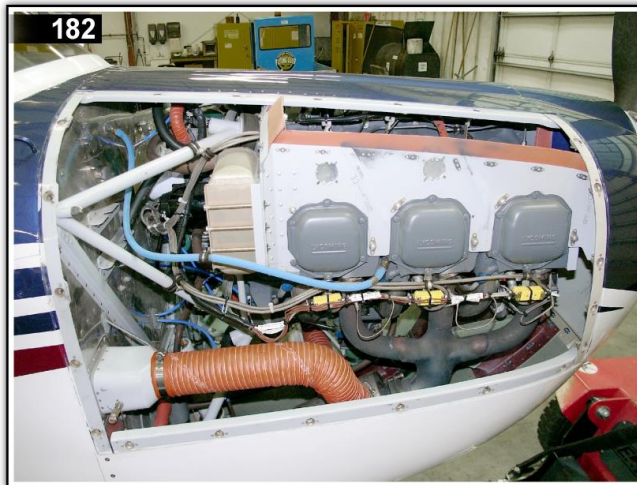
A new filter must be installed at 500 hours of engine operation or one year, whichever occurs first. A new filter must be installed if the filter is damaged.

FILTER PANELS

The panels of the filter can have distortion when wet, but they will go back to their normal shape when dry.

Model Differences

182 DIFFERENCES - ENGINE - DESCRIPTION AND OPERATION (71-00-01)



The 182T uses the Textron Lycoming IO-540-AB1A5. This engine is a direct-drive, six-cylinder, fuel-injected, horizontally-opposed, air-cooled engine.

The T182T uses TIO-540-AK1A, a turbocharged version of the same design.

The cylinders, numbered from front to rear, are staggered to permit a separate throw on the crankshaft for each connecting rod.



The right front cylinder is number 1 and the other cylinders on the right side of the engine are identified by odd numbers 3 and 5.

The left front cylinder is number 2 and the other cylinders on the left side are identified as 4 and 6.

182 DIFFERENCES – DESCRIPTION AND OPERATION - ENGINE SPECS IO-540-AB1A5

Cessna's Maintenance Manual Section 71-00-01, Table 1 provides the engine information pertaining to the IO-540-AB1A5 and the TIO-540-AK1A engine.

Refer to the Lycoming and Cessna Engine Manuals for more information pertaining to the IO-540_AB1A5 and the TIO-540-AK1A engine.

Table 1. IO-540-AB1A5 Technical Description

Rated Horsepower at 2400 RPM	230
Number of Cylinders	6 Horizontally Opposed
Displacement	541.5 Cubic Inches (8.875 l)
Bore	5.125
Stroke	4.375
Compression Ratio	8.5:1
Firing Order	1-4-5-2-3-6
Magnetos:	
Right Magneto	Slick Model No. 6351 (fires at 23° BTDC)
Left Magneto	Slick Model No. 6351 (fires at 23° BTDC)
Spark Plugs	18MM
Torque:	420 Inch-pounds
Valve Rocker Clearance (hydraulic tappets collapsed)	0.028 to 0.080 inch
Fuel Injector	RSA-5AD1
Tachometer	Mechanical Drive
Oil Capacity	9.0 Quarts (8.52 l)
Oil Pressure	
Minimum Idling	20 PSI
Normal	50 to 90 PSI
Maximum	115 PSI
Oil Temperature	
Normal	100 to 245°F (38 to 118°C)
Maximum	245°F (118°C)
Dry Weight - with accessories	382 Lbs

Table 2. TIO-540-AK1A Technical Description

Rated Horsepower at 2400 RPM	235
Number of Cylinders	6 Horizontally Opposed
Displacement	541.5 Cubic Inches (8.875 l)
Bore	5.125
Stroke	4.375
Compression Ratio	8.0:1
Firing Order	1-4-5-2-3-6
Magnetos:	
Right Magneto	Slick Model No. 6361 (fires at 20° BTDC)
Left Magneto	Slick Model No. 6361 (fires at 20° BTDC)
Spark Plugs	18MM
Torque:	420 Inch-pounds
Valve Rocker Clearance (hydraulic tappets collapsed)	0.028 to 0.080 inch
Fuel Injector	RSA-5AD1
Tachometer	Mechanical Drive
Oil Capacity	9.0 Quarts (8.52 l)
Oil Pressure	
Minimum Idling	20 PSI
Normal	50 to 90 PSI
Maximum	115 PSI
Oil Temperature	
Normal	100 to 245°F (38 to 118°C)
Maximum	245°F (118°C)
Dry Weight - with accessories	472 Lbs

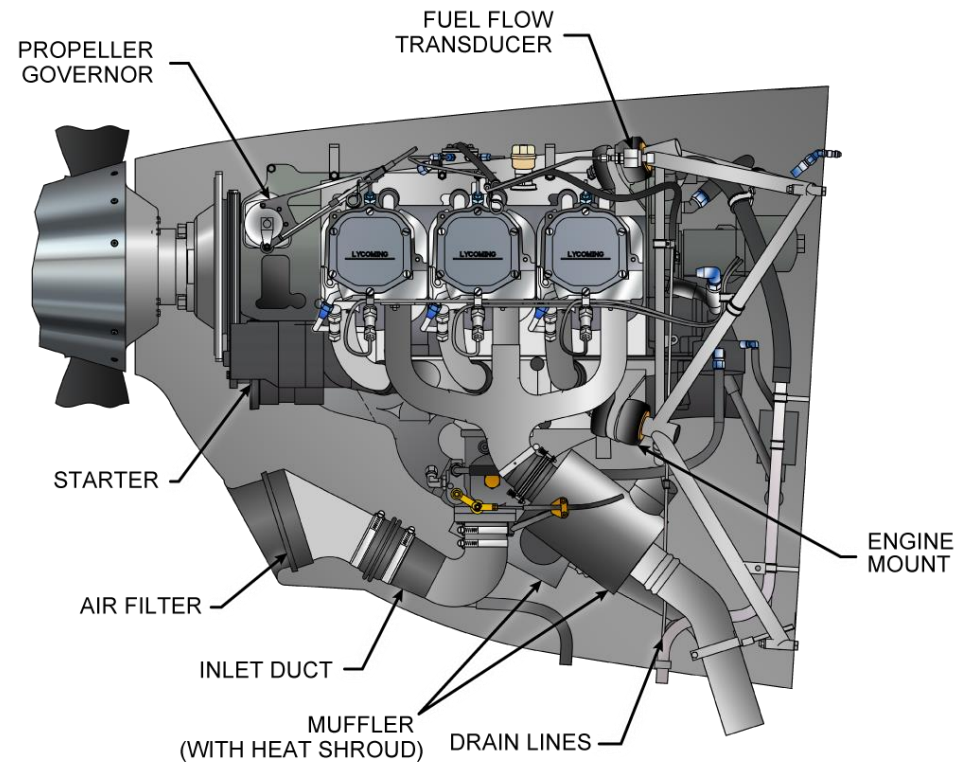
206 DIFFERENCES - ENGINE SPECS IO-540-AC1A5 &TIO-540-AJ1A

The engine used on the 206 is the Textron Lycoming IO-540-AC1A5 and the turbocharged TIO-540-AJ1A engine.

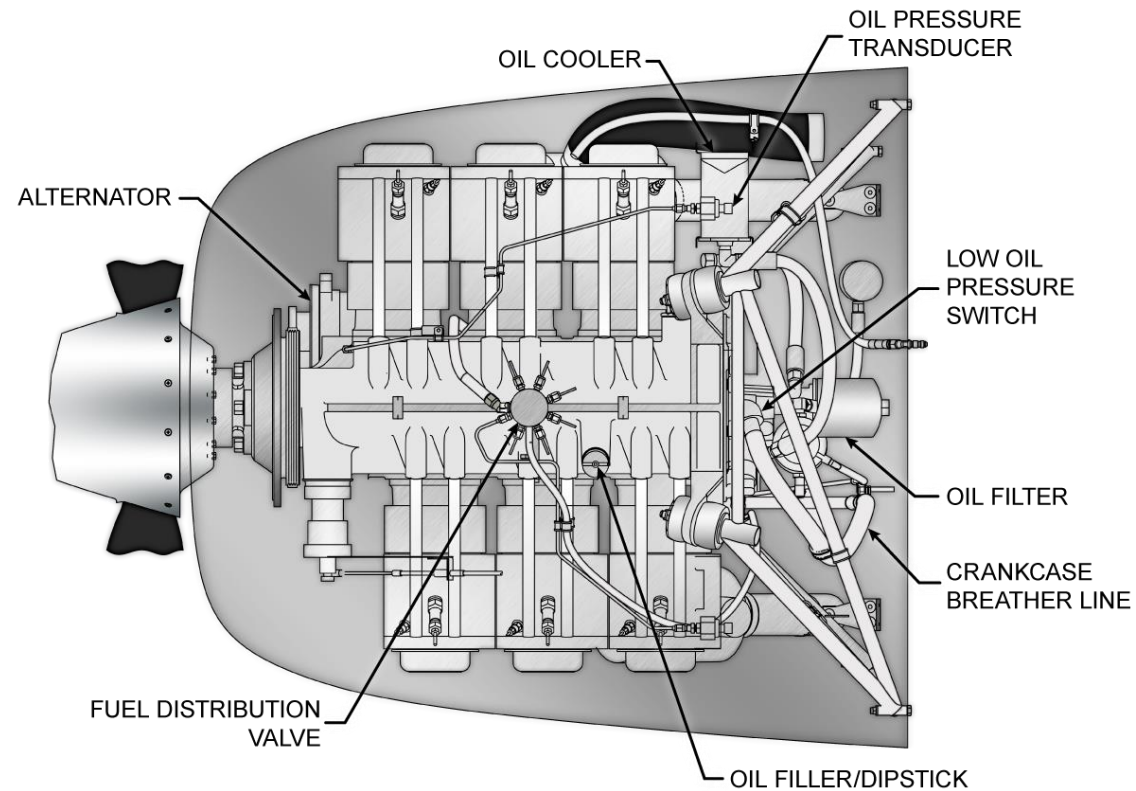
Cessna’s Maintenance Manual Section 71-00-01 Table 1 provides the engine information pertaining to the IO-540-AC1A5 and the TIO-540-AJ1A engine.

Refer to the Lycoming and Cessna Engine Manuals for more information pertaining to the IO-540-AC1A5 and the TIO-540-AJ1A engine.

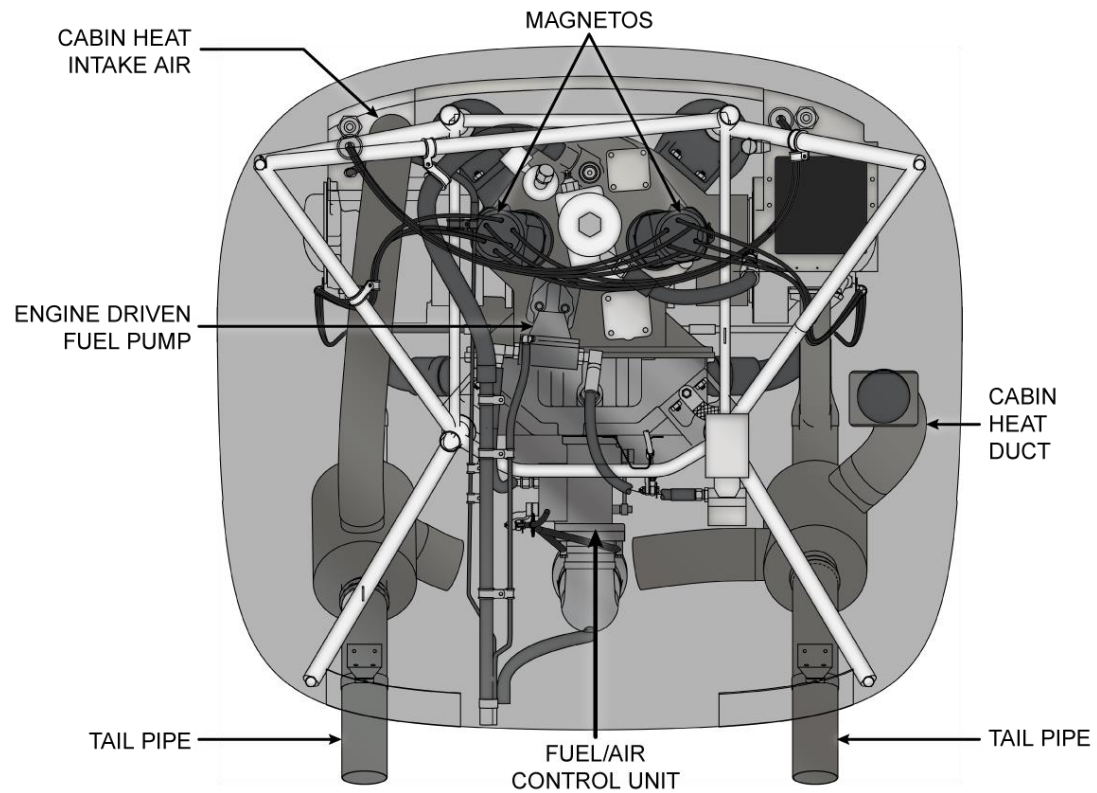
Table 1. IO-540-AC1A5 Technical Description	
Rated Horsepower at 2700 RPM	300
Number of Cylinders	6 Horizontally Opposed
Displacement	541.5 Cubic Inches (7.87 l)
Bore	5.125
Stroke	4.376
Compression Ratio	8.9:1
Firing Order	1-4-5-2-3-6
Magnetos:	
Right Magneto	Slick Model No. 6351 (fires at 20° BTDC)
Left Magneto	Slick Model No. 6351 (fires at 20° BTDC)
Spark Plugs	18MM
Torque	420 Inch-pounds
Valve Rocker Clearance (hydraulic tappets collapsed)	0.028 to 0.080 inch (0.7 to 2.0 mm)
Fuel Injector	PAC RSA-10ED1
Tachometer	Mechanical Drive
Oil Capacity	11.0 Quarts (10.41 l)
Oil Pressure	Minimum 25 PSINormal 55 to 95 PSI Maximum 115 PSI
Oil Temperature	Normal 165 to 200°F (74 to 93.3°C)Maximum 245°F (118.3°C)
Dry Weight - with accessories	454 Lbs (205.93 kg)
Table 1: TIO-540-AJ1A Technical Description	
Rated Horsepower at 2500 RPM	310
Number of Cylinders	6 Horizontally Opposed
Displacement	541.5 Cubic Inches (8.87 l)
Bore	5.125
Stroke	4.375
Compression Ratio	7.3:1
Firing Order	1-4-5-2-3-6
Magnetos:	
Right Magneto	Slick Model No. 6361 (fires at 20° BTDC)
Left Magneto	Slick Model No. 6361 (fires at 20° BTDC)
Spark Plugs	18MM
Torque	420 Inch-pounds
Valve Rocker Clearance (hydraulic tappets collapsed)	0.028 to 0.080 inch (0.7 to 2.0 mm)
Fuel Injector	PAC RSA-10ED1
Tachometer	Mechanical Drive
Oil Capacity	11.0 Quarts (10.41 l)
Oil Pressure	Minimum 25 PSINormal 55 to 95 PSI Maximum 115 PSI
Oil Temperature	Normal 165 to 200°F (74 to 93.3°C)Maximum 245°F (118.3°C)

182 DIFFERENCES - ENGINE - DESCRIPTION (71-00-01)

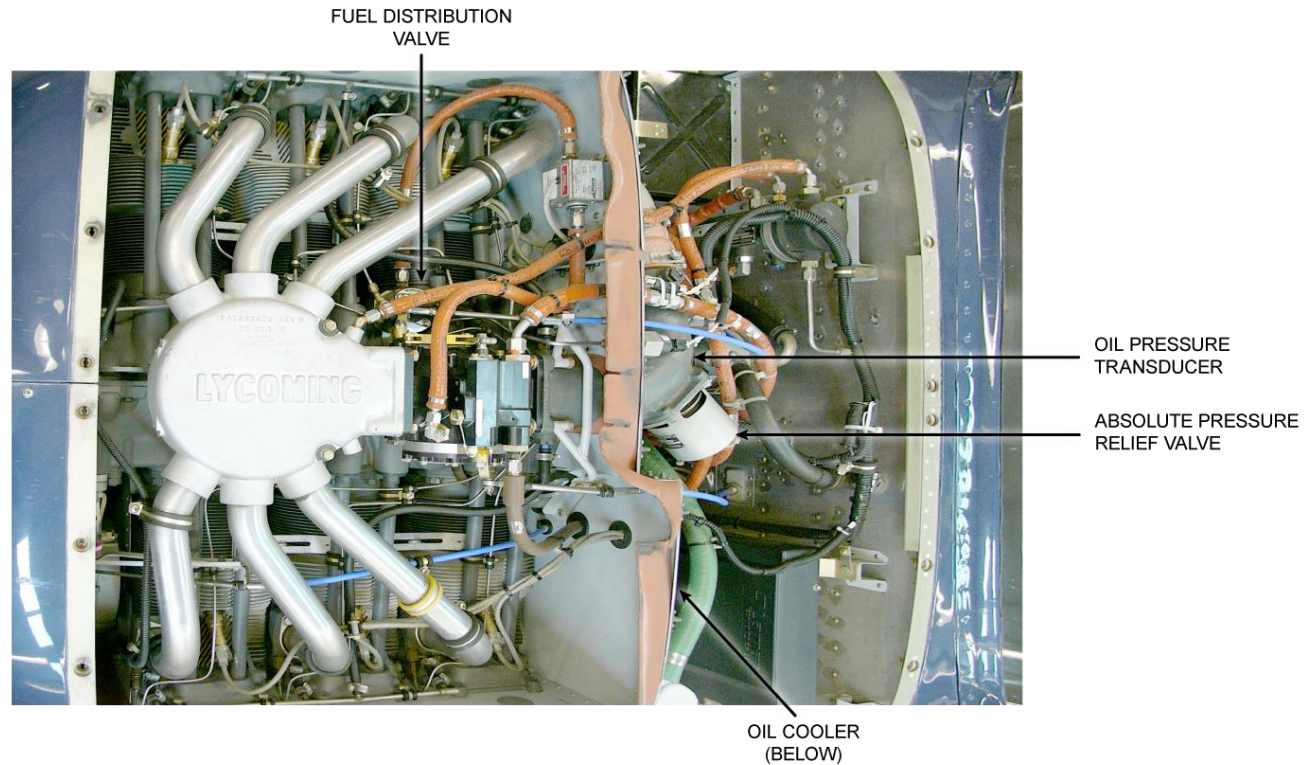
The component locations on the ID-540-AB1A5 and TIO-540-AK1A differ from components on the IO-360-L2A used on the 172.

182 DIFFERENCES - ENGINE - DESCRIPTION (71-00-01)

Identify 182 component locations for parts that differ from the 172.

182 DIFFERENCES - ENGINE - DESCRIPTION (71-00-01)

Identify 182 component locations for parts that differ from the 172.

206 DIFFERENCES - ENGINE - DESCRIPTION (71-00-01)

The Textron Lycoming IO-540-AC1A5 is a direct-drive, six-cylinder, fuel-injected, horizontally-opposed, air-cooled engine.

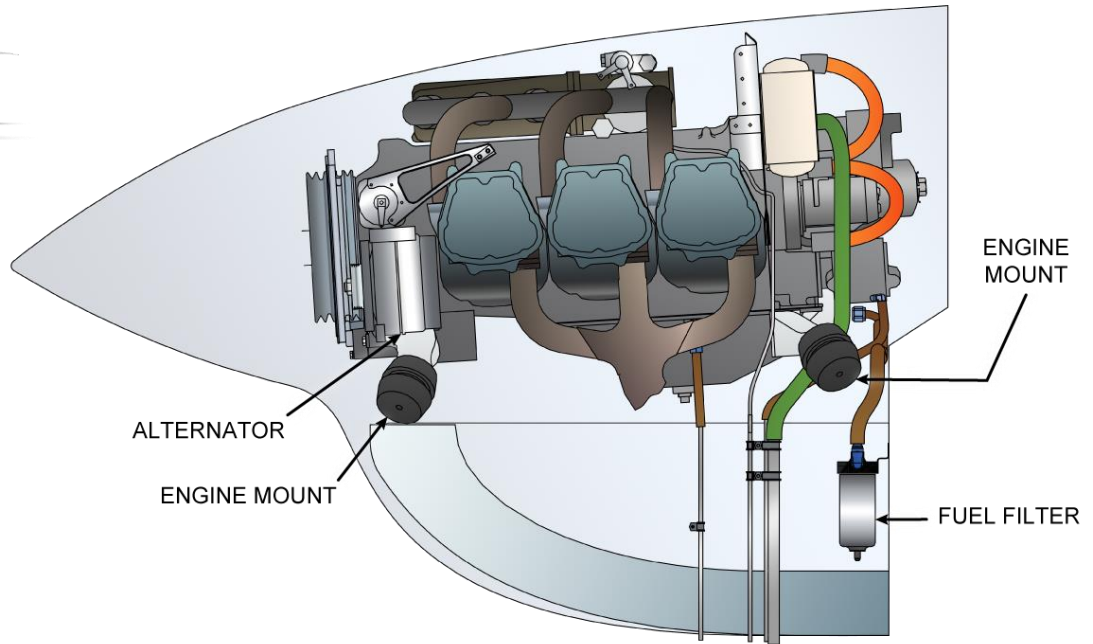
The TIO-540-AJ1A is a turbocharged version of the same design.

The cylinders, numbered from front to rear, are staggered to permit a separate throw on the crankshaft for each connecting rod.

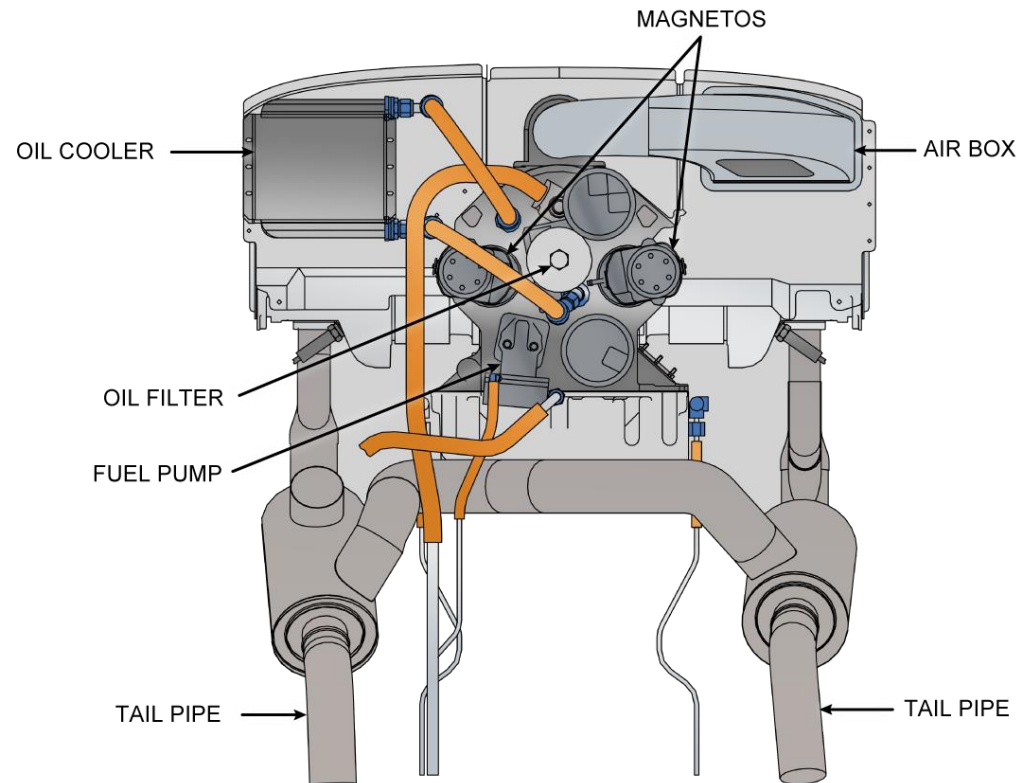
The right front cylinder is number 1 and the other cylinders on the right side of the engine are identified by odd numbers 3 and 5.

The left front cylinder is number 2 and the other cylinders on the left side are identified as 4 and 6.

206 DIFFERENCES - ENGINE - DESCRIPTION (71-00-01)

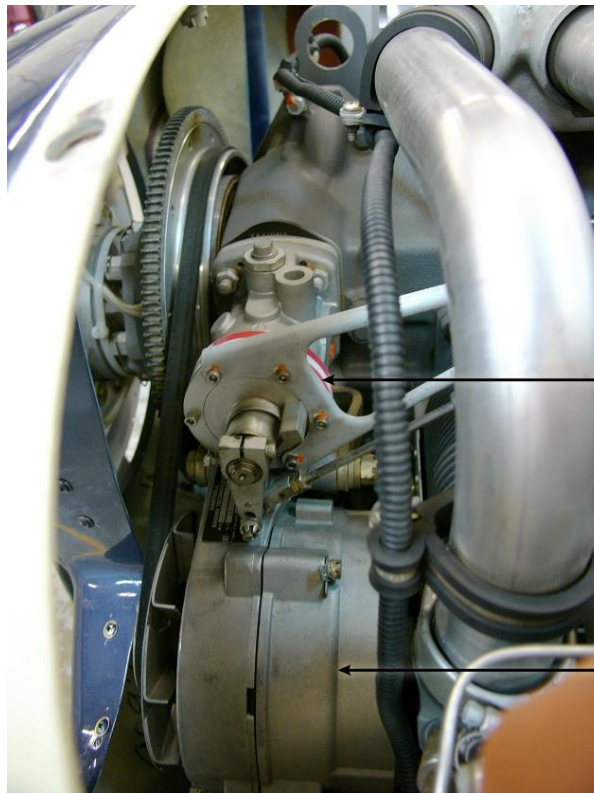


Identify 206 component locations for parts that differ from the 172.

206 DIFFERENCES - ENGINE - DESCRIPTION (71-00-01)

Identify 206 component locations for parts that differ from the 172.

206 DIFFERENCES - ENGINE - DESCRIPTION (71-00-01)



PROPELLOR
GOVERNOR

ENGINE MOUNT

ALTERNATOR

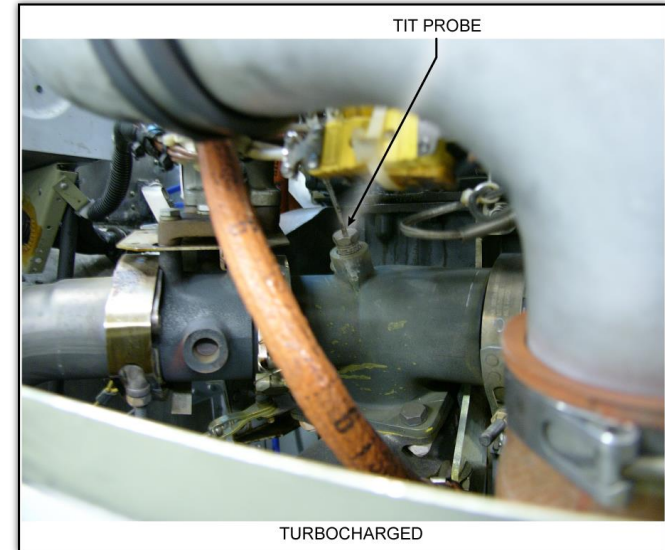
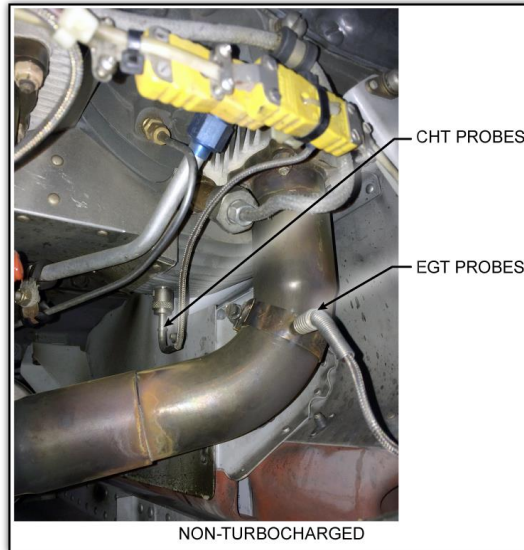


206 DIFFERENCES - ENGINE – MAINTENANCE PRACTICES (71-00-01)

For engine removal and installation follow the steps outlined in 71-00-01 of the maintenance manual.

Engine Removal Differences

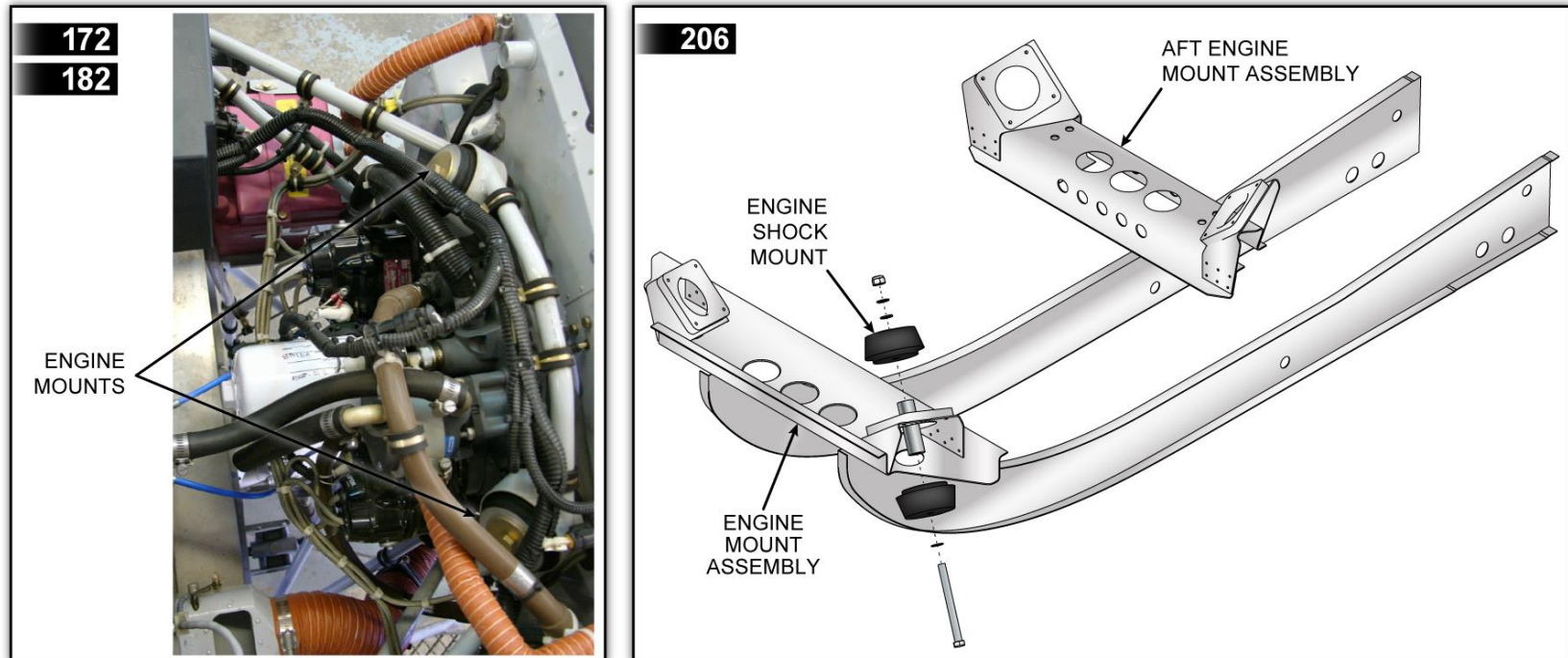
- For airplanes with standard avionics, disconnect the electrical connector from the EGT Probe (on non-turbocharged airplanes) or disconnect the electrical connector from the TIT Probe (on turbocharged airplanes) and then disconnect the electrical terminal from the CHT probe.
- For airplanes with Garmin G1000 avionics, disconnect the EGT and the CHT thermocouple connectors.



Engine and Mount Installation Differences.

- For airplanes with standard avionics, connect the electrical connector to the EGT Probe (on non- turbocharged airplanes) or connect the electrical connector to the TIT Probe (on turbocharged airplanes).
- For airplanes with standard avionics, connect the electrical terminal to the CHT probe.
- For airplanes with Garmin G1000 avionics, connect the EGT and the CHT thermocouple connectors.

206 DIFFERENCES - ENGINE MOUNT - MAINTENANCE PRACTICES (71-20-00)

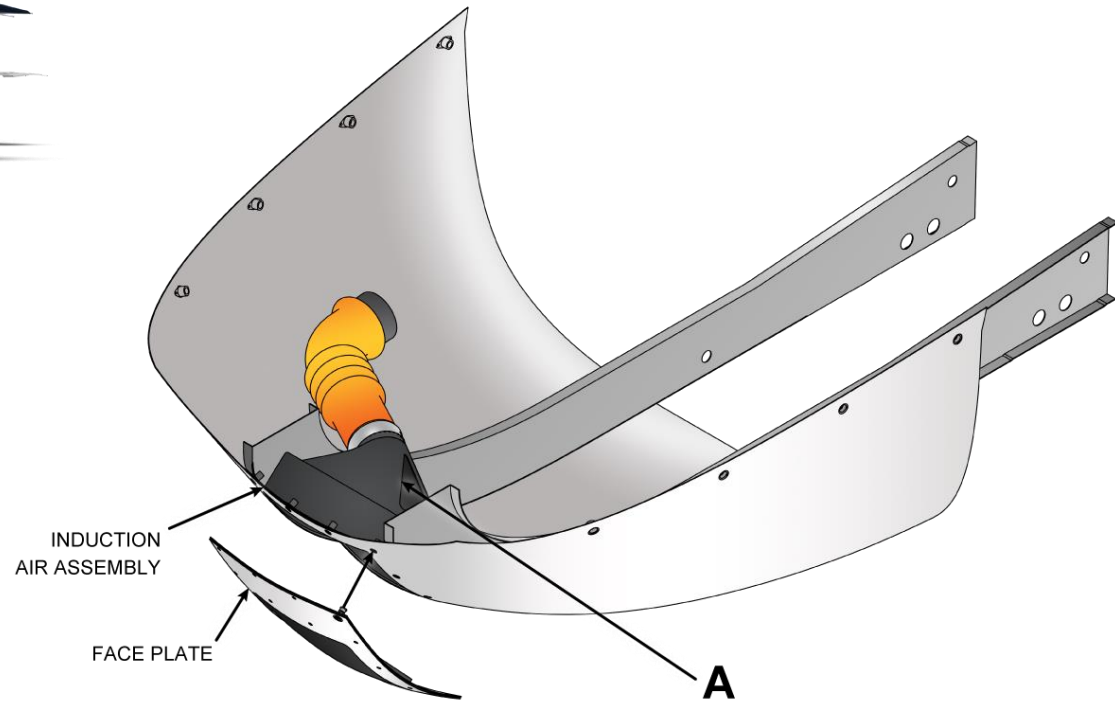
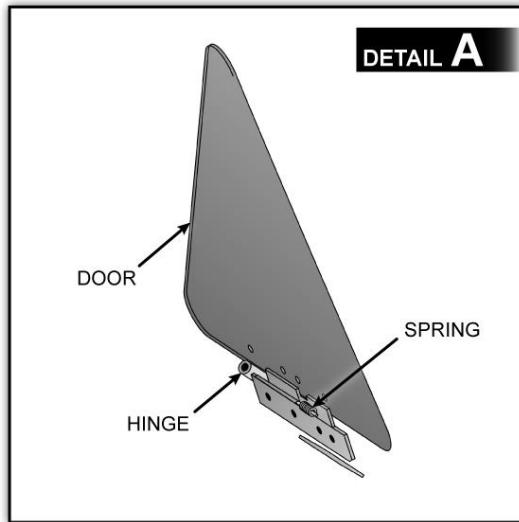


The 206 engine mount assembly uses four rubber mounts to isolate engine noise and vibration. (Left photo)

The shock mounts for the 206 (Left photo) connect the engine to the engine mount assembly and are made of rubber and metal construction and assembled in a sandwich to isolate noise and vibration from the cabin area. Nuts should be torqued from 450 to 500 inch-pounds upon installation.

For the 172 and the 182 - The dynafocal engine mount is made of 4130 steel and uses four rubber mounts to isolate engine noise and vibration from the engine mount.

The mount is attached to the fuselage at four points on the firewall using bolts, washers and nuts. (Right photo)

206 DIFFERENCES - INDUCTION AIR FILTER SYSTEM - MAINTENANCE PRACTICES (71-60-00)

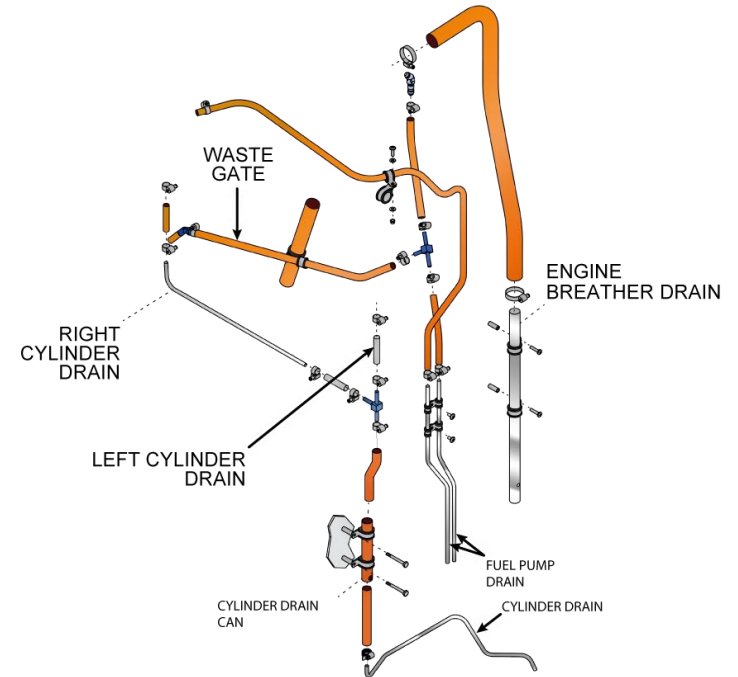
Ram air to the engine enters the induction air box through the induction air filter, located on the upper right side of the engine.

From the induction air box, the air is directed to the inlet of the fuel/air control unit and, ultimately, through individual intake runners into their respective cylinders.

206 DIFFERENCES - ENGINE DRAIN SYSTEM- MAINTENANCE PRACTICES (71-70-00)

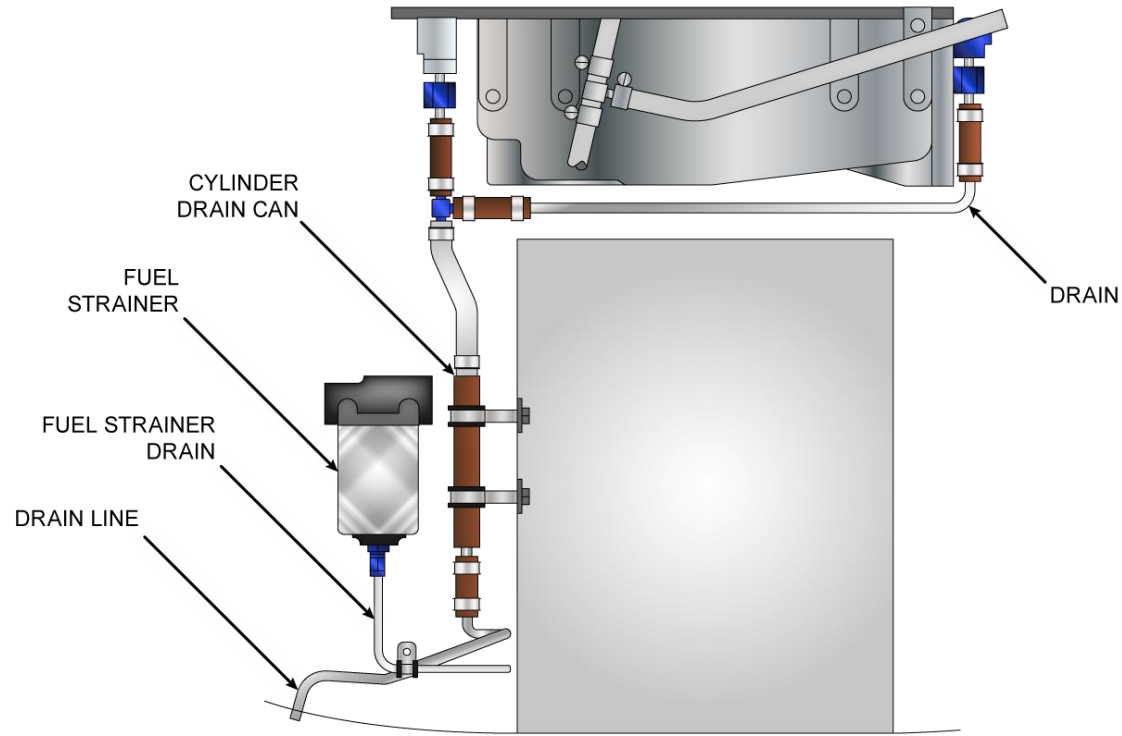
Different components in the engine compartment have drain lines to let fluid and/or fumes escape.

- The drain lines are attached with hose clamps and fittings.
- The routing of the drain lines are on the left and right sides of the lower cowl.
- Line removal and installation have clamps, fittings and hoses that are connected together to make the routing.
- You must examine the drain lines to make sure of the correct routing and condition when you remove and install the components.



- Some airplanes have an optional cylinder drain can installed. The cylinder drain can is designed to catch the fuel that drains from the engine cylinders at shut down.
- If a cylinder drain can has not been installed and you want to install one, you must obtain MK206-71-02 for instructions.

206 DIFFERENCES - ENGINE DRAIN SYSTEM- MAINTENANCE PRACTICES (71-70-00)



ATA73 - Fuel Injection System

Overview

LESSON OBJECTIVES

- Provide a simple description of the whole subject, using common words and examples, using typical terms and identify safety precautions related to the airframe, its systems and power plant
- Identify aircraft manuals, maintenance practices important to the airframe, its systems and power plant
- Define the general layout of the fuel injection system
- Define the general layout and characteristics of the fuel injection system
- Identify special tooling and test equipment used with the fuel injection system

OVERVIEW

Cessna's Maintenance Manual Chapter 73 provides a description of the RSA Fuel Injection system used on the IO- 360-L2A.



Refer to the Model Series Structural Repair Manual for repair of structural members and repair techniques used throughout the airplane.

General Information

- The fuel injection system is a low pressure, multi nozzle, continuous flow system which injects raw fuel into the engine cylinder heads.
- The injection system applies the principle of measuring engine air consumption to control fuel flow.
- More air flow through the venturi will result in more fuel being delivered to the engine, and less air flow through the venturi results in a decreased flow of fuel to engine.

This section will cover the following procedures:

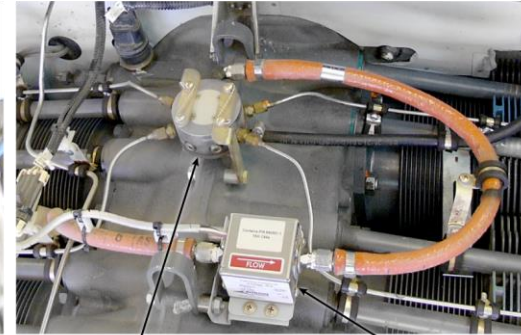
- Fuel Injection Troubleshooting
- Fuel Injection Maintenance Practices
- Fuel indicator Maintenance practices



FUEL AIR CONTROL UNIT



MECHANICAL FUEL PUMP



FUEL DISTRIBUTION VALVE

PRESSURE TRANSDUCER

Fuel Injection System Description and Operation

DESCRIPTION (73-00-01)

Fuel from the wing tanks supplies fuel to the fuel injection system through a series of lines, valves and pumps.

From the engine-driven fuel pump, fuel enters the fuel/air control unit, passes through the fuel distribution valve, and is routed to individual injection nozzles at each cylinder.

For a schematic of the entire fuel system, refer to Chapter 28, Fuel Storage and Distribution - Description and Operation, Figure 1.

The Fuel Injection system consist of the following components:

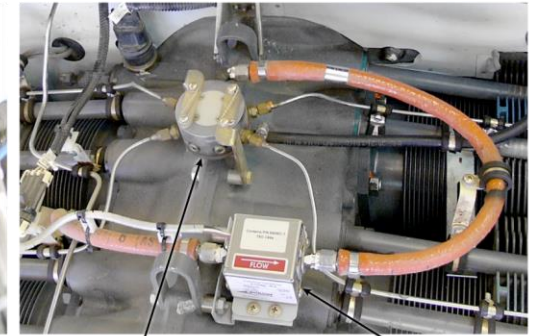
- Fuel/Air Control Unit - Also known as the 'servo regulator,' is located on the underside of the engine and integrates the functions of measuring airflow and controlling fuel flow. The control unit consists of an airflow sensing system, a regulator section and a fuel metering section.
- Fuel Distribution Valve - Also known as a 'spider' or a flow divider, is located on top of the engine and distributes fuel evenly to the four cylinders once it has been regulated by the fuel/air control unit. The fuel distribution valve attaches to the fuel distribution valve, which feeds into a pressure transducer. This transducer measures fuel pressure and translates that reading into fuel flow at the cockpit indicator.
- Injection Nozzles (4 total) - Each cylinder contains an injection nozzle, also known as an air bleed nozzle or a fuel injector. Nozzle incorporates a calibrated jet that determines, in conjunction with fuel pressure, the fuel flow entering each cylinder. Fuel entering the nozzle is discharged through the jet into an ambient air pressure chamber within the nozzle assembly. The nozzle assembly also contains a calibrated opening which is vented to the atmosphere, and allows fuel to be dispersed into the intake portion of the cylinder in an atomized, cone-shaped pattern.



FUEL AIR CONTROL UNIT



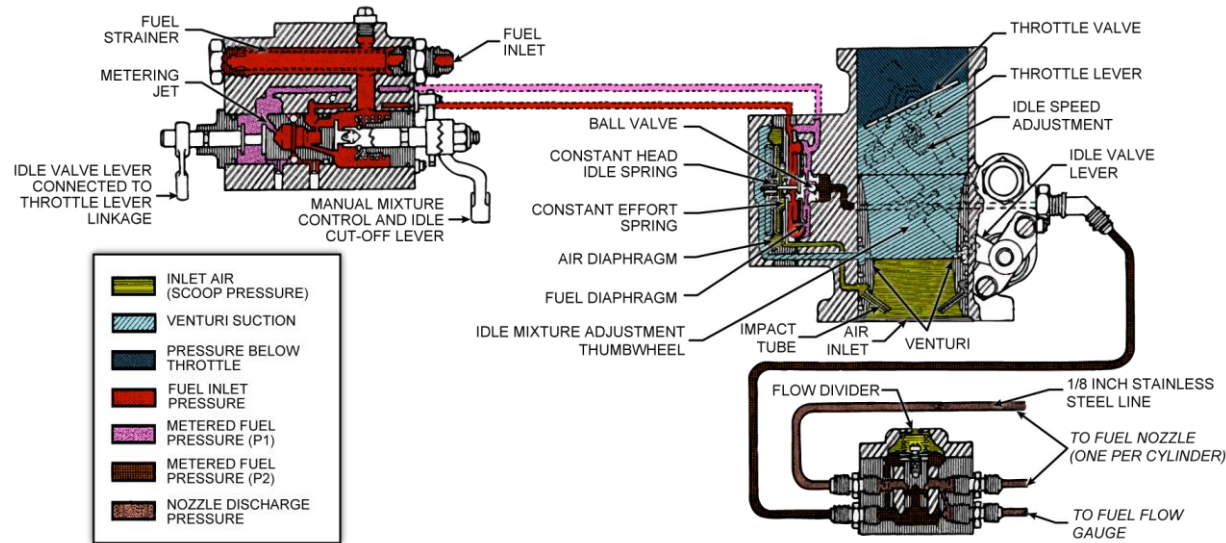
MECHANICAL FUEL PUMP



FUEL DISTRIBUTION VALVE

PRESSURE TRANSDUCER

FUEL INJECTION SYSTEM – OPERATION (73-00-01)



The wing tanks store and deliver fuel to the fuel injection system through a series of lines, valves and pumps.

From the engine-driven fuel pump, fuel enters the fuel/air control unit, passes through the fuel distribution valve, and is routed to individual injection nozzles at each cylinder.

Refer to Cessna's Model 172 Maintenance Manual Chapter 28 Fuel Storage and Distribution - Description and Operation, Figure 1 for a schematic of the entire fuel system.

The fuel/air control unit is the heart of the injection system and occupies the position ordinarily used by the carburetor at the engine intake manifold inlet.

Operation of the fuel injection system is based on the principle of measuring airflow and using the airflow signal to operate a servo valve. The accurately regulated fuel pressure established by the servo valve, when applied across the fuel control system, makes fuel flow proportional to airflow.

The fuel/air control unit is comprised of an integrated airflow sensing system, a regulator section and a fuel metering section.

FUEL INJECTION SYSTEM – OPERATION (73-00-01)

The Airflow Sensing System consists of a throttle body which houses the air throttle valve, the venturi, and servo valve and fuel control unit.

- Differential pressure between impact air and the venturi throat pressure is a measurement of the velocity of the air entering the engine.
- Pressures are vented through drilled channels in the throttle body to both sides of an air diaphragm and create a force across the diaphragm. A change in air throttle position or a change in engine speed will change the air velocity, which in turn changes the force across the air diaphragm.

The Regulator Section contains the air diaphragm mentioned in the preceding paragraph and a fuel diaphragm.

- Fuel inlet pressure is applied to one side of the fuel diaphragm.
- The other side of the fuel diaphragm is exposed to fuel that has passed through the metering jet (metered fuel pressure).
- The differential pressure across the fuel diaphragm is referred to as the fuel metering force.
- The air metering force applied to the air diaphragm is transmitted through the regulator stem and tends to move the ball valve in the opening direction.
- The fuel metering force across the fuel diaphragm acts to oppose the air metering force and tends to close the ball valve. Because the air forces are very low in the idle range,

a constant head idle spring is provided to maintain an adequate fuel metering force at low rpm.

- As the air metering force increases, the spring compresses until the spring retainer touches the air diaphragm and acts as a solid member.
- The constant effort spring produces a force which provides a smooth transfer from idle to low power cruise operation. Whenever the air metering, fuel metering and spring forces are balanced, the ball valve maintains a fixed position.

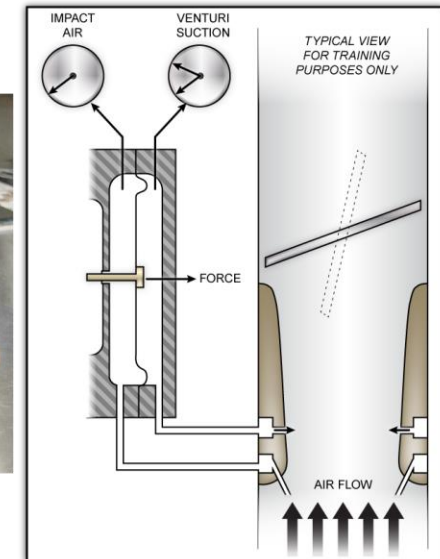
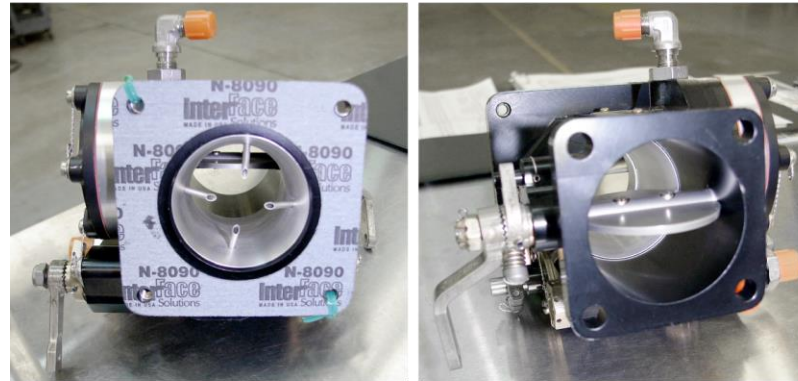
The Fuel Metering Section is contained within the throttle body casting and consists of an inlet fuel screen, a rotary idle valve and a rotary mixture valve. Both idle speed (closed throttle position) and idle mixture (relationship between throttle position and idle valve position) may be adjusted externally to meet individual engine requirements.

- Idle valve is connected to the throttle valve by means of an external adjustable link and controls fuel flow through the low speed range of operation and is adjustable to obtain good idling characteristics without affecting fuel metering in the high power range.
- Mixture control valve gives full rich mixture on one stop and a progressively leaner mixture as it is moved toward idle cutoff.
- The full rich stop defines sea level requirements and the mixture control provides for altitude leaning

FUEL SERVO INTERNAL AIRFLOW (73-00-01)

The Fuel Injection Systems meters fuel in direct ratio to the volume of air being consumed by the engine at any given time, which is accomplished by sensing Venturi suction and impact air pressures in the throttle body.

Opening or closing the throttle valve results in a change in the volume of air being drawn into the engine, which results in a change in the velocity of air passing across the impact tubes and through the venturi.



When air velocity increases, the pressure at the impact tubes remains relatively constant depending upon the inlet duct configuration, air figure location, etc.

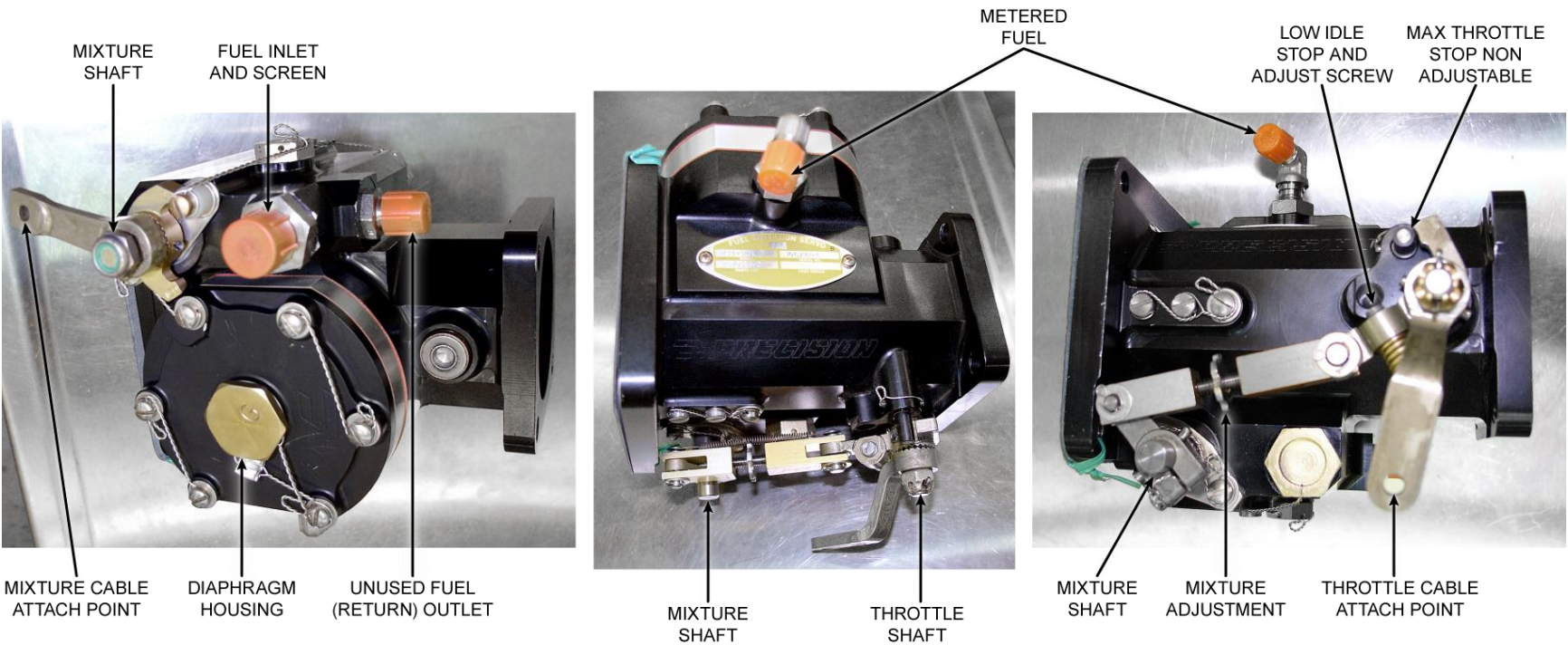
The pressure at the Venturi throat decreases. Which creates a differential (impact minus suction) used over the entire range of operation of the fuel injection system as a measurement of the volume of air consumption.

Reciprocating engines operate most efficiently in a very narrow range of air to fuel or fuel/air ratios.

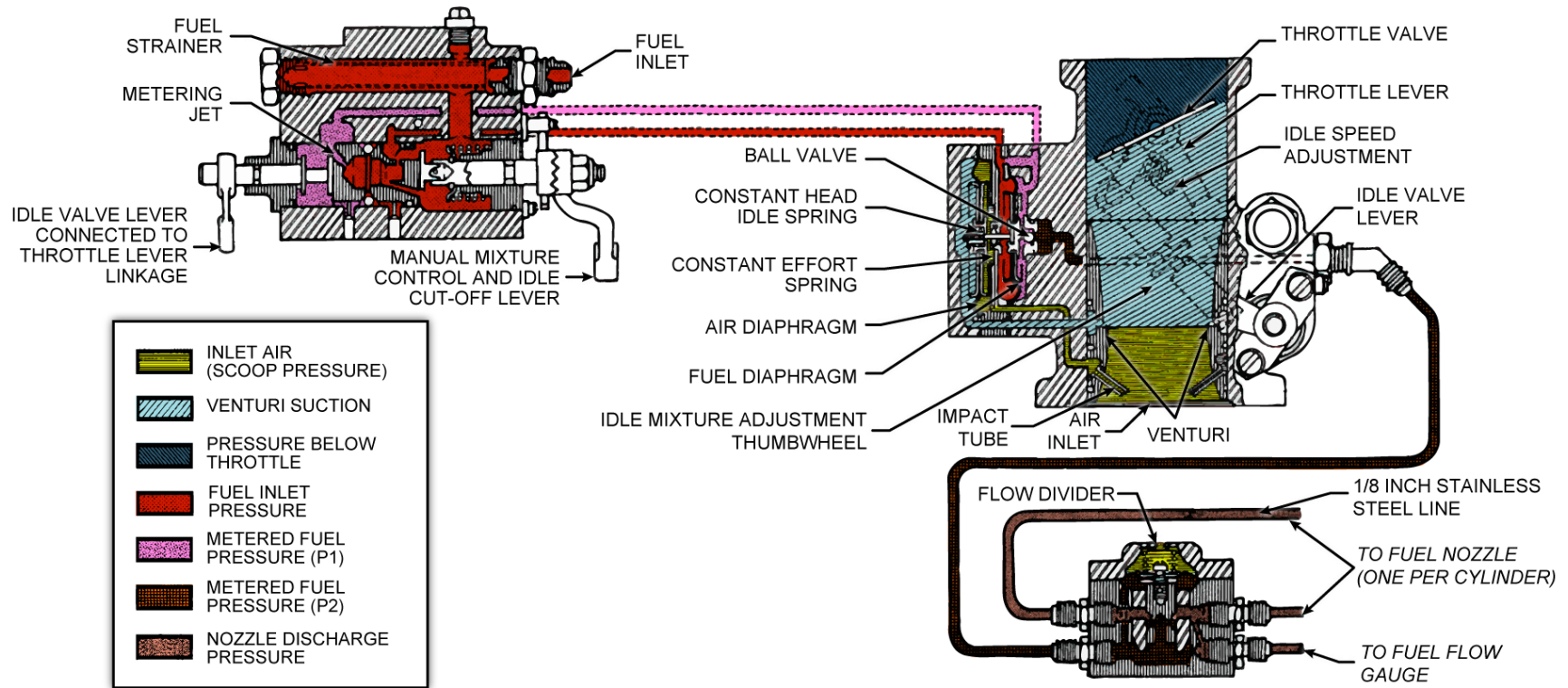
The injection system uses the measurement of air volume flow to generate a usable force which to regulate the flow of fuel to the engine in proportion to the amount of air being consumed.

This is accomplished by channeling the impact and Venturi suction pressures to opposite sides of a diaphragm.

FUEL SERVO EXTERNAL PARTS (73-00-01)



OPERATION - CRUISE CONDITION (73-00-01)



The two opposing forces (fuel and air differentials) are equal, and the regulator servo valve (which connects both diaphragms by a stem) is kept at a fixed position that allows discharge of just enough metered fuel to maintain pressure balance.

If the throttle is opened to increase power, air flow immediately increases. This results in an increase in the pressure differential across the air diaphragm to a theoretical value of "3". Immediate result is a movement of the regulator servo valve to the right.

This increase servo valve opening causes a decrease in pressure in the metered fuel chamber in the metered fuel chamber and an increase in fuel pressure differential across the main metering jet.

OPERATION - CRUISE CONDITION (73-00-01)

When the fuel differential pressure force reaches a value of "3" (equaling the air diaphragm force) , the regulator stops moving and the servo valve stabilizes at position, which will maintain the balance of pressure differentials, i.e., air and fuel equalizing 3.

The servo valve does not meter fuel. The servo valve controls pressure differential across the metering jet.

The engine delivers metered fuel through the fuel injector servo unit through a system that includes a flow divider and a set of discharge nozzles (one nozzle per cylinder).

The flow divider consists of the following components:

- Valve
- Sleeve
- Diaphragm Spring

The primary functions of the flow divider are:

- Assure equal distribution of metered fuel to the nozzles at and just above idle
- Provide isolation of each nozzle from all the others for clean engine shut down

Fuel discharge jet within the fuel nozzle is sized to accommodate the maximum fuel flow required at the rated horsepower

As the engine accelerates, it gradually moves the flow divider valve open against the spring pressure.

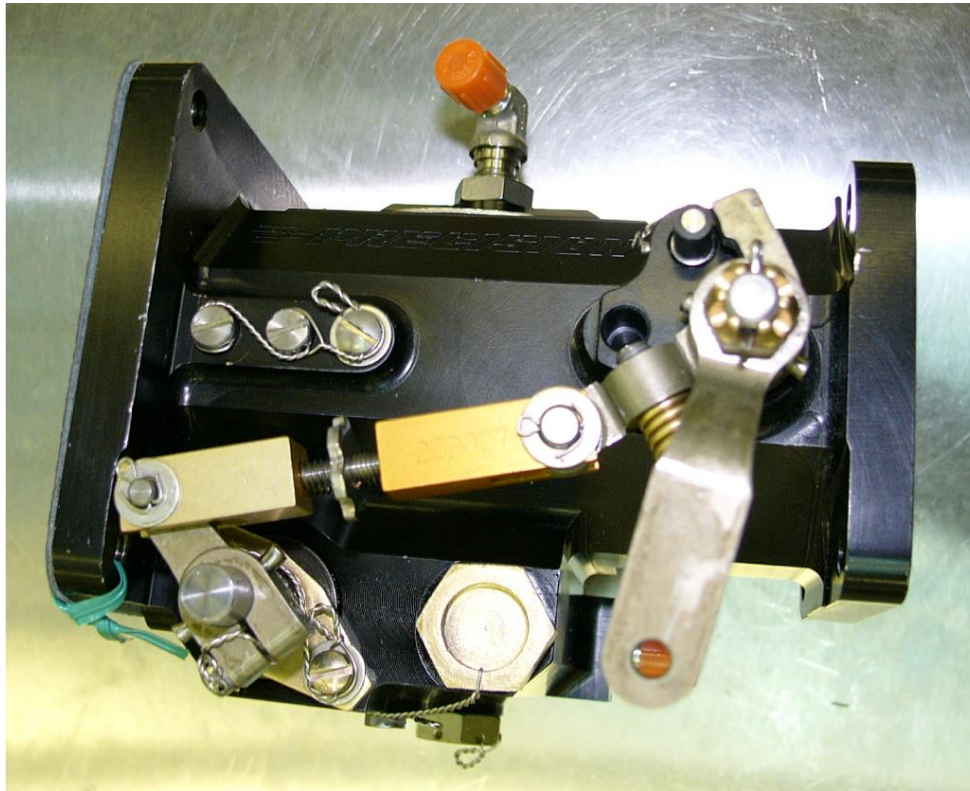
The "V" slot opening to each engine nozzle is greater than the area of the fuel restrictor in the nozzle.

The metered fuel is assumed by the nozzles.

Cylinders with restricted nozzles will be running lean and remaining cylinders will be rich.

Flow divider can be disassembled in the field for cleaning and inspection.

When connected to the tester, the flow divider valve should almost open immediately (1/2 psig)

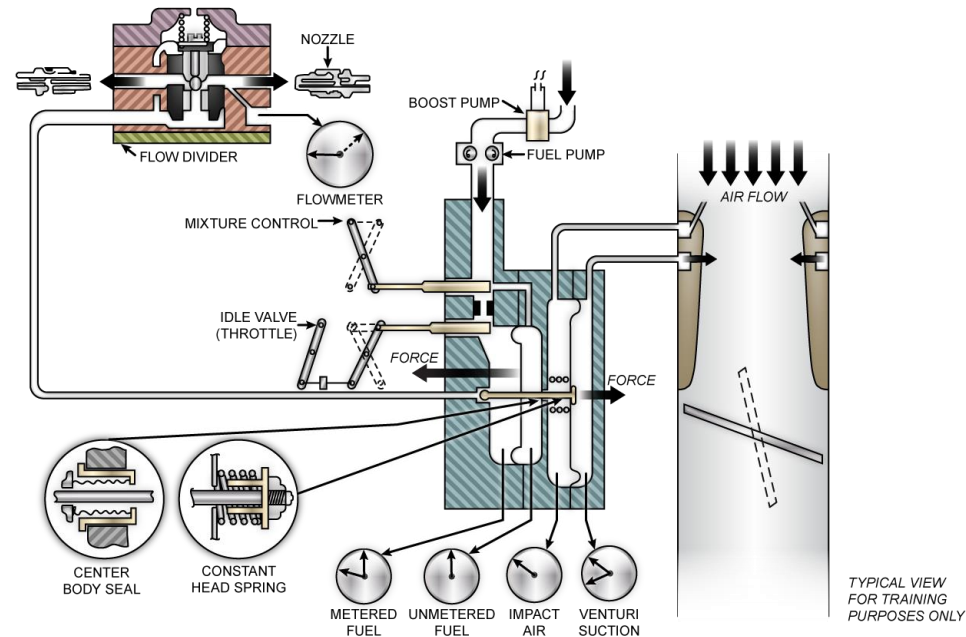
MIXTURE CONTROL (73-00-01)

The external idle valve allows the mechanic to properly tune for the proper idle mixture.

Idle mixture is correct when the engine gains approximately 25 to 50 rpm from its idle speed setting as the mixture control is placed in cut off.

The Venturi in the idle range, the air metering force is not sufficient to accurately control fuel flow (not enough negative Venturi pressure).

OPERATION - FUEL SYSTEM (73-00-01)



The manual mixture control (sliding valve) can be used by the pilot to effectively reduce the size of the metering jet. To maintain a differential pressure across the metering jet in proportion to the volume of air flow effective size.

Constant head idle spring augments the force of the air diaphragm in the idle and off idle range.

The idle spring assures that the regulator servo valve is open sufficiently to allow fuel being metered by the idle valve to flow out to the flow divider.

As airflow increases above idle the air diaphragm begins to move to the right in response to increasing air pressure differential. The idle spring will compress until its retainer guide contacts the diaphragm plate.

OPERATION - FUEL SYSTEM (73-00-01)

From this point, in terms of air flow, fuel flow, or power the constant head idle spring assembly is a solid member moving with the air diaphragm and exerts no force on its own.

The constant head spring is furnished on a selection of strengths so the overhaul technician can properly calibrate the injector for idle fuel flow and for the transition to servo regulator controlled fuel flow.

The transition from idle to servo regulator controlled fuel flow has to be supplemented with a constant effort spring. This spring assists the air diaphragm to move smoothly from the low air flow idle range to the high power range.

A center body seal assembly separates the air section from the fuel section.

Leakage through the center body seal causes extremely rich operation and poor cut off. The presence of raw fuel out the impact tubes indicates seal leakage.

OPERATION - FUEL NOZZLE (73-00-01)

Normally aspirated requires the simple nozzle assembly with the air bleed screen and shroud press in. The air bleed type nozzles discharge fuel inside the nozzle body into a vented chamber.

The exit is always exposed to manifold pressure, which on a normally aspirated engine is always less atmospheric, which results in air being drawn in through the air bleed and mixed with fuel in the fuel/air chamber to provide for fuel atomization. This is important to the idle and low power ranges where manifold pressure is weakest and bleed air intake is greatest.

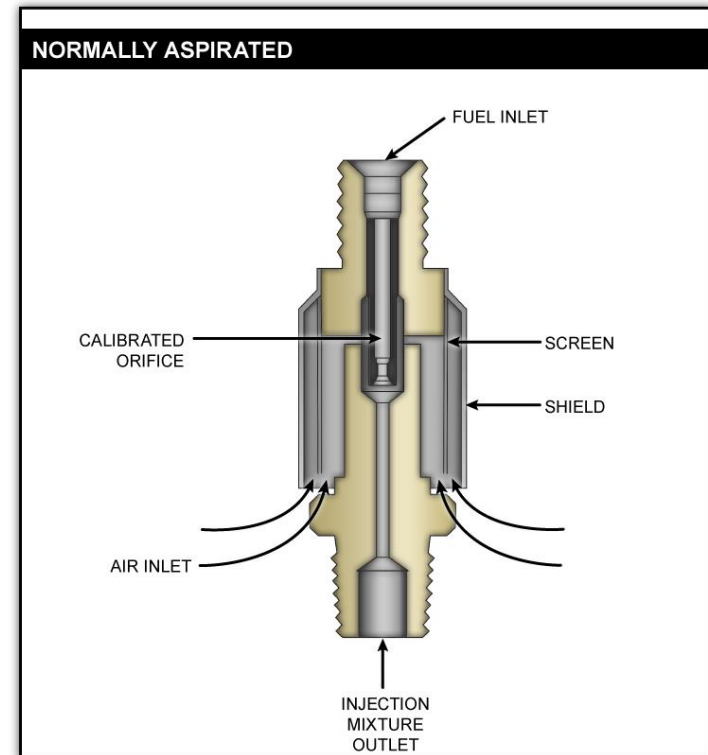
Plugged air bleed in this range allows the exit of the fuel restrictor to be exposed to manifold suction that effectively increases the pressure differential across the restrictor and causes an increase in fuel flow through that nozzle.

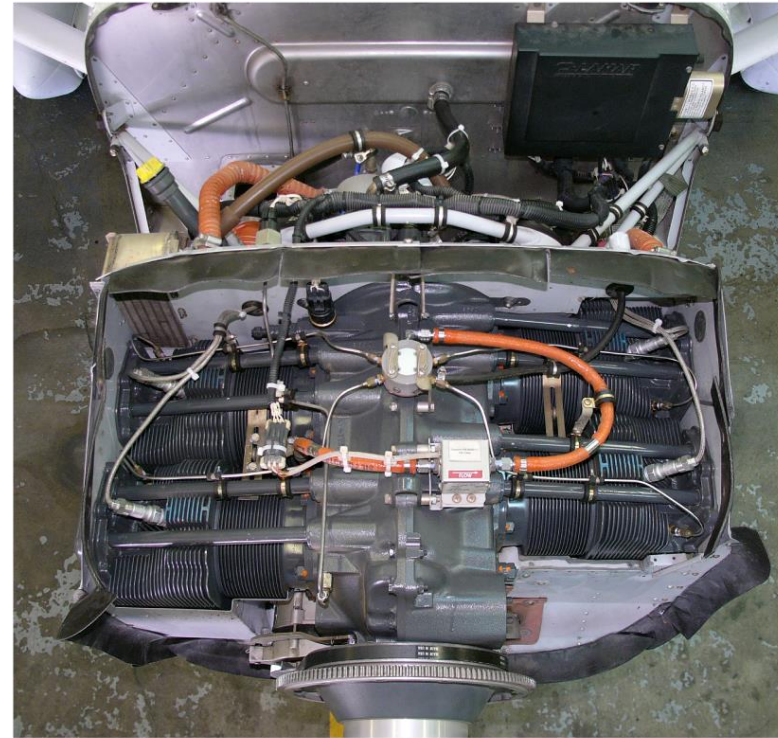
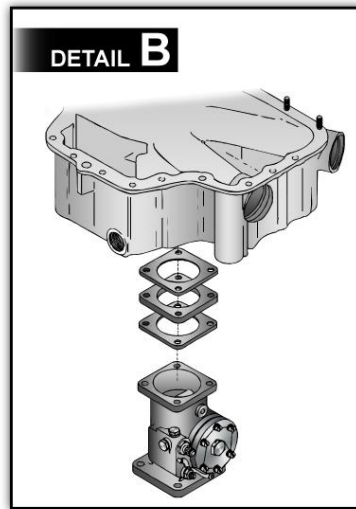
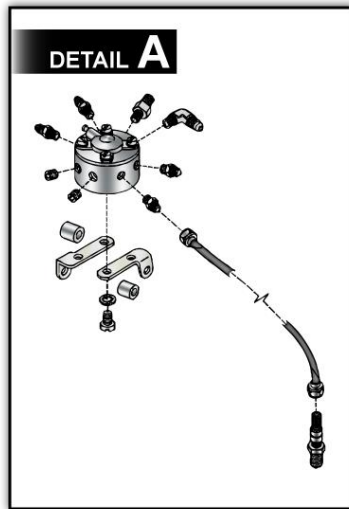
Since this nozzle is in effect, stealing fuel from the other nozzles, this cylinder will run rich and the other cylinders will be correspondingly lean. A net decrease in metered fuel pressure will result and show up on the flowmeter as a lower fuel flow indication.

Refer to the RSA Fuel Injection Training Manual for the Comparison Check procedures.

Over torque of the nut connecting the fuel line to the nozzle can result in pressing the insert deeper into the body and closing off the air bleed on older nozzles. Over torque can crack the flange off the insert on the newer type nozzles. Torque nut to 25 to 50 inch-pounds.

Over torque the nozzles into the cylinder head results in distortion of the base of the nozzle and upsets its calibration and spray pattern. Torque nozzle at 60 inch-pounds.



FUEL INJECTION SYSTEM – MAINTENANCE PRACTICES (73-00-01)

Cessna's Maintenance Manual Section 73-00-01 provides instructions for removal/installation, adjustment and cleaning of various components used in the fuel injection system.

Refer to Cessna's Maintenance Manual section 73-00-01 and Lycoming Maintenance Manual section 73-00-00) for maintenance information beyond the scope of this section.

FUEL INJECTION SYSTEM – MAINTENANCE PRACTICES (73-00-01)

Always observe the following general precautions and rules during fueling, defueling, fuel bay purging, repairing, assembly or disassembly of system components, and electrical system checks and repairs on the airplane fuel system.

Plugs or caps should be placed on all disconnected hoses, lines and fittings to prevent residual fuel drainage, thread damage, or entry of dirt or foreign material into fuel system.

Flush system any time fuel system is opened with 1/2 gallon of fuel at the inlet of servo and flow divider using the fuel boost pump.

Keep all parts clean and free of contaminants when working on fuel injection system.

Make a note number and position of washers for reinstallation when removing the mixture and throttle control linkages from control unit. Torque nuts in a crisscross (opposite) pattern to 90 inch-pounds and then re-torque nuts in the same manner to a final torque value of 180-200 inch pounds.

Refer to Cessna's Maintenance Manual Chapter 76 Throttle Control - Maintenance Practices, Figure 201 and Chapter 76, Fuel Mixture Control - Maintenance Practices and Figure 201 for an illustration of washer and linkage sequence when installing mixture and throttle control linkages.



Cotter Pin Hole

Do not back the nuts off to line the cotter pin hole up with the castellation's in the nut.

Torque each nut to 30 inch-pounds and then proceed tightening the nut until the cotter pin hole lines up with the castellation in each nut. Do not exceed 50 inch-pounds.

FUEL INJECTION SYSTEM – MAINTENANCE PRACTICES (73-00-01)

Refer to Cessna's Model 172 Maintenance Manual Chapter 71, Cowling - Maintenance Practices for removing and installing the engine cowls.

The Fuel Injection System Maintenance practices consist of the following tasks.

- Fuel Distribution Valve
- Injection Nozzles



Lubricants

Use only fuel-soluble lubricants (such as engine oil) on the nozzle threads during installation.

Idle Speed and Mixture Adjustment

Refer to Cessna's Model 172 Maintenance Manual Chapter 73 Section 73-00-01 Figure 201 for adjustment procedures.

FUEL INJECTION SYSTEM – MAINTENANCE PRACTICES (73-00-01)**Propeller and Propeller Blast**

During adjustment procedure stay clear of propeller and/or propeller blast to avoid possible injury or death.

**Precision Airmotive Service Letter SIL RS-67**

For additional information in conjunction with procedures below, refer to the Precision Airmotive Service Letter SIL RS-67.

**Oil Temperature**

It may not be possible to get an oil temperature of 150°F (65°C) at cooler ambient temperatures. In that condition, it will be necessary to set the idle speed and mixture at a lower temperature.

FUEL INJECTION SYSTEM – MAINTENANCE PRACTICES (73-00-01)**Fuel Mixture**

To aid in the adjustment of the fuel mixture, the clevis on the fuel servo has an L (lean) and R (rich) stamp on it to indicate the direction that the thumb wheel should be moved to enrich the fuel mixture and increase the RPM rise. Turn the thumb wheel in the opposite direction you will lean the fuel mixture and decrease the RPM rise.

After each adjustment is made, the engine speed should be increased to approximately 1800 RPM and held for approximately 10 to 15 seconds to clean the spark plugs and clear the cylinders of excess fuel.

FUEL INJECTION SYSTEM – MAINTENANCE PRACTICES (73-00-01)**Fuel Mixture 2**

If the mixture was excessively rich or lean when this procedure was started the engine speed will require readjustment as the fuel mixture is adjusted to the desired value. Set the idle speed to the specified RPM after the mixture has been set to get the 10 to 50 RPM rise a lean condition.

**Idle Speed and RPM changes.**

Small changes in the idle speed and RPM are permitted. Find the cause of any large variations in RPM. Injector Nozzle Cleaning

Refer to Cessna's Model 172 Maintenance Manual Chapter 5, Inspection Time Limits for the injector nozzles and fuel strainer cleaning intervals.

Refer to Cessna's Model 172 Maintenance Manual Chapter 5, Inspection Time Limits for the air throttle shaft lubrication intervals

TROUBLESHOOTING (73-00-01)

Refer to Cessna's Model 172 Maintenance Manual Section 73-00-01, Table 101 for trouble shooting the fuel injection system.

The trouble shooting procedures consist of the following malfunctions:

- High Fuel Flow Reading Unsatisfactory
- Fuel Cutoff.
- Engine Will Not Increase to the Necessary Rpm Rough Idle.
- Low Takeoff Fuel Flow.
- Engine Is Difficult To Start.
- Engine Operates Rough.

INJECTION NOZZLE FLOW TEST (73-00-01)

If nozzle plugging is suspected, disconnect injector lines at the nozzles.

Cap nozzles with clean valve stem caps to protect nozzles from contamination during removal. Refer to Injection Nozzles Removal/Installation.

Pull up injector lines taking care that lines are not kinked. Install nozzles back into lines and torque from 25 to 50 inch-pound.

Using clear containers (bottles with graduations are preferred) flow fuel into containers using aircraft boost pump and observe nozzle discharge pattern.

When the mixture control is placed in the full rich position the nozzles should display a pencil stream pattern.

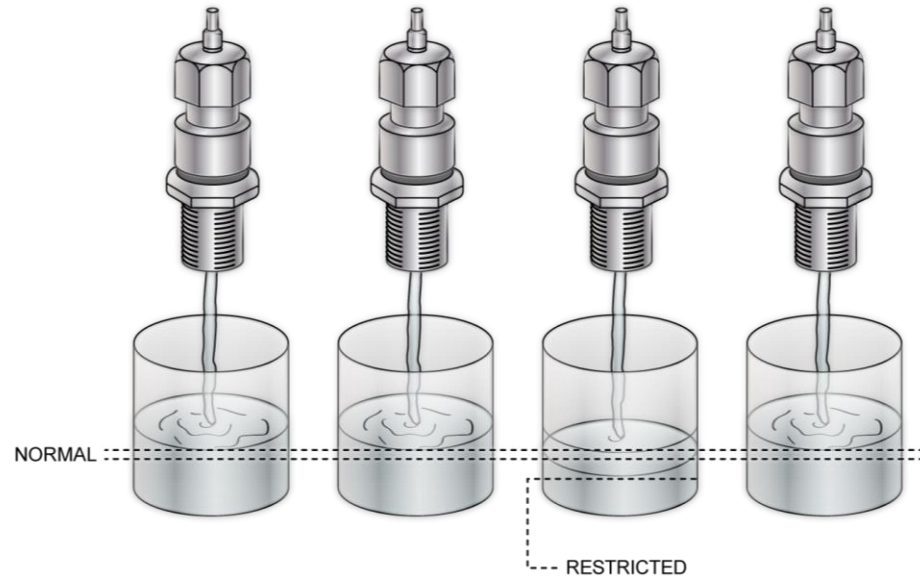
The nozzles should also flow the same amount of fuel from cylinder to cylinder. If an unusual flow pattern or an unequal amount of fuel is noted in any of the containers the nozzles should be thoroughly cleaned. Refer to Injector Nozzle Cleaning.

After cleaning install clean protective valve stem caps.

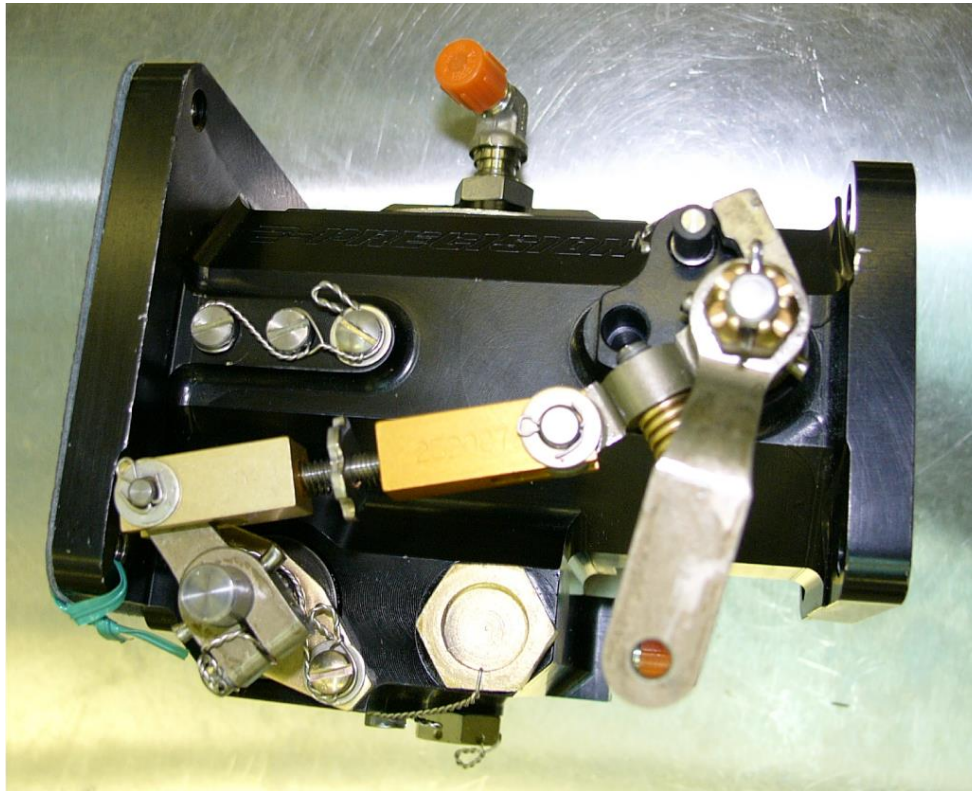
It is recommended that after cleaning the nozzles, they be reinstalled in the injector lines and a nozzle flow check is conducted to verify that the nozzles are clean.

Following a successful flow check reinstall the protective flow caps and reinstall the nozzles in the cylinders and torque from 55 to 60 inch-pound. Remove protective caps and reinstall injector lines to the nozzles and torque from 25 to 50 inch-pound.

Perform leak check



FUEL SYSTEM ADJUSTMENTS (73-00-01)



Idle Speed and Mixture Adjustment

Refer to Cessna's Model 172 Maintenance Manual Section 73-00-01 Figure 201 for adjustment procedures.

FUEL SYSTEM ADJUSTMENTS (73-00-01)

Idle Speed and Mixture Adjustment



Propeller and Propeller Blast

During adjustment procedure stay clear of propeller and/or propeller blast to avoid possible injury or death.



Precision Airmotive Service Letter SIL RS-67

For additional information in conjunction with procedures below, refer to the Precision Airmotive Service Letter SIL RS-67.

Ensure that the alternate air door is closed during this adjustment.

Run engine until the oil temperature increases to 150°F (65°C).

FUEL SYSTEM ADJUSTMENTS (73-00-01)

Idle Speed and Mixture Adjustment



Oil Temperature

It may not be possible to get an oil temperature of 150°F (65°C) at cooler ambient temperatures. In that condition, it will be necessary to set the idle speed and mixture at a lower temperature.

With the mixture control in the full rich position, set the idle speed to 675 RPM, +25 or -25 RPM.

Advance the throttle to approximately 1800 RPM and immediately return it to idle. Idle speed should be approximately the same as set above.

Adjust the fuel mixture control by rotating the knob counterclockwise, toward lean, quickly for approximately one inch, then very slowly until the peak RPM is obtained and the engine speed starts to drop off.

Note the difference between the starting RPM and the peak RPM. This is the lean rise.

- If the rise is less than 10 RPM it is necessary to enrichen the fuel mixture.
- If the rise is more than 50 RPM it is necessary to lean the fuel mixture.

FUEL SYSTEM ADJUSTMENTS (73-00-01)

Idle Speed and Mixture Adjustment



Adjustment of the Fuel Mixture

To aid in the adjustment of the fuel mixture, the clevis on the fuel servo has an L (lean) and R (rich) stamp on it to indicate the direction that the thumb wheel should be moved to enrichen the fuel mixture and increase the RPM rise. Turn the thumb wheel in the opposite direction you will lean the fuel mixture and decrease the RPM rise.

Adjust the thumb wheel to set a rise 10 to 50 RPM.

- If the adjustment thumb wheel bottoms out on the blocks, center it as follows:
- Measure the distance between the two blocks. Disconnect the spring from the linkage pin.
- Remove the cotter pin, linkage pin, wave washer, and flat washer.
- Turn the block and adjustment screw until the adjusting thumb wheel is centered.
- The distance between the blocks should measure the same as above.
- Install the linkage pin, flat washer, wave washer, cotter pin, and spring.

After each adjustment is made, the engine speed should be increased to approximately 1800 RPM and held for approximately 10 to 15 seconds to clean the spark plugs and clear the cylinders of excess fuel. Put throttle in idle position.

FUEL SYSTEM ADJUSTMENTS (73-00-01)

Idle Speed and Mixture Adjustment

Repeat the procedure until you get the desired RPM rate change at idle.



NOTE

Engine Speed Readjustment

If the mixture was excessively rich or lean when this procedure was started the engine speed will require readjustment as the fuel mixture is adjusted to the desired value. Set the idle speed to the specified RPM after the mixture has been set to get the 10 to 50 RPM a lean rise condition.

Operate engine to full throttle and back to idle to make sure that the setting has not changed.



NOTE

Idle Speed and RPM Changes

Small changes in the idle speed and RPM are permitted. Find the cause of any large variations in RPM

Fuel Flow Indicator

MAINTENANCE PRACTICES OVERVIEW (73-30-00)

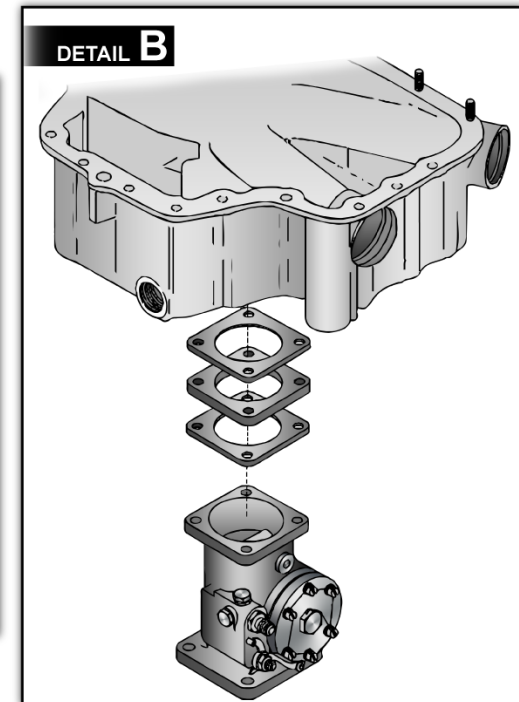
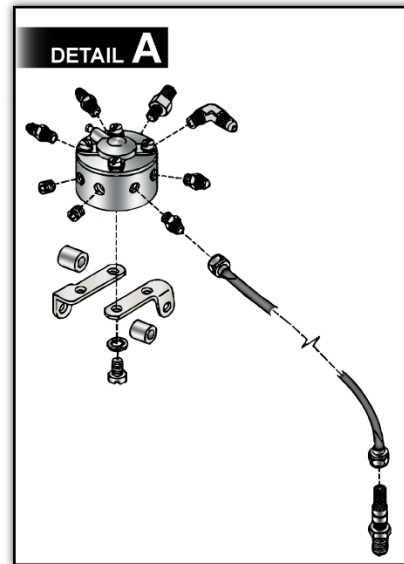
The fuel flow indicator maintenance practices consist of the removal and installation of the following components:

EGT/Fuel Flow Gage

- The fuel flow gage is on the right half of the dual-function EGT/Fuel Flow gage on the left side of the instrument panel.
- On NAV III airplanes, fuel flow is displayed in the MFD.

Transducer

- Refer to Cessna's Model 172 Maintenance Manual Section 73-30-00 Figure 202 for the removal and installation of the transducer for airplanes with Garmin G1000.
- Refer to Cessna's Model 172 Maintenance Manual Chapter 71, Cowling - Maintenance Practices for the removal and installation of the engine cowls.
- Make sure that the arrow on the transducer shows the correct direction of flow.

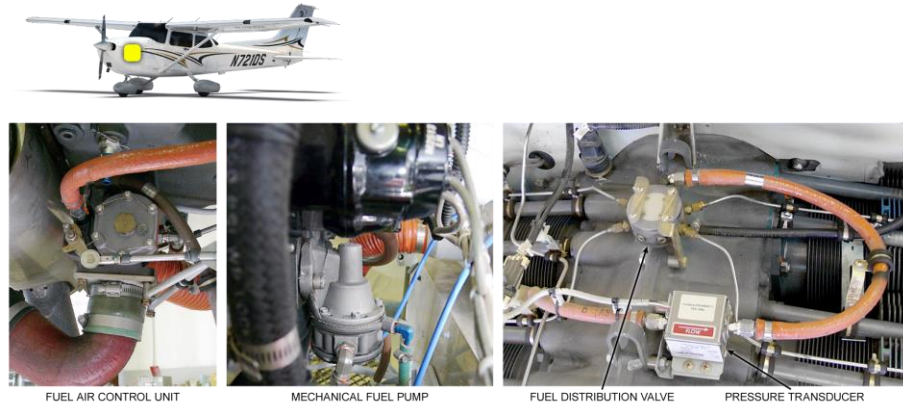


Fuel Injection System Review

Fuel from the wing tanks supplies fuel to the fuel injection system through a series of lines, valves and pumps.

From the engine-driven fuel pump, fuel enters the fuel/air control unit, passes through the fuel distribution valve, and is routed to individual injection nozzles at each cylinder.

The Fuel Injection system consist of the following components:



- Fuel/Air Control Unit - Also known as the 'servo regulator,' is located on the underside of the engine and integrates the functions of measuring airflow and controlling fuel flow.
- The control unit consists of an airflow sensing system, a regulator section and a fuel metering section.
- Fuel Distribution Valve - Also known as a 'spider' or a flow divider, is located on top of the engine and distributes fuel evenly to the four cylinders once it has been regulated by the fuel/air control unit.
- The fuel distribution valve attaches to the fuel distribution valve, which feeds into a pressure transducer. This transducer measures fuel pressure and translates that reading into fuel flow at the cockpit indicator.
- Injection Nozzles (4 total) - Each cylinder contains an injection nozzle, also known as an air bleed nozzle or a fuel injector.
 - Nozzle incorporates a calibrated jet that determines, in conjunction with fuel pressure, the fuel flow entering each cylinder.
 - Fuel entering the nozzle is discharged through the jet into an ambient air pressure chamber within the nozzle assembly.
 - The nozzle assembly also contains a calibrated opening which is vented to the atmosphere, and allows fuel to be dispersed into the intake portion of the cylinder in an atomized, cone-shaped pattern.

Model Differences

182/206 DIFFERENCES - FUEL INJECTION SYSTEM (73-00-01)



The fuel injection system is a low pressure, multi-nozzle, continuous flow system that injects raw fuel into the engine cylinder heads.

The injection system is based on the principle of measuring engine air consumption to control fuel flow. More airflow through the Venturi results in more fuel flowing to the engine, and less airflow through the Venturi results in a decreased flow of fuel to engine.

182/206 DIFFERENCES - FUEL INJECTION SYSTEM (73-00-01)

System components include the:

- Fuel/Air Control Unit
- Fuel Distribution Valve (Flow Divider)
- Injection Nozzles (6 Total)
- Lines Used to Connect the Components

182 Fuel Distribution Valve

- The fuel distribution valve is a rigid line which feeds into a pressure transducer.
- This transducer measures fuel pressure and translates that reading into fuel flow at the cockpit indicator. This is not applicable to NAV III airplanes.

206 Fuel/Air Control Unit

- Fuel flows from the servo, through the fuel flow transducer, to the distribution valve, and out to the fuel nozzles.
- On turbocharged airplanes, a fuel flow transducer attached to the aft right baffle and connected to the fuel inlet line measures flow.

The fuel injection system for the 182 aircraft is located in the bottom section of the engine bay.

Operation:

Fuel is stored in the wing tanks and moves to the fuel injection system via a series of lines, valves and pumps.

From the engine driven fuel pump, fuel enters the fuel/air control unit, passes through the fuel distribution valve, and routes to individual injection nozzles at each cylinder.

182/206 DIFFERENCES - FUEL INJECTION SYSTEM (73-00-01)**206 - Maintenance Practices:**

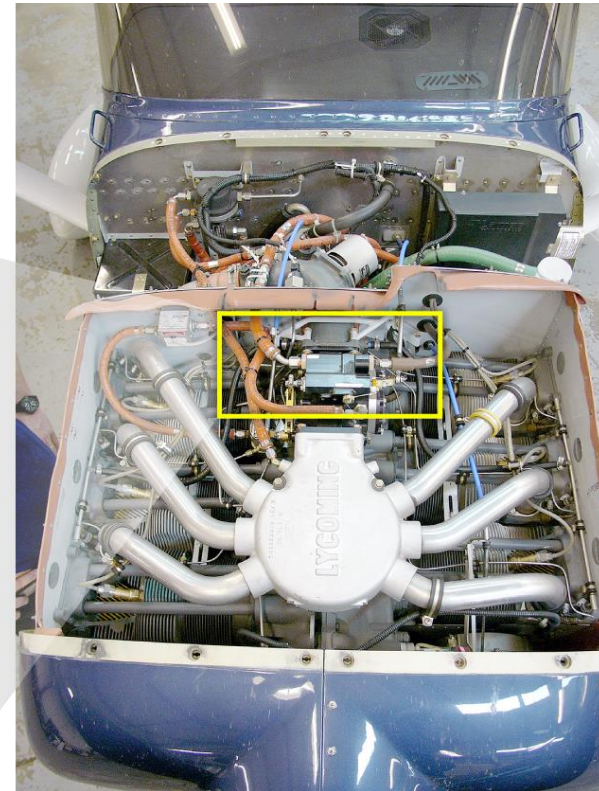
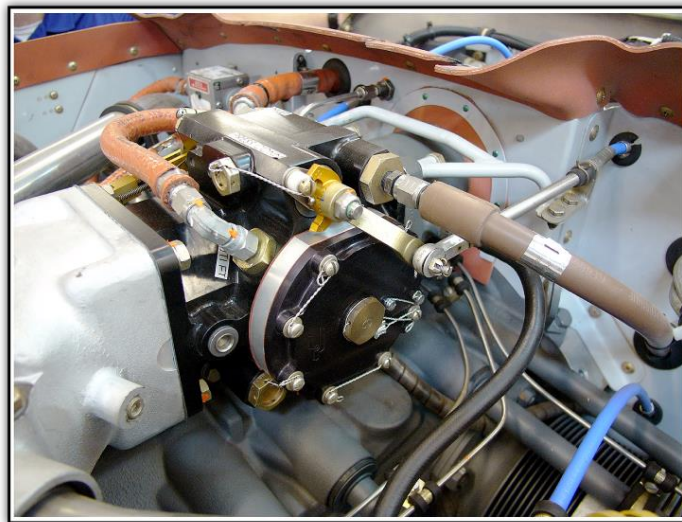
- Fuel/Air Control Unit Removal/Installation
- Fuel Distribution Valve Removal/Installation
- Injection Nozzles Removal/Installation
- Injection Nozzle Flow Test
- Idle Speed and Mixture Adjustment
- Injector Nozzle Cleaning
- Fuel Strainer Cleaning
- Air Throttle Shaft Lubrication
- Engine Driven Fuel Pump Pressure Setting (T206)

182 – Maintenance Practices

- Fuel/Air Control Unit Removal/Installation
- Fuel Distribution Valve Removal/Installation
- Injection Nozzles Removal/Installation
- Injection Nozzle Flow Test
- Idle Speed and Mixture Adjustment
- Injector Nozzle Cleaning
- Fuel Strainer Cleaning
- Air Throttle Shaft Lubrication
- Engine Driven Fuel Pump Pressure Setting (T182)

Maintenance practices for the 182 are the same as for the 172 with one additional step to set the pressure of the engine driven fuel pump.

182/206 DIFFERENCES - FUEL INJECTION SYSTEM (73-00-01)

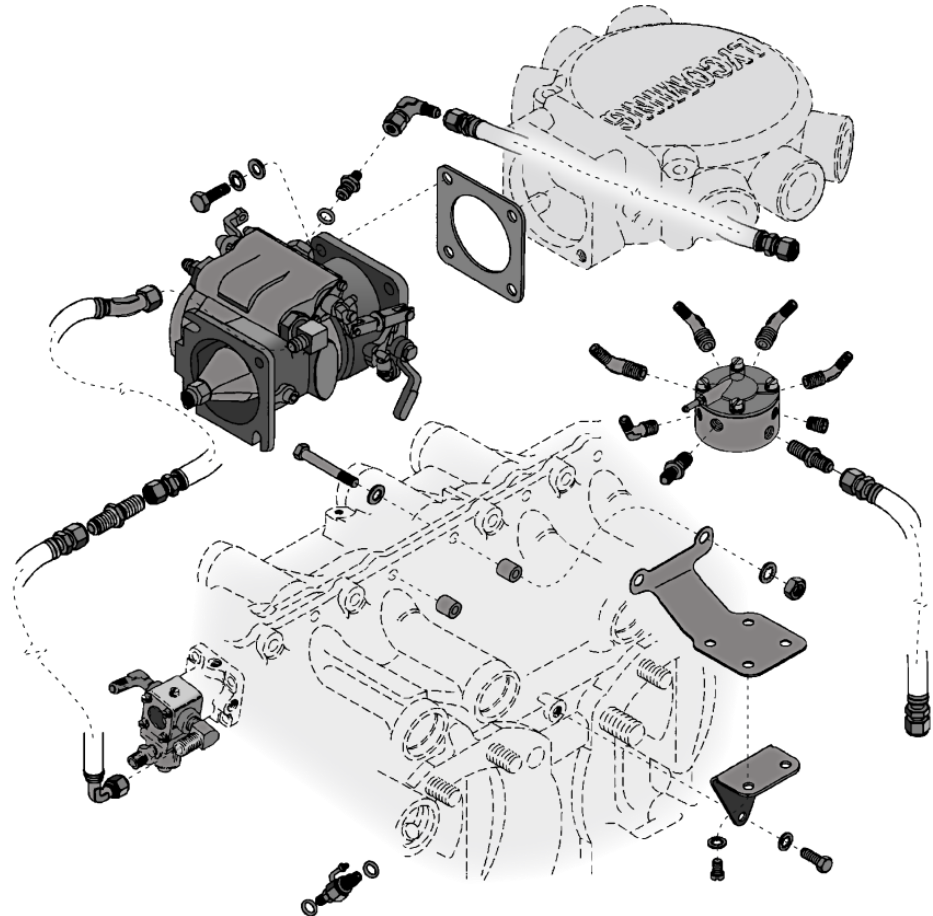


The fuel injection system for the 206 aircraft is located in the top mid section of the engine bay.

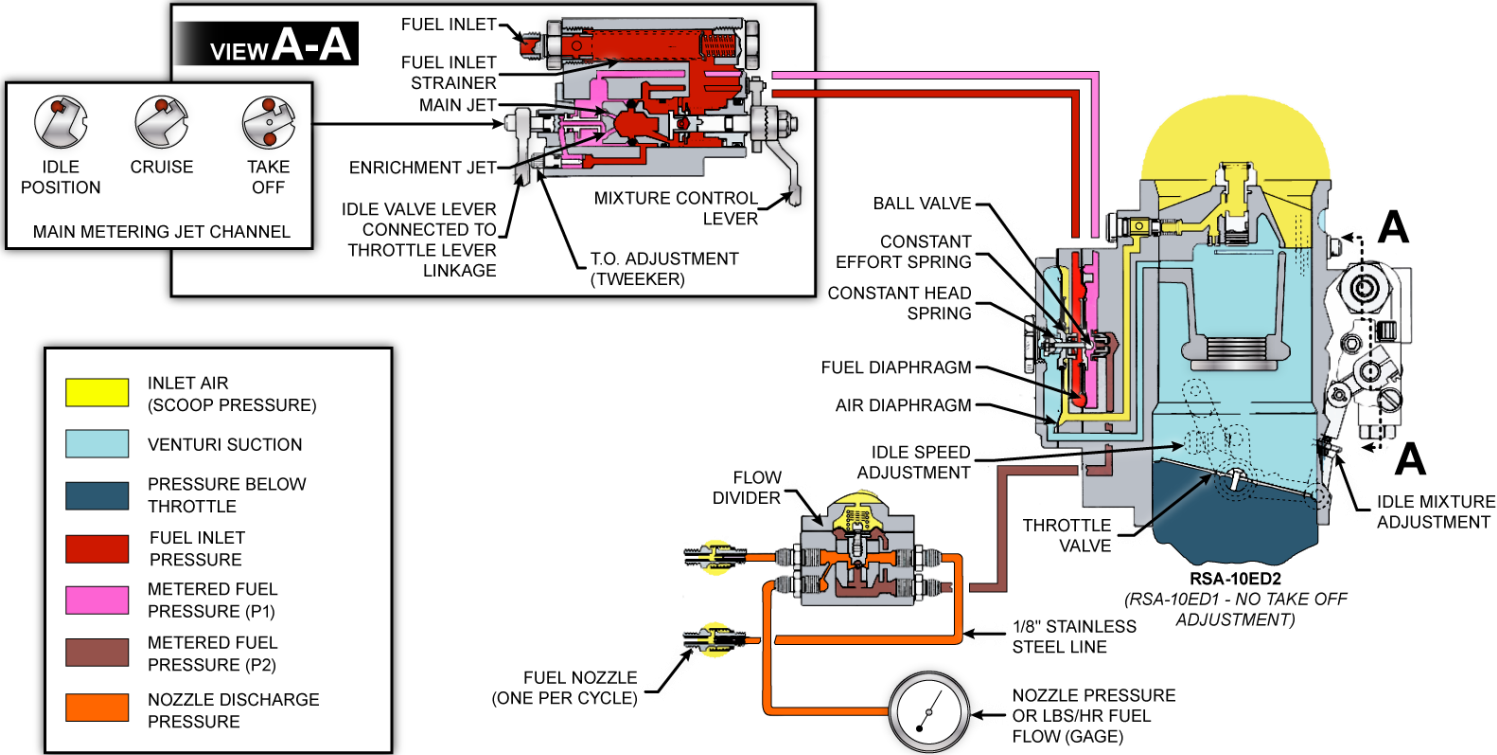
182/206 DIFFERENCES - FUEL INJECTION SYSTEM (73-00-01)

The RSA 10-ED1 fuel injection system installed on the Cessna 206 does not have an automatic mixture control.

- Therefore, it is necessary for the pilot to lean the mixture to maintain proper fuel burn and engine temperatures.
- The bullet type Venturi installed in the center of the throttle bore in the RSA 10 systems could house an automatic mixture control (AMC) however no Cessna 206 aircraft use a AMC configuration.
- Therefore, the internal housing has no AMC on the bullet type Venturi, and simply channels impact air to the air diaphragm and Venturi suction air to the opposite side of the same diaphragm.
- The air and fuel diaphragms and the rest of the fuel injection system operate in the same manner as in the 182 and the 172.



182/206 DIFFERENCES - FUEL INJECTION SCHEMATIC (73-00-01)

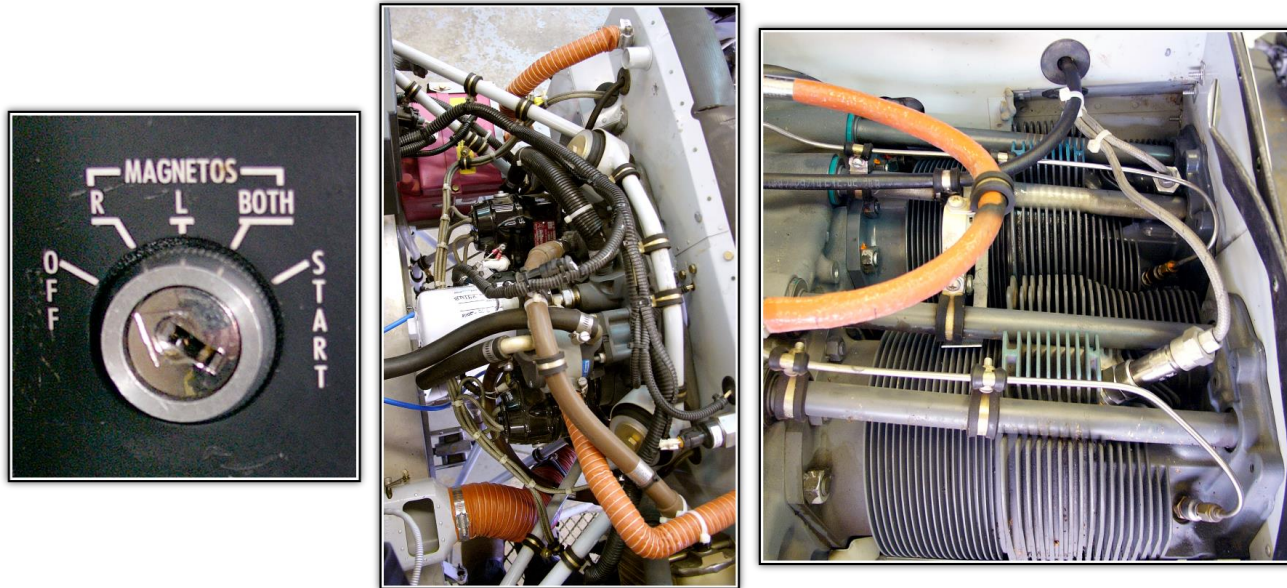


ATA74 - Ignition

Overview

LESSON OBJECTIVES

- Explain safety precautions related to the engine ignition system
- Explain maintenance practices important to the engine ignition system
- Explain normal system operations
- Explain system indications
- Explain special tooling and test equipment used with Cessna High Wing Series Aircraft
- Explain procedures for replacement of unique components

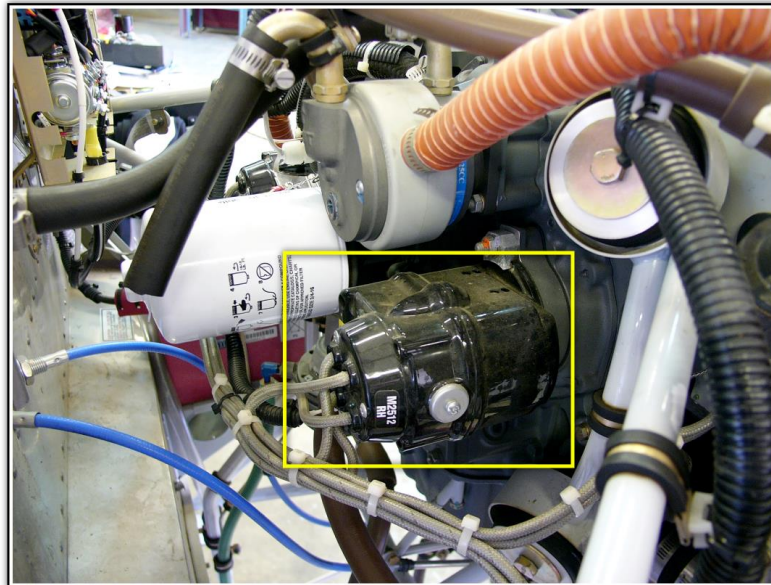
SYSTEM OVERVIEW - ENGINE IGNITION (74-00-00)

The Lycoming IO-360-L2A engine uses two Unison/Slick 4371 series, impulse-coupled magnetos to fire two spark plugs in each cylinder. The left magneto fires the upper left and lower right spark plugs, and the right magneto fires the lower left and upper right spark plugs. Normal operation utilizes both magnetos due to the more complete burning of the fuel/air mixture with dual ignition. A rotary-type switch located on the left switch and control panel controls ignition and starter operation. The MAGNETOS switch positions are OFF, R, L, BOTH, and START.

Switch positions: Operate the engine on both magnetos (BOTH position) except for magneto checks. The R and L positions are for checking purposes and emergency use only. Rotating the MAGNETOS switch to the spring-loaded START position, with the MASTER switch in the ON position, the starter contactor closes and the starter, now energized, will crank the engine. Releasing the switch will automatically return it to the BOTH position.

Ignition System Maintenance Practices

IGNITION SYSTEM TROUBLESHOOTING (74-10-00)



Troubleshooting charts for the following conditions are available in the Cessna Model 172 AMM (74-10-00):

- Engine will not start
- Engine will not idle or run properly

IGNITION SYSTEM TROUBLESHOOTING (74-10-00)**P LEAD**

Make sure that each magneto P lead is grounded.

**PROPELLER ROTATION**

Before you rotate the propeller remove a minimum of one spark plug from each cylinder to prevent the start of the engine.

For complete description, operation, troubleshooting, maintenance, overhaul and lubrication requirements of the magnetos, refer to the Lycoming Direct Drive Engine Overhaul Manual, Lycoming Operators Manual, Lycoming Service Instruction 1437 and the Unison 4300/6300 Series Magneto Maintenance and Overhaul Manual.

MAGNETO REMOVAL/INSTALLATION (74-10-00)

Refer to Cessna's Maintenance Manual Chapter 74 Section 74-10-00 for the removal and Installation of the magnetos. Refer to Cessna's Maintenance Manual Chapter 71 for remove and install the ring cowl.

**NOTE****PROCEDURE**

The removal and installation for each magneto is typical.

MAGNETO REMOVAL/INSTALLATION (74-10-00)**P LEAD**

Make sure that each magneto P lead is grounded.

**PROPELLER ROTATION**

Before you rotate the propeller remove a minimum of one spark plug from each cylinder to prevent the start of the engine.

Disengage the high tension cover from the magneto.

For a reference point when you install the magneto, turn the propeller in the normal direction until each impulse coupling releases near Top Dead Center (TDC) on the number one cylinder compression stroke.

MAGNETO REMOVAL/INSTALLATION (74-10-00)

 NOTE	IMPULSE COUPLING You will hear a click sound from the impulse couplings when they release.
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The crankshaft position can be found by the marks on the front or aft face of the starter ring gear support.

- Marks on the front face of the ring gear, they must be aligned with the small hole that is found at the two o'clock position on the front face of the starter housing.
- Marks on the aft face of the ring gear, they must be aligned with the engine case parting line.

Turn the propeller in the opposite direction of the normal propeller operation to approximately 30 degrees BTDC (Before Top Dead Center) on the number one cylinder compression stroke.

Turn the propeller in the normal direction to 25 degrees BTDC on the number one cylinder compression stroke.

Disconnect the P lead and ground wire from the magneto.

Examine the magneto angle to help make sure you put it in the same position for installation.

Install the Magneto

- Apply a small quantity of silicone grease such as DC4 to each side of the new magneto base gasket, which will help future timing adjustments.
- Make sure the magneto drive gear is installed correctly, the nut torqued correctly and the cotter pin is installed.

MAGNETO REMOVAL/INSTALLATION (74-10-00)



T-118 TIMING PIN

Make sure you remove the T-118 timing pin immediately after you attach the magneto to the accessory case and before the magneto or propeller is turned.

Insert the T-118 timing pin into the left or right timing hole in the magneto distributor block, depending on rotation of the magneto.

Turn the magneto rotor in the opposite of normal direction until the timing pin engages fully into the distributor gear.

If the magneto rotor does not move freely and the pin will not go into the hole in the gear, the pin has hit the pointer on the gear. Pull the pin out far enough to continue to turn the magneto freely in the opposite direction of normal movement until the pointer has passed the pin, and then insert the pin. Turn the magneto rotor until the pin engages the gear.

Do a check of the crankshaft to make sure the propeller has not moved and is still set in position with the number one cylinder at 25 degrees BTDC (Before Top Dead Center) on the compression stroke. If the propeller has been turned and only one magneto was removed, it will be necessary to engage the impulse coupling on the magneto that is installed, and establish the crankshaft position.

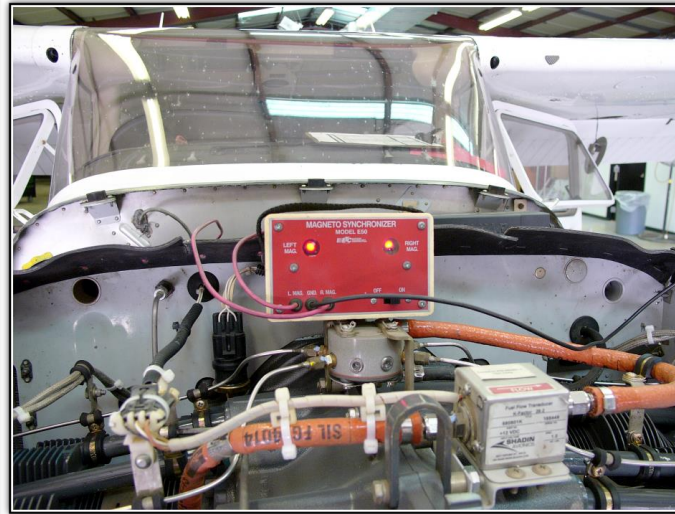
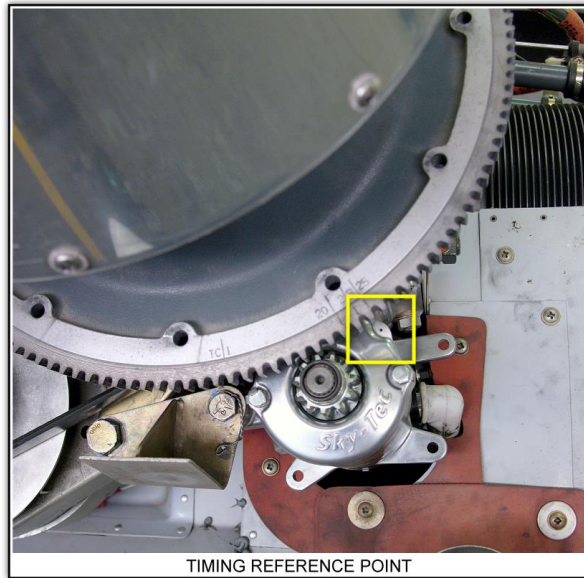
With the number one cylinder at 25 degrees BTDC on the compression stroke, do the steps that follow.

Install the magneto with the new base gasket and the T-118 timing pin in position. Engage the magneto drive gear with the engine gear, in a position that will give a range of magneto timing adjustments in each direction. Hold the magneto in position against the accessory case and install the nuts, flat washers, clamps and new lock washers.

MAGNETO REMOVAL/INSTALLATION (74-10-00)

Magneto Timing

With the magneto set in position, first tighten each nut to 8 foot-pounds (10 Nm). Torque nut of 17 foot-pounds (23 Nm) from one side to another. Connect the P lead to the magneto. Attach a ground wire and high-tension outlet cover to the magneto. Tighten the P lead nut to a torque of 13 to 15 inch-pounds (1.5 to 1.7 Nm).

MAGNETO-TO-ENGINE EXTERNAL TIMING ADJUSTMENT (74-10-00)

Refer to Cessna Maintenance Manual section 74-10-00 Magneto-to-Engine External Timing.

Position the ignition is in the OFF position. Remove the engine cowl.

Remove a minimum of one spark plug from each cylinder.

Turn the propeller in the normal direction of movement until each impulse coupling releases as the number one cylinder moves near TDC (Top Dead Center) on the compression stroke.

MAGNETO-TO-ENGINE EXTERNAL TIMING ADJUSTMENT (74-10-00)**NOTE****IMPULSE COUPLING**

You will hear a click sound from the impulse couplings when they release.

Turn the propeller in the opposite direction of normal movement to approximately 30 degrees BTDC (Before Top Dead Center) on the number one cylinder compression stroke.

Make sure that cylinder number one is at 25 degrees BTDC (Before Top Dead Center) on the compression stroke.

Connect a standard aircraft magneto timing light between an acceptable engine ground and the P lead terminal of the magneto.

**NOTE****MAGNETO TIMING LIMITS**

Most standard aircraft magneto timing lights show open points with a Light On condition and/or a signal that you can hear.

Loosen the mount clamps that attach the magneto to the accessory case so that the magneto will turn on the accessory case.

Place ignition switch to the BOTH position.

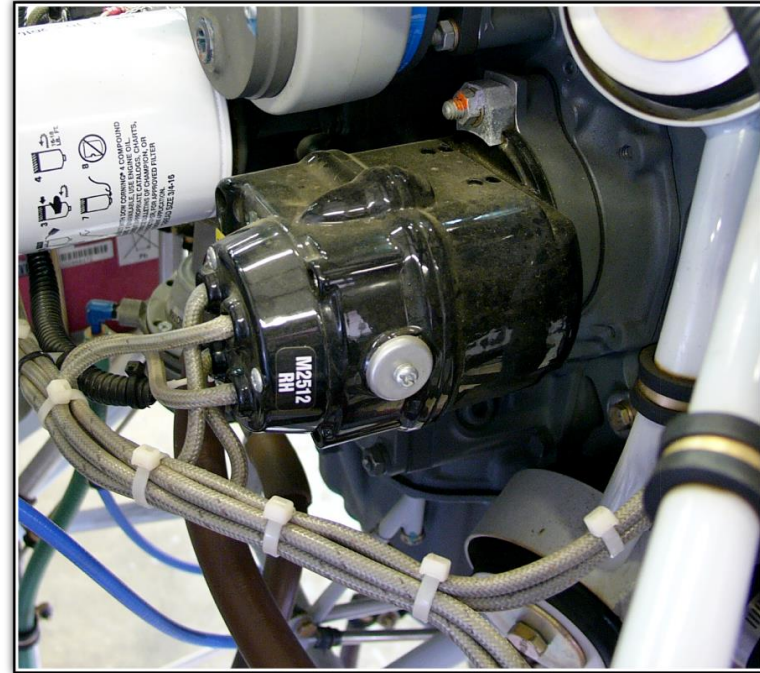
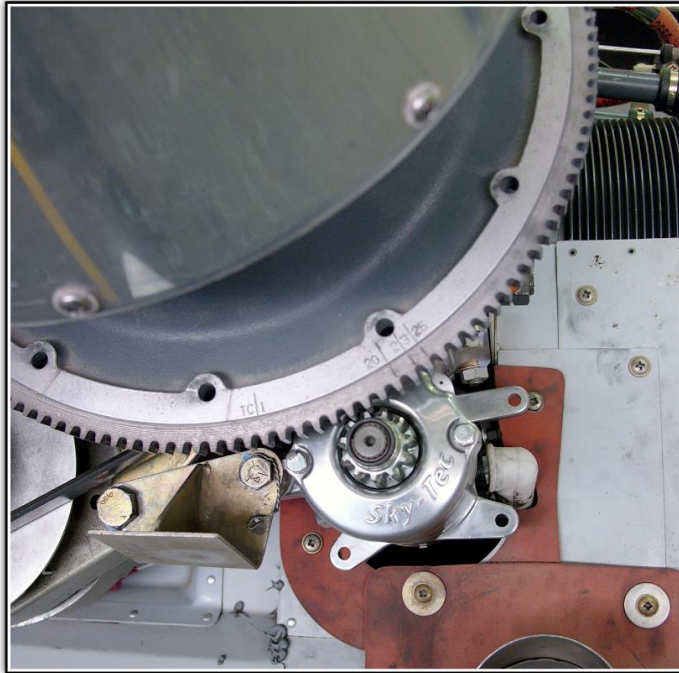
MAGNETO-TO-ENGINE EXTERNAL TIMING ADJUSTMENT (74-10-00)

Look at the magneto from the aft side of the engine. If the timing light is illuminated, turn the magneto frame clockwise until the timing light shuts off. Turn the magneto frame counter-clockwise until the timing light comes on, which shows that the contact breaker points are open.

**TORQUE**

Do not torque the nuts more than 17 foot-pounds (23 Nm) or the mounting flange can crack.

With the magneto set in position, first tighten each nut to 8 foot-pounds (10 Nm). Torque nut 17 foot-pounds (23 Nm) from one side to another. Perform a check of the magneto timing to make sure it has not changed.

MAGNETO-TO-ENGINE TIMING CHECK (74-10-00)

Refer to Cessna Maintenance Manual section 74-10-00 Magneto-to-Engine Timing Check.

Place ignition in the OFF position. Remove engine cowl.

Remove a minimum of one spark plug from each cylinder.

Connect a standard aircraft magneto timing light between an acceptable engine ground and the P lead terminal of the magneto.

MAGNETO-TO-ENGINE TIMING CHECK (74-10-00)**NOTE****MAGNETO TIMING LIMITS**

Most standard aircraft magneto timing lights show open points with a Light On condition and/or a signal that you can hear.

Place ignition switch to the BOTH position.

Turn the propeller in the normal direction until each impulse coupling releases as the number one cylinder moves near TDC (Top Dead Center) on the compression stroke.

**NOTE****IMPULSE COUPLING**

You will hear a click sound from the impulse couplings when they release.

Turn the propeller in the opposite direction approximately 30 degrees BTDC (Before Top Dead Center) on the number one cylinder compression stroke.

MAGNETO-TO-ENGINE TIMING CHECK (74-10-00)

Slowly turn the propeller in the normal direction of movement until the timing light comes on. Examine the crankshaft to make sure it is in the correct position.

**TIMING LIGHT**

The timing light must come on at 25 degrees BTDC with the number one cylinder on the compression stroke.

If the crankshaft is not in the correct position you will have to make an adjustment as needed.

Place ignition switch back to OFF.

Install the spark plugs and leads and cowl.

Perform engine preflight operational check of the ignition system.

IGNITION WIRING HARNESS (74-10-00)

Ignition harnesses vary with the engine models; however, for purposes of description all harnesses are composed of the same basic components. Basically, each lead is composed of a Magneto terminal assembly, the ignition cable and the spark plug end assembly. The number of leads in the harness assembly is, of course, determined by the number of cylinders on the engine.



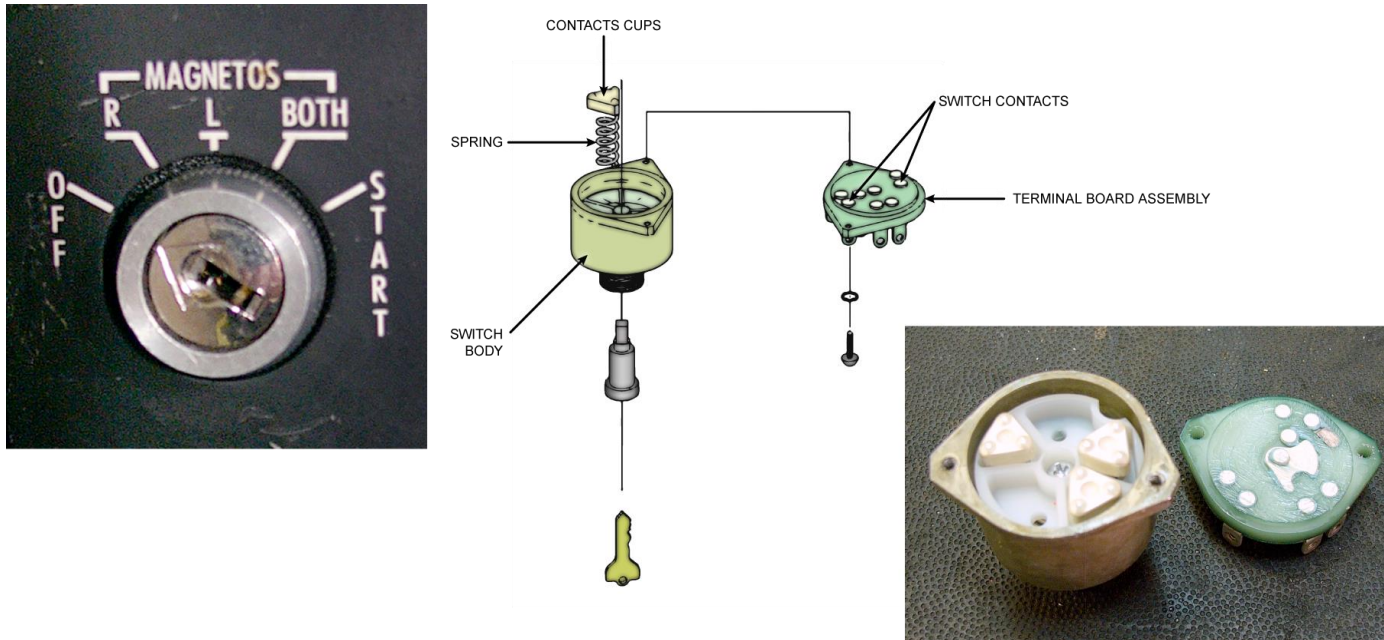
For More Information

APPROVED SPARK PLUGS

For information relative to approved spark plugs for the subject engines consult the latest revision of Service Instruction No. 1042 and Service Bulletin 359.

Ignition Switch

INSPECTION/CHECK (74-30-00)



The Ignition Switch inspection/check consist of the inspecting and lubricating the ACS Ignition Switch. Inspection and lubrication procedures for the ACS brand ignition switch should be accomplished every 2000 hours.

Detailed step-by-step procedures in the maintenance include:

Switch Removal and Install

Switch Cleaning

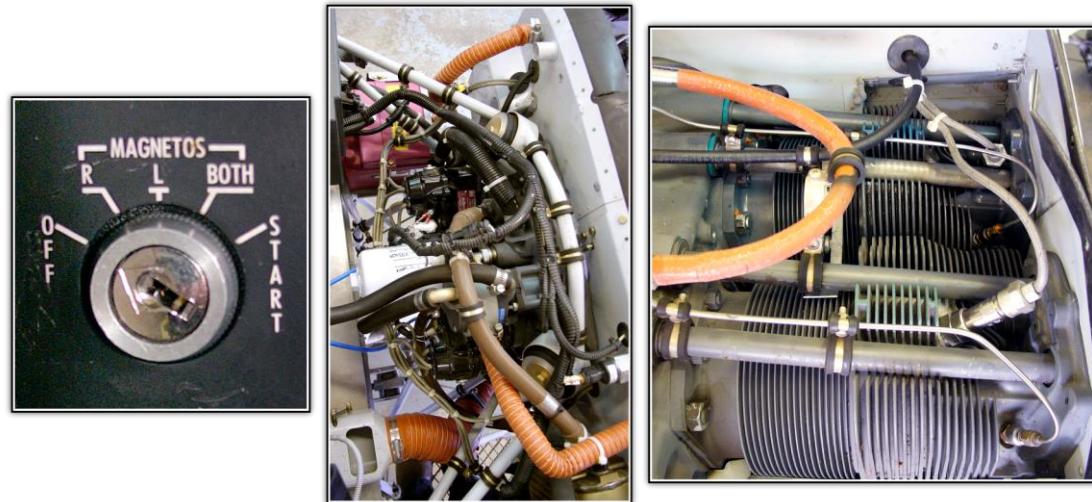
Switch Inspection

Switch Reassembly

Operational Check

System Review

ENGINE IGNITION SYSTEM



The engine uses two Unison/Slick 4371 series, impulse-coupled magnetos to fire two spark plugs in each cylinder. The left magneto fires the upper left and lower right spark plugs, and the right magneto fires the lower left and upper right spark plugs. Normal operation utilizes both magnetos due to the more complete burning of the fuel/air mixture with dual ignition.

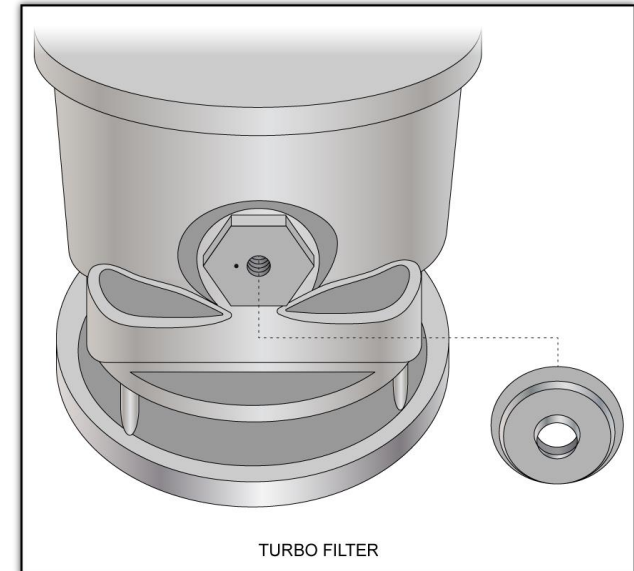
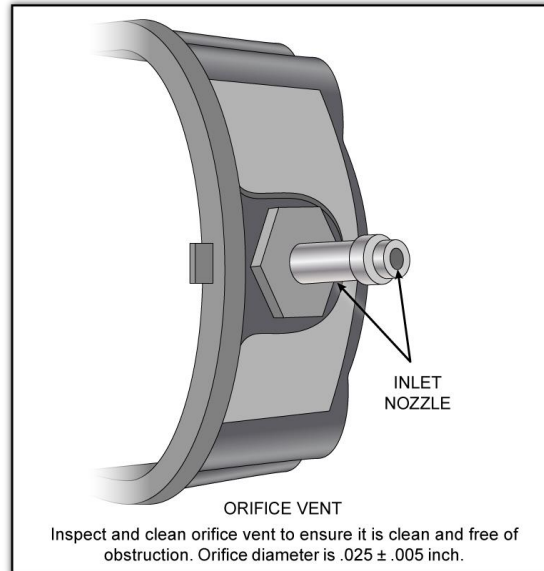
A rotary-type switch located on the left switch and control panel controls ignition and starter operation. The MAGNETOS switch positions are OFF, R, L, BOTH, and START. Operate the engine on both magnetos (BOTH position) except for magneto checks. The R and L positions are for checking purposes and emergency use only. Rotating the MAGNETOS switch to the spring-loaded START position, with the MASTER switch in the ON position, the starter contactor closes and the starter, now energized, will crank the engine. Releasing the switch will automatically return it to the BOTH position. >

Model Differences

182/206 DIFFERENCES - IGNITION SYSTEM (74-10-00)

The difference between the 172 ignition system and the 182 and 206 systems is in the magnetos.

- At high altitudes the air is thinner, and this allows electricity to jump across the spark plug easier.
- As a normally aspirated aircraft engine operates at higher altitudes this is not a major factor.
- But in turbo charged engines the magneto must be pressurized to prevent internal spark arcing within the magneto housing.
- Therefore, if we don't have the magneto pressurized we would get high altitude misfire.
- It is important on turbocharged Lycoming engines that every 100hrs the technician preforms Lycoming service instruction 1308E or its current revision.
- This service instruction covers the pressurized magneto pressure test.
- The non-turbocharged IO-540-AB1A5 (182) and IO-540-AC1A5 (206) use two Slick 6351 series magnetos.



182/206 DIFFERENCES - IGNITION SYSTEM (74-10-00)

- The turbocharged TIO-540-AK1A (182) and TIO-540-AJ1A (206) use two Slick 6361 series (pressurized) magnetos, impulse coupled to fire dual plugs in each cylinder. Maintenance of the magnetos is limited to removal, installation and engine-to-magneto timing.
- For complete description, operation, troubleshooting, maintenance, overhaul and lubrication requirements of the magnetos, refer to Unison 4300/6300 Series Magneto Maintenance and Overhaul Manual.
- For inspection time requirements of the magnetos, refer to Chapter 5, Inspection Time Limits. For inspection procedures, refer to Unison 4300/6300 Series Magneto Maintenance and Overhaul Manual and latest revisions.

Magneto Removal/Installation**MAGNETO REMOVE/INSTALL**

The removal and installation for each magneto is typical.

Refer to The Cessna model AMM for systematic maintenance procedures.

182/206 DIFFERENCES - IGNITION SYSTEM (74-10-00)**Remove the Magneto**

Be sure to follow these precautions during removal and installation of ignition magnetos:

**MAGNETO**

Make sure that each magneto P lead is grounded.

**PROPELLER TURNING**

Before you turn the propeller, remove a minimum of one spark plug from each cylinder to prevent the start of the engine at that time.

182/206 DIFFERENCES - IGNITION SYSTEM (74-10-00)**Install the Magneto****GASKET SURFACES**

Make sure the gasket surfaces are clean to prevent oil leaks.

Ignition Timing

Ignition timing maintenance practices consist of Magneto-to-Engine External Timing Adjustment and Magneto-to-Engine timing check.

Refer to the Cessna model AMM for systematic procedures.

Timing adjustment and test procedures are similar between the model series aircraft. Each series of the aircraft requires the timing be adjusted at different timing mark degree setting.

ATA76 - Engine Controls

Overview

LESSON OBJECTIVES

- Explain safety precautions related to the engine controls
- Explain maintenance practices important to the throttle controls
- Explain maintenance practices important to the fuel mixture controls
- Explain special tooling and test equipment used with Cessna High Wing Series Aircraft
- Explain procedures for replacement of unique components

ENGINE CONTROLS SYSTEM OVERVIEW

Cessna's Maintenance Manual ATA 76 provides the maintenance practices on the throttle controls and fuel mixture controls.

General Information

- The Lycoming IO-360-L2A engine controls consist of the following components:
- The throttle control and mixture control is the push-pull type that incorporates a knurled friction knob, which prevents vibration induced "creeping" of the control.
- The mixture control is the push-pull type that incorporates a threaded Vernier mechanism for fine adjustment.
- The ball bearing-type rod end on the throttle is secured to the engine with a predrilled AN bolt, a castellated nut and a cotter pin



NOTE

STEEL AN BOLTS

Steel AN bolts with an undrilled shank are identified with an 'A' suffix (AN3-6A). A steel bolt of the same size, with the shank drilled for castellated nut and cotter pin is identified as AN3-6. Aluminum bolts and undrilled bolts must not be used in this application

Throttle Control

MAINTENANCE PRACTICES (76-10-00)



- When adjusting the throttle control, always check that throttle control slides smoothly throughout its full range of travel and locks securely with the friction lock and the throttle arm operates through its full arc of travel.
- **Do not lubricate throttle control. If excessive binding is noticed, replace throttle control.**
- When disconnecting engine controls pay particular attention to the exact position, size and number of attaching parts for re-connecting controls.

THROTTLE CONTROLS

Refer to Cessna's Maintenance Manual Section 76-10-00 Figure 201 for the removal and the installation and adjusting the throttle control.

Refer to Cessna's Maintenance Manual Chapter 71, Cowling - Maintenance Practices for removing and installing the engine cowling.

Make sure that the throttle has no less than 0.12-inch (3.18 mm) and no more than 0.25-inch (6.35 mm) cushion at each stop.

Check of the rod end witness hole for proper rod end engagement with the throttle control.



NOTE

THROTTLE CONTROL INSTALLATION

When installing throttle control, ensure that control is routed exactly as previously installed. Ensure that no binding or preloading occurs from a too small bend radius.



NOTE

INSTRUMENT PANEL

To prevent damage to the instrument panel finish and markings, ensure the control housing does not rotate against the instrument panel during installation.

Make sure that the throttle has no less than 0.12-inch (3.18 mm) and no more than 0.25-inch (6.35 mm) cushion at each stop.

Check of the rod end witness hole for proper rod end engagement with the throttle control.

Fuel Mixture Control

MAINTENANCE PRACTICES (76-11-00)



The fuel mixture control maintenance practices consist of the removal and installation and adjusting the throttle control.

When adjusting the fuel mixture control always check that fuel mixture control slides smoothly throughout its full range of travel and adjusts through its full Vernier range and the mixture arm operates through its full arc of travel.

Do not lubricate fuel mixture control. If there is excessive binding, replace fuel mixture control.

When disconnecting engine controls, pay particular attention to the exact position, size and number of attaching parts as noted when connecting controls.

MAINTENANCE PRACTICES (76-11-00)

General Information

Refer to Cessna's Maintenance Manual Section 76-11-00 Figure 201 for the removal and the installation and adjusting the fuel mixture control.

Refer to Cessna's Maintenance Manual Chapter 71, Cowling - Maintenance Practices for removing and installing the engine cowling.

Refer to Chapter 5 for the mixture control inspection requirements. Inspection consist of the following criteria:

- Check bolt, castellated nut, cotter pin and rod end for security and condition.
- Witness hole in the rod end must be covered with the mixture cable threads.
- Check that fuel mixture control slides smoothly throughout its full range of travel and adjusts through its full Vernier range.
- Mixture arm operates through its full arc of travel.



NOTE

MIXTURE CONTROL INSTALLATION

When installing mixture control ensure that control is routed exactly as previously installed. Ensure that no binding or preloading occurs from a too small bend radius.

MAINTENANCE PRACTICES (76-11-00)**INSTRUMENT PANEL**

To prevent damage to the instrument panel finish and markings, ensure the control housing does not rotate against the instrument panel during installation.

Make sure that the throttle has no less than 0.12-inch (3.18 mm) and no more than 0.25-inch (6.35 mm) cushion at each stop.

Refer to Chapter 5 for the mixture control inspection requirements. Inspection consist of the following criteria:

- Check bolt, castellated nut, cotter pin and rod end for security and condition.
- Witness hole in the rod end must be covered with the mixture cable threads.
- Check that fuel mixture control slides smoothly throughout its full range of travel and adjusts through its full Vernier range.
- Mixture arm operates through its full arc of travel.

Engine Controls System Review



The Lycoming IO-360-L2A engine controls consist of the following components:

- The throttle control and mixture control is the push-pull type that incorporates a knurled friction knob, which prevents vibration induced "creeping" of the control.
- The mixture control is the push-pull type that incorporates a threaded Vernier mechanism for fine adjustment.
- The ball bearing-type rod end on the throttle is secured to the engine with a predrilled AN bolt, a castellated nut and a cotter pin

Model Differences

182/206 DIFFERENCES - ENGINE CONTROLS - (76-00-00)



The throttle controls for the 182 and 206 differ from the 172.

The propeller control is located between the throttle and mixture controls.

The theory of operation is the same with all models of Cessna SEHW.

Care should be taken on the routing location of the cables when replacing them.

The difference in the various throttle, mixture, or propeller control cable is length.

182/206 DIFFERENCES - ENGINE CONTROLS - (76-00-00)**BRACKETS**

When replacing brackets insure that the proper bracket for that serial affectivity is ordered.

**BRACKETS**

When inspecting ATA 76 items, insure cables and brackets do not rub on other objects. Bracket are not allowed any cracks.

ATA77 - Engine Indicating

Overview

LESSON OBJECTIVES

- Provide a simple description of the whole subject, using common words and examples, using typical terms and identify safety precautions related to the airframe, its systems and power plant
- Identify aircraft manuals, maintenance practices important to the airframe, its systems and power plant
- Define the general layout of the Engine Indicating
- Define the general layout and characteristics of the power plant
- Identify special tooling and test equipment used with the Engine Indicating

ENGINE INDICATING - SYSTEM OVERVIEW

Cessna's Maintenance Manual Chapter 77 provides description and maintenance practices of the engine indicating system.

The 172S Skyhawk uses the G100 Avionics System.

Garmin G1000, the engine speed (RPM) is measured by the tachometer sending unit and changed to an electrical signal.

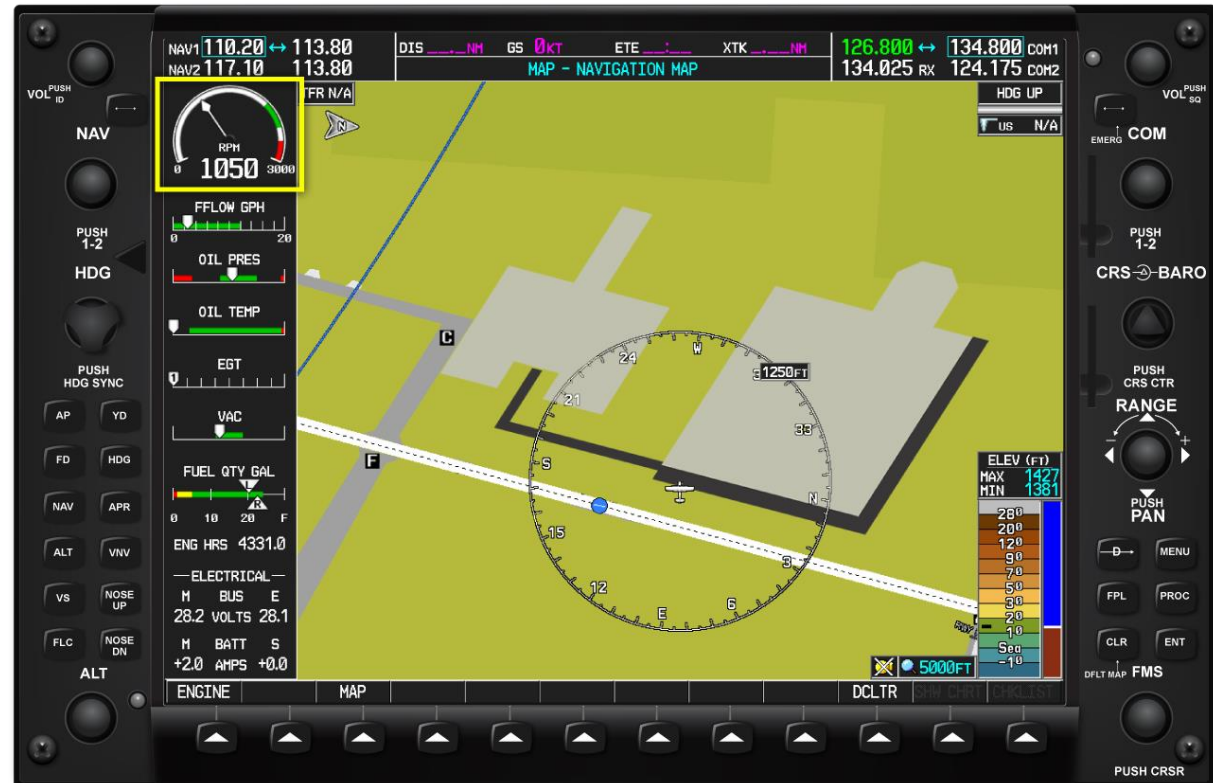
The Garmin Display Units (GDU) display the following engine parameters:

- Engine Speed
- Exhaust gas temperature
- Cylinder Head Temperature

Refer to Cessna's Maintenance Manual Chapter 79 for oil pressure and temperature indication.



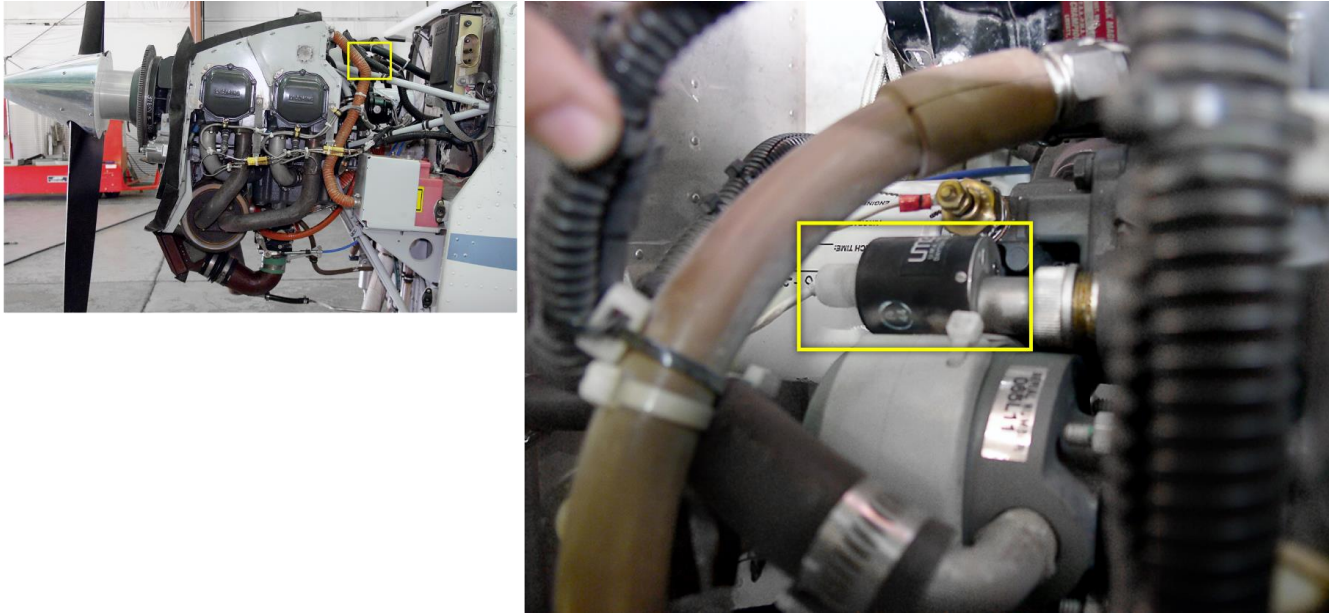
Tachometer (77-10-00)



The tachometer is an instrument measuring the rotation speed of the aircraft motor.

- With the Garmin G1000 installed, the tachometer for the 172 will be found on the top left side of the PFD.
- Without the Garmin installed the tachometer will be an analogue dial on the instrument panel of the cockpit.

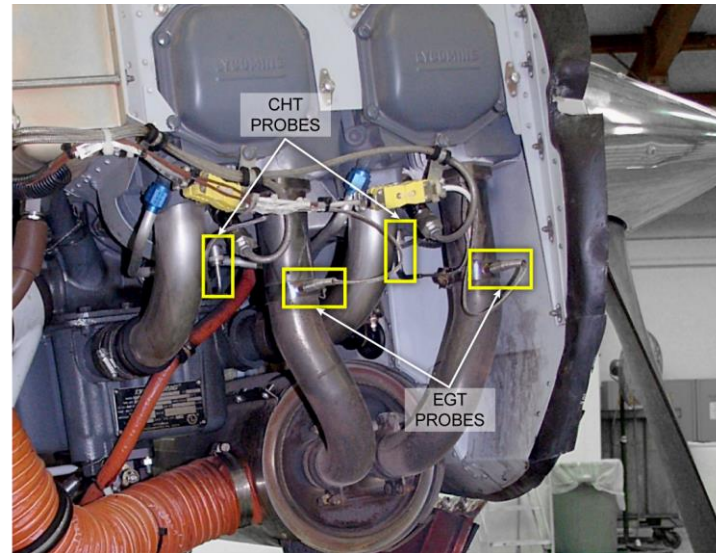
MAINTENANCE PRACTICES (77-10-00)



The Model 172 Maintenance Manual Section 77-10-00 Tachometer Maintenance Practices provide the removal and installation procedures for the tachometer sending unit.

Engine Temperature Indicating System (77-20-00)

MAINTENANCE PRACTICES (77-20-00)



Maintenance Manual section 77-20-00 shows the removal and installation procedures for the Engine Temperature Indicating System. A probe installed in the exhaust and a probe installed in a cylinder, send the temperature information to the EGT/CHT indicator.

- Exhaust Gas Temperature (EGT)
- Cylinder Head Temperature (CHT)

The EGT system is used to measure the temperature of the exhaust gas. The measurement gives an indication of the fuel/air mixture for the pilot. The system has one indicator installed in the instrument panel, which gives the two functions that show the EGT and CHT information.

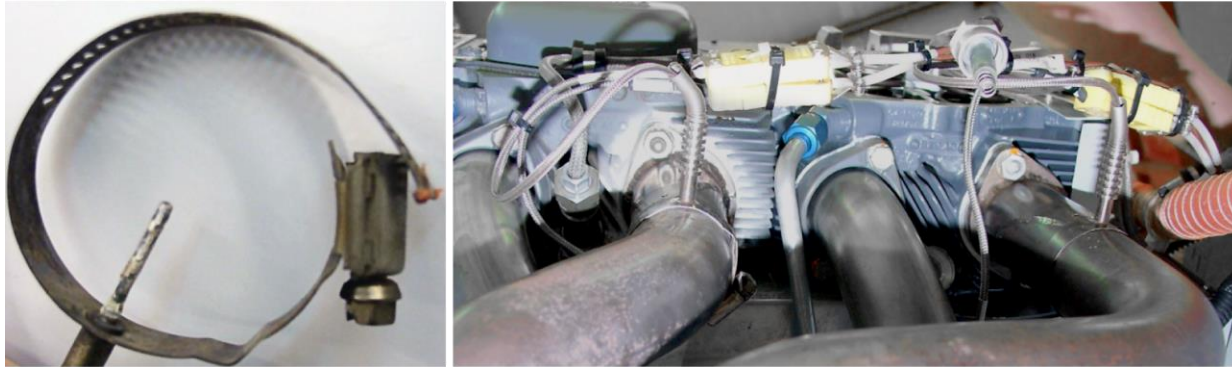
On airplanes with Garmin G1000, each cylinder has EGT and CHT probes.

ENGINE TEMPERATURE INDICATING SYSTEM - MAINTENANCE PRACTICES (77-20-00)**Exhaust System And Engine Heat**

Make sure the exhaust system and engine are cool before the probes are removed.

**Damage to the Lead Wire**

Damage to the lead wire can occur because of engine movement during startup and shutdown if there is not sufficient length in the lead wire.

ENGINE INDICATING SYSTEM - EGT PROBE (77-20-00)

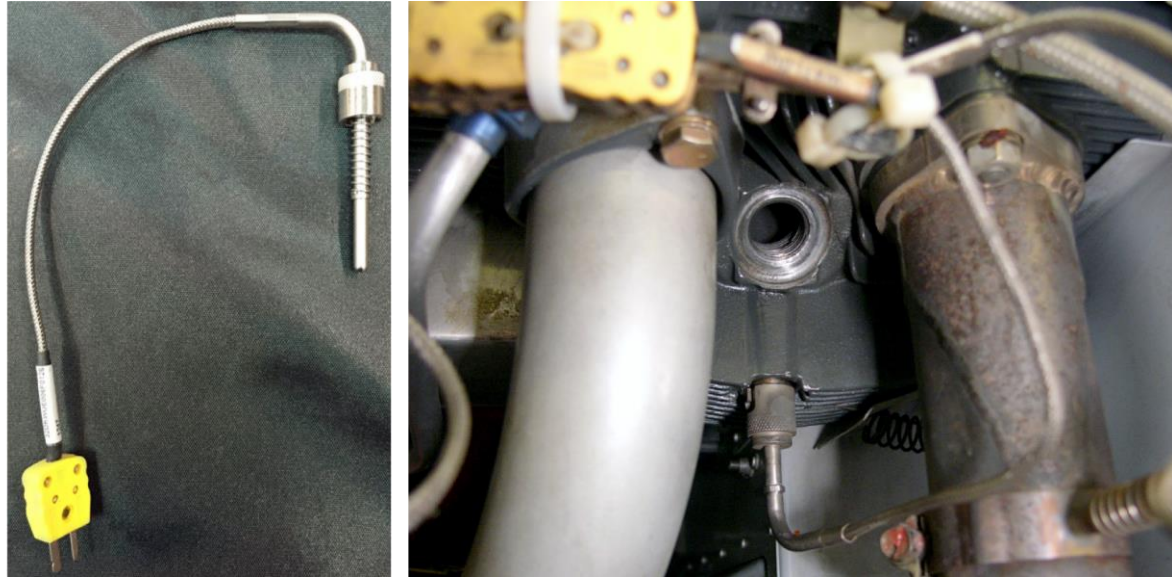
Ensure leads do not touch exhaust during any maintenance practices and inspections.

**NOTE****EGT Probe**

The EGT probe is welded to the clamp.

**NOTE****EGT Probe G1000**

Airplanes with Garmin G1000 have an EGT probe at each cylinder. Removal and installation of the EGT probes are typical.

ENGINE INDICATING SYSTEM - CHT PROBES (77-20-00)

The insulation on the wires inside the braided harness can melt if the harness is too close to the exhaust.

**NOTE****CHT Probes**

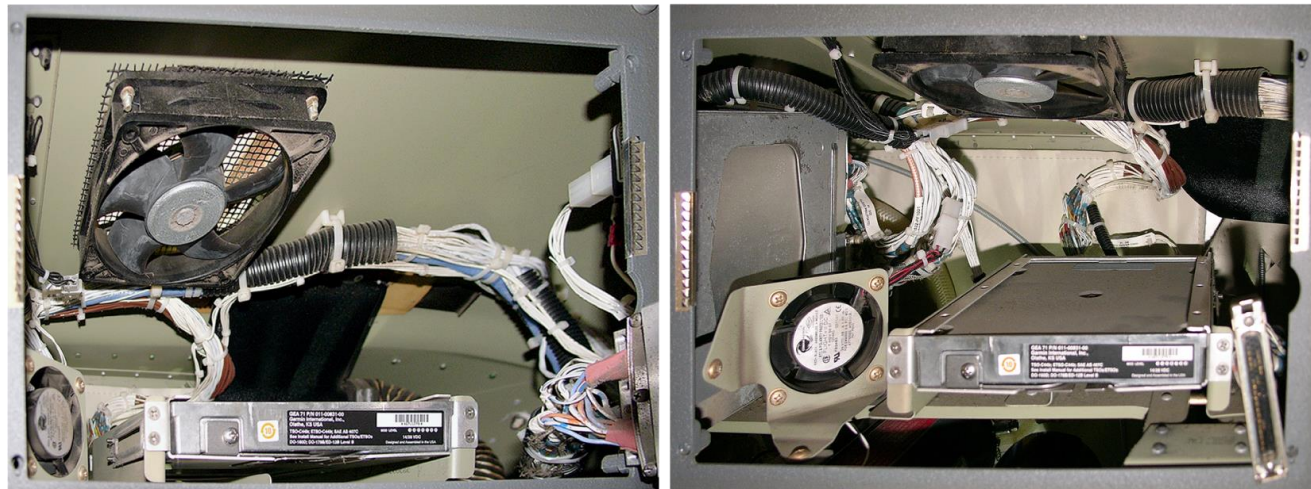
The CHT probes use a bayonet-style connector.

**NOTE****CHT Probes G1000**

Airplanes with Garmin G1000 have a CHT probe for each cylinder. Removal and installation of the CHT probes is typical.

Engine/Airframe Unit (77-40-00)

MAINTENANCE PRACTICES (77-40-00)



The GE 71 Engine/Airframe Unit speaks directly with the GIA 63 Integrate Avionics Units.

On airplanes with Garmin G1000, the GE 71 Engine/Airframe Unit is a microprocessor-based Line Replaceable Unit (LRU) that receives and processes signals from the engine and airframe sensors.

Engine/Airframe Unit Maintenance Practice Engine/Airframe Unit maintenance practices provide the procedures for the removal and installation of the GE 71 Engine/Airframe Unit located in the cockpit forward of the instrument panel.

Refer to the Garmin G1000 Line Maintenance Manual for troubleshooting the GE 71 Engine/Airframe Unit.

MAINTENANCE PRACTICES (77-40-00)

Refer to Cessna's Maintenance Manual Section 77-40-00 Figure 201 for the removal and installation of the GEA 71 Engine/Airframe Unit.

Refer to Model 172 Maintenance Manual Chapter 34, Control Display Unit - Maintenance Practices for the removal and installation of the Multi-Function Display (MFD). Inspect the electrical connector and connector pins for damage.

Refer to the Wiring Diagram Manual and the Garmin G1000 Line Maintenance Manual for replacing the electrical connector or connector pins. Refer to the Garmin G1000 Line Maintenance Manual to perform an operation check to ensure that the engine/airframe unit operates correctly.



Software and Configuration

If a new unit is installed, it is necessary to load the software and configuration.



Position without resistance.

Make sure the unit goes into position without resistance. Damage to the connectors, unit, or mounting rack will occur if the unit is pushed into position with force.

MAINTENANCE PRACTICES (77-40-00)**Mounting Rack**

The unit must be in position in the mounting rack to let the locking stud engage the channel.

**Position without resistance.**

Make sure the lever moves without resistance. Damage to the unit will occur if the lever is pushed into position with force.

Engine Indicating System Review



Cessna's Maintenance Manual Chapter 77 provides description and maintenance practices of the engine indicating system.

The Garmin G1000 provides the engine speed (RPM), which is measured by the tachometer sending unit and changed to an electrical signal. The Garmin Display Units (CDU) display the following engine parameters:

- Engine Speed
- Exhaust gas temperature
- Cylinder Head Temperature

Refer to Cessna's Maintenance Manual Chapter 79 for oil pressure and temperature indication.

Model Differences

182/206 DIFFERENCES - ENGINE TEMPERATURE - DESCRIPTION AND OPERATION (77-20-00)



Description:

The system that shows the temperature for the 182 and 206 aircraft engines includes the indicators and probes for the:

- Cylinder Head Temperature (CHT)
- Exhaust Gas Temperature (EGT) for the non-turbo airplanes
- Turbine Inlet Temperature (TIT) for airplanes with a turbo engine

182/206 DIFFERENCES - ENGINE TEMPERATURE - DESCRIPTION AND OPERATION (77-20-00)

Operation:

Non-Turbocharged Airplanes:

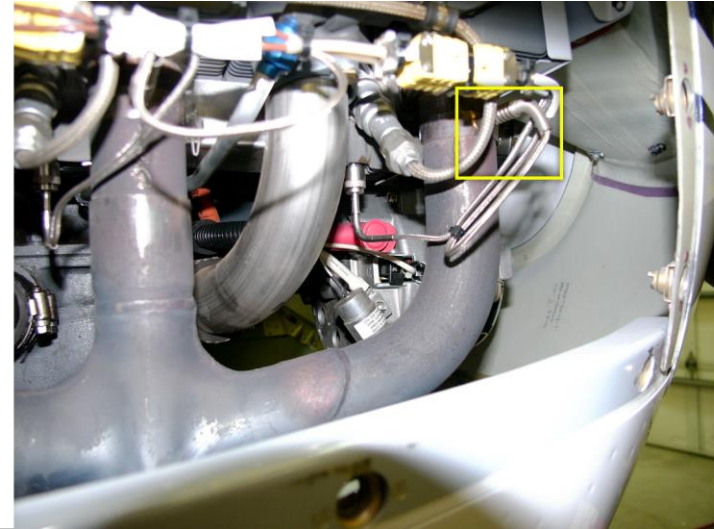
- On the non-turbocharged airplanes, the EGT system measures the temperature of the exhaust gas.
- The measurement gives an indication of the fuel/air mixture for the pilot.
- The system has one indicator in the instrument panel to show the EGT and CHT information.
- A probe installed in the exhaust and a probe installed in a cylinder send the temperature information to the TIT/CHT indicator.
- On airplanes with Garmin G1000, each cylinder has EGT and CHT probes.

Turbocharged Airplanes.

- On turbocharged airplanes, the TIT system measures temperature of the exhaust gas as it enters the turbine.
- The measurement gives an indication of the fuel/air mixture for the pilot.
- The system has one indicator installed in the instrument panel, which gives two functions that show the TIT and CHT information.
- A probe installed in the turbine inlet and a probe installed in a cylinder, send the temperature information to the TIT/CHT indicator.
- On airplanes with Garmin G1000, each cylinder has EGT and CHT probes.

182 DIFFERENCES - ENGINE TEMPERATURE - MAINTENANCE PRACTICES (77-20-00)

EGT Probe Removal/Installation

**EXHAUST SYSTEM**

Make sure the exhaust system and engine are cool before the probes are removed.

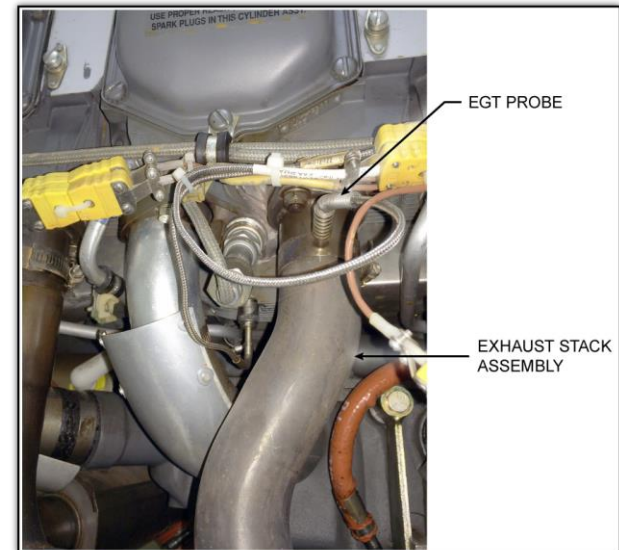
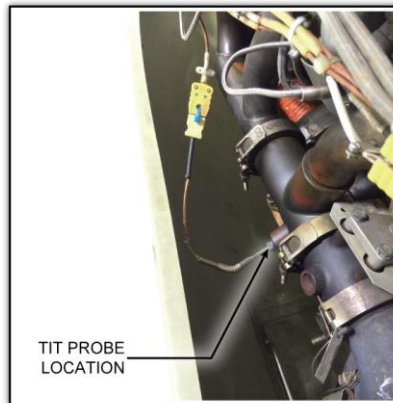
182 DIFFERENCES - ENGINE TEMPERATURE - MAINTENANCE PRACTICES (77-20-00)**EGT PROBE**

The EGT probe is welded to the clamp. Note: Airplanes with the Garmin G1000 have an EGT probe at each cylinder. Removal and installation of the EGT probes are typical.

**Lead Wire**

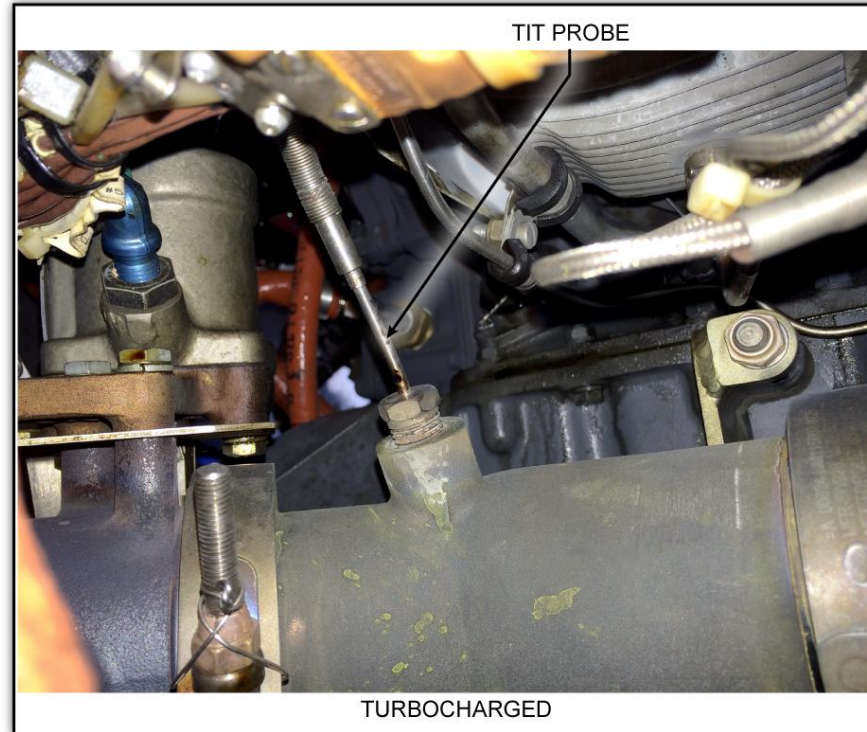
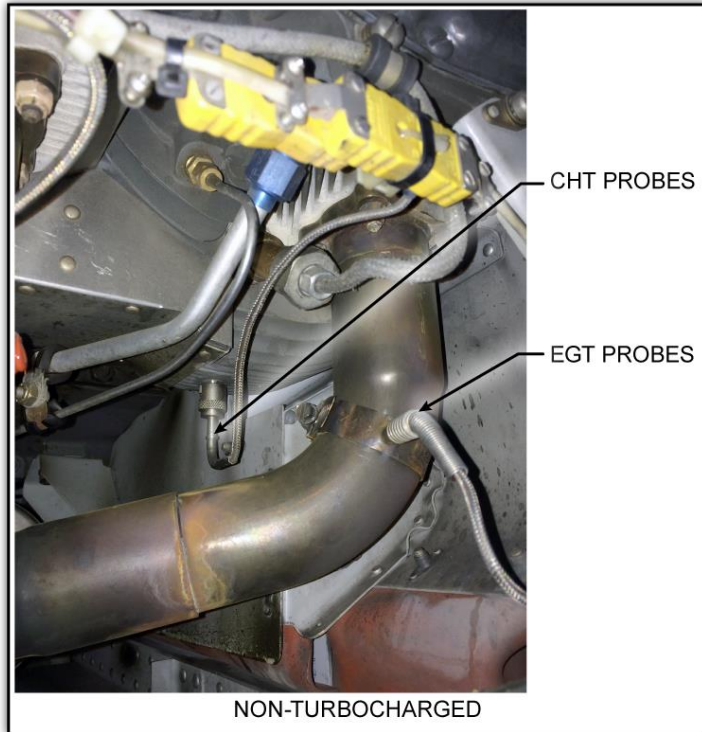
Damage to the lead wire can occur because of engine movement during startup and shutdown if there is not sufficient length in the lead wire.

EGT Probe Lead Wire Repair

182 DIFFERENCES - ENGINE TEMPERATURE - MAINTENANCE PRACTICES (77-20-00)**TIT Probe Removal/Installation****Lead Wire**

Make sure the exhaust system and engine are cool before the probes are removed.

CHT Probe Removal/Installation

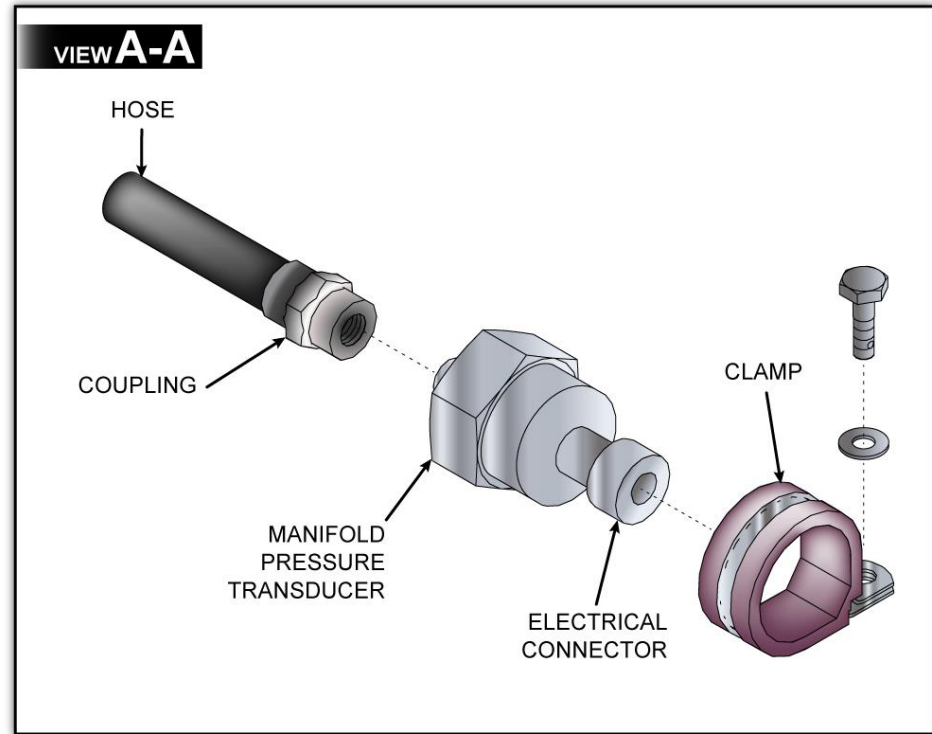
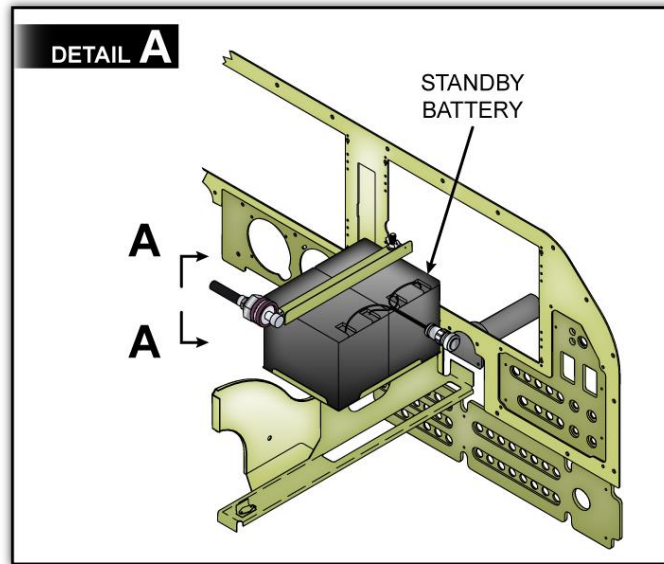
206 DIFFERENCES - ENGINE – MAINTENANCE PRACTICES (71-00-01)

For engine removal and installation follow the steps outlined in this section of the maintenance manual.

Engine Removal Differences: For airplanes with Garmin G1000 avionics, disconnect the EGT and the CHT thermocouple connectors.

Engine and Mount Installation Differences: For airplanes with Garmin G1000 avionics, connect the EGT and the CHT thermocouple connectors.

182/206 DIFFERENCES - MANIFOLD PRESSURE TRANSDUCER - MAINTENANCE PRACTICES AIRPLANES (77-30-00)



These Maintenance Practices apply to airplanes with the Garmin G1000 system.

For complete remove/replace procedures see 77-30-00 in the maintenance manual.

Procedures include:

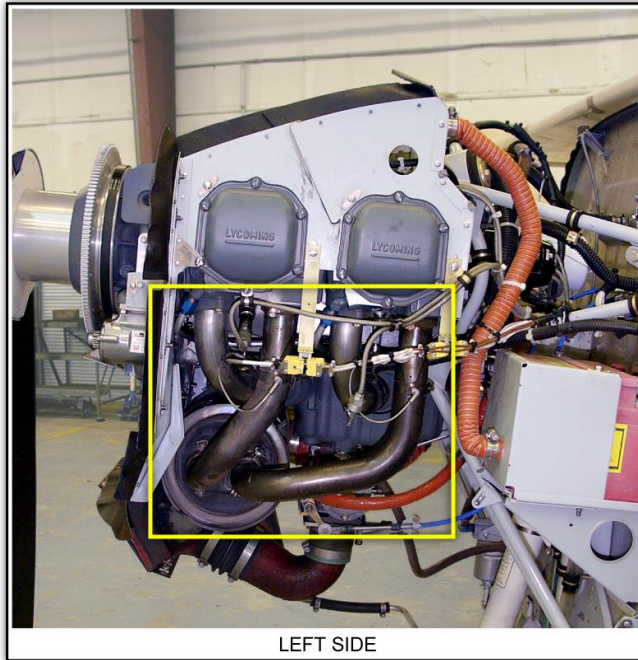
- Remove the Manifold Pressure Transducer
- Install the Manifold Pressure Transducer

ATA78 - Exhaust

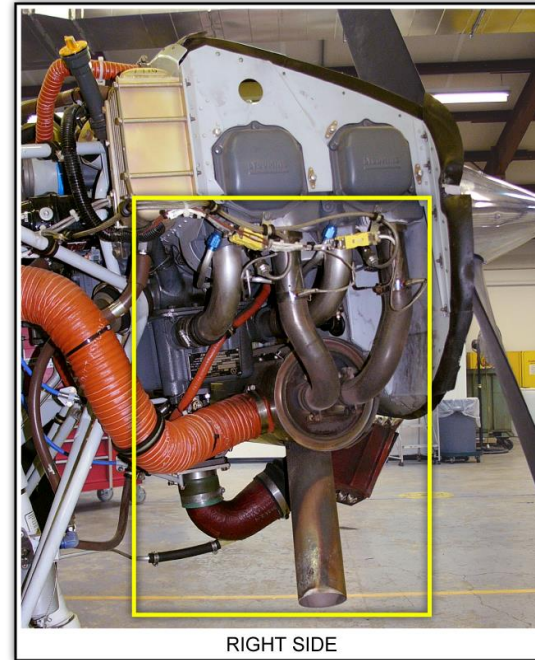
Overview

LESSON OBJECTIVES

- Explain safety precautions related to the exhaust.
- Explain maintenance practices important to the exhaust
- Explain special tooling and test equipment used with Cessna High Wing Series Aircraft
- Explain procedures for replacement of unique components

EXHAUST SYSTEM OVERVIEW (78-00-00)

LEFT SIDE



RIGHT SIDE

The Cessna's Maintenance Manual Chapter 78 provides the description, removal, installation and testing procedures for the Exhaust System.

General Information

The exhaust system consists of an exhaust pipe (riser) from each cylinder to the muffler with a single tailpipe which routes exhaust gases out through the lower cowl area.

The muffler is located beneath the engine, and is enclosed by a shroud which captures radiated exhaust heat.

This heated air is then ducted to the airplane cabin through flexible hoses.

Exhaust System

MAINTENANCE PRACTICES (78-10-00)



Exhaust Removal and Installation

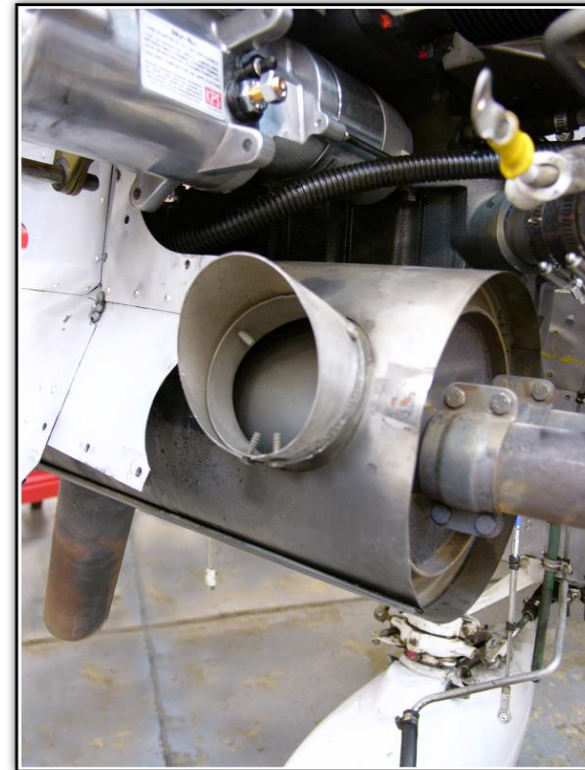
Refer to Cessna's Maintenance Manuals Section 78-10-00, Figure 201 for the removal and installation of the exhaust system.

Refer to Cessna's Maintenance Manual Chapter 71, Engine Cowling - Maintenance Practices for the removal and installation of the engine cowlings.

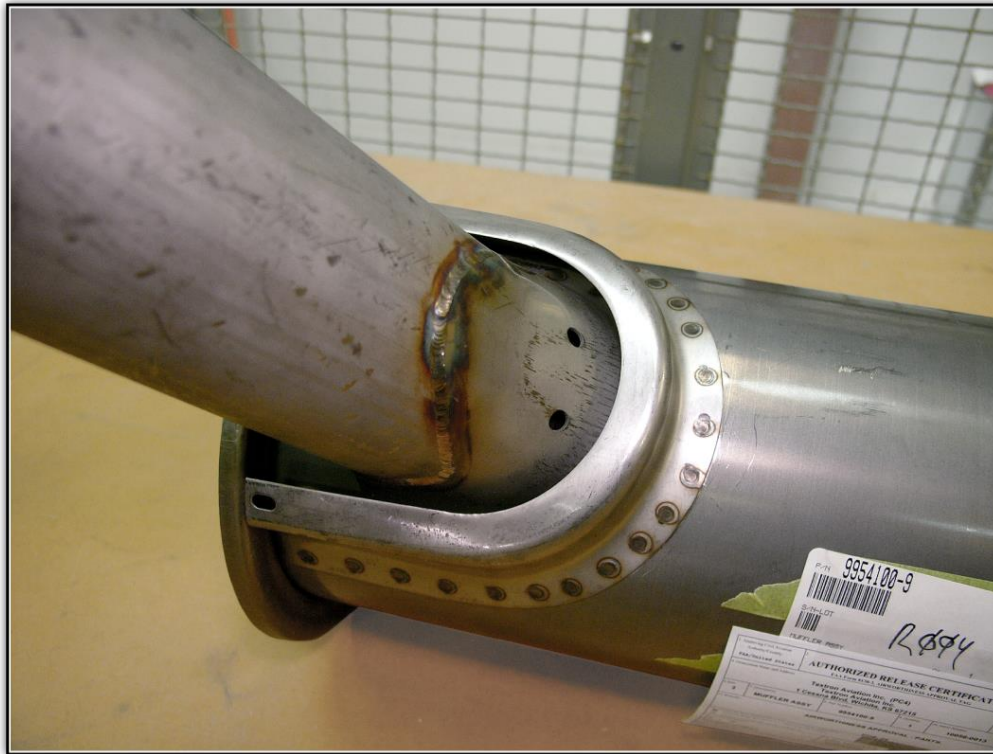
Refer to Cessna's Maintenance Manual Section 78-10-00 for inspecting the muffler.

Torque risers 200-210 inch-pounds at engine, then tighten clamps connecting risers to muffler.

MUFFLER - INSPECTION/CHECK (78-10-00)



MUFFLER - INSPECTION/CHECK (78-10-00)



MUFFLER - INSPECTION/CHECK (78-10-00)**MUFFLER LEAK CHECK**

Failure to inspect muffler for leaks could result in carbon monoxide entering the cabin, leading to serious injury or death.

**INSPECTION TIME INTERVALS**

The exhaust system must be thoroughly inspected at time intervals set forth in Chapter 5, Inspection Time Limits, or anytime exhaust fumes are detected in the cabin.

Examine the interior of the muffler for cracks or general deterioration with a flashlight and mirror.

- During visual inspection, examine the exterior of muffler for holes, cracks and burned spots.
 - Pay special attention to areas adjacent to welds and to exhaust gas deposits (which indicate an exhaust leak).
 - Perform air leak check should be made on the system as follows:
- Attach the pressure side of the vacuum cleaner to the tail pipe opening with a rubber plug to effect a seal as required.

MUFFLER - INSPECTION/CHECK (78-10-00)**NOTE****VACUUM CLEANER HOSE**

The inside of vacuum cleaner hose should be free of any contamination that might be blown into the engine exhaust system.

Examine all joints in the exhaust system with vacuum cleaner operating. This inspection may be checked by using a soap and water solution and watching for bubbles for the following action:

- Forming of bubbles is considered acceptable
- If bubbles are blown away, system is not considered acceptable.

Perform water test to determine muffler integrity as followed:

Seal muffler openings with rubber expansion plugs.

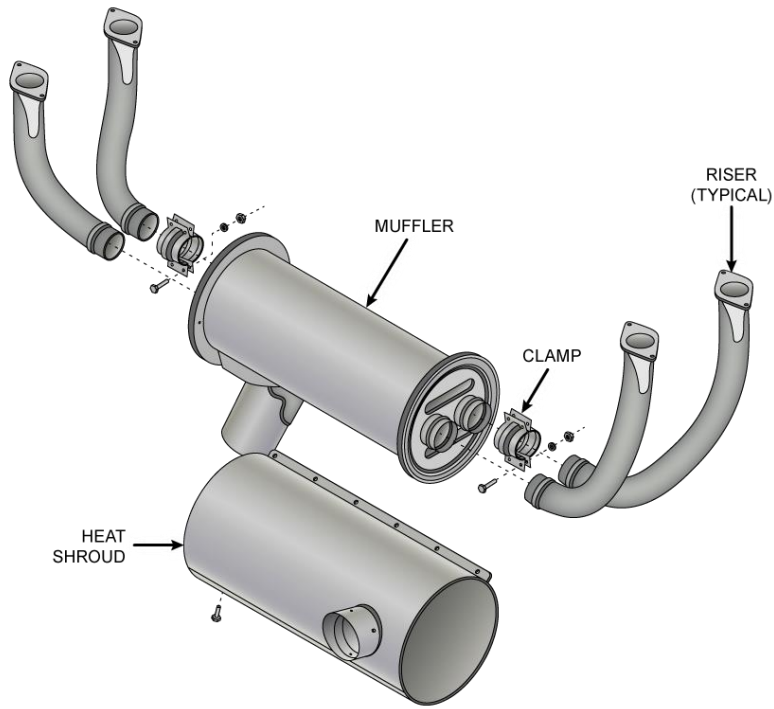
MUFFLER - INSPECTION/CHECK (78-10-00)**NOTE****EXPANSION PLUG**

One expansion plug should be adapted to allow for introduction of low-pressure air into muffler.

With a pressure gauge or manometer, apply approximately 3.0 PSI, +0.5 or -0.5 PSI (6 inches mercury), to interior of muffler and submerge muffler into water inspect for leaks.

- Any leaks will appear as bubbles and can be readily detected and the muffler must be removed from service and repaired or replaced.
- If no defects are found, remove muffler from water, remove plugs and dry muffler with compressed air.

Exhaust System Review



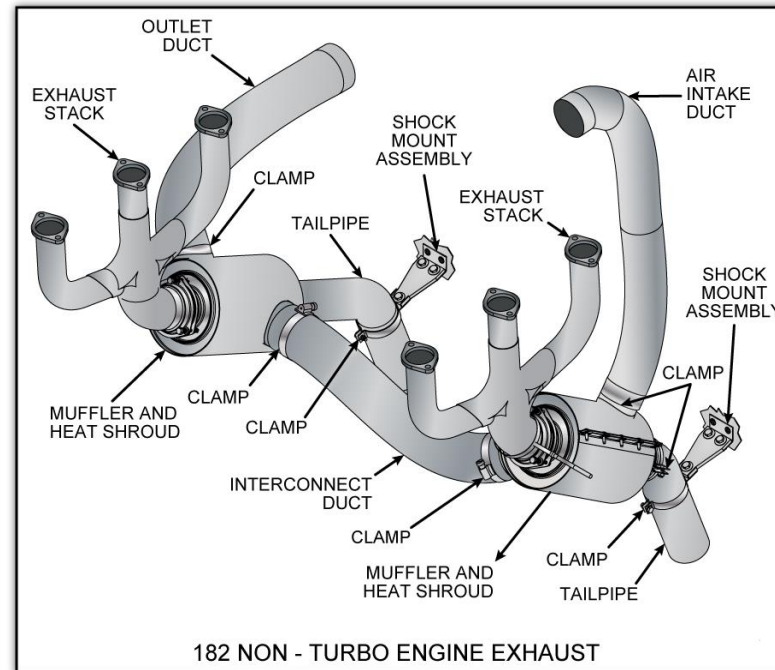
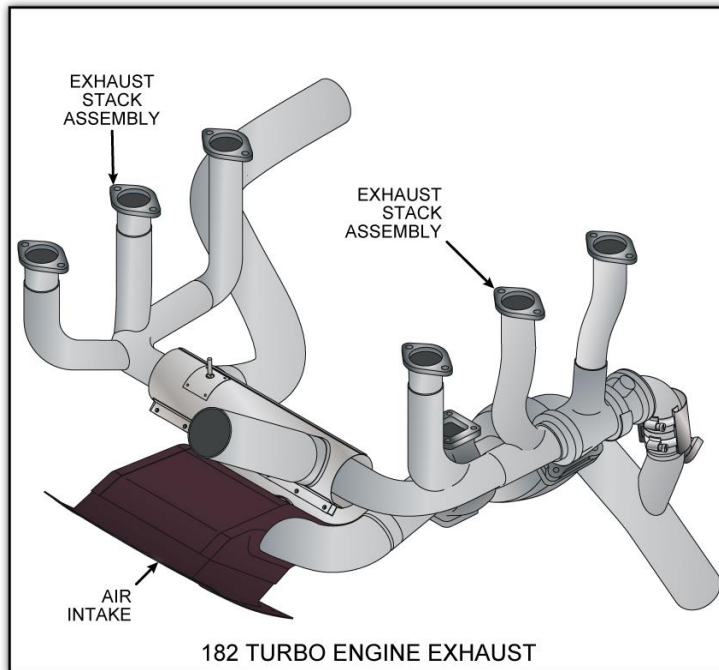
Cessna's Maintenance Manual Chapter 78 provides the description, removal, installation, and testing procedures for the Exhaust System.

General Information.

The exhaust system consists of an exhaust pipe (riser) from each cylinder to the muffler with a single tailpipe which routes exhaust gases out through the lower cowling area. The muffler is located beneath the engine, and is enclosed by a shroud which captures radiated exhaust heat. This heated air is then ducted to the airplane cabin through flexible hoses.

Model Differences

182 DIFFERENCES - ENGINE EXHAUST



The exhaust system has two exhaust stacks, two muffler assemblies, two tail pipes, and associated hardware.

The muffler assemblies have heat shrouds to provide cabin heat.

The left muffler shroud has an air intake duct connected to the upper left engine baffle.

A duct interconnects the left and right heat shrouds. The duct connected to the right heat shroud is routed to the cabin heat control valve on the firewall.

182 DIFFERENCES - ENGINE EXHAUST

182 Turbo Charged Engine

- The exhaust system (turbocharged) has an exhaust stack assembly, heat shroud, and associated hardware.
- The heat shroud supplies cabin heat. The shroud has an air intake duct connected to the upper right engine baffle.
- A duct connects the shroud to the cabin heat control valve on the firewall.



EXHAUST SYSTEM

The exhaust system (turbocharged) has Lycoming components, with the exception of the heat shroud and exhaust stack.

- Reference Lycoming Service Instructions SI204D (or latest revision) and SI1562 before performing maintenance on the exhaust system.
- List of Manufacturers Technical Publications. Attach the pressure side of an industrial vacuum cleaner to the exhaust stack opening with a rubber plug to make a seal, as necessary.

182 DIFFERENCES - ENGINE EXHAUST**VACUUM CLEANER HOSE**

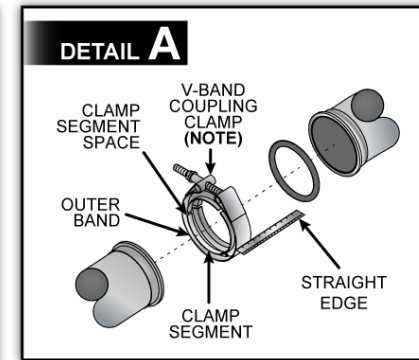
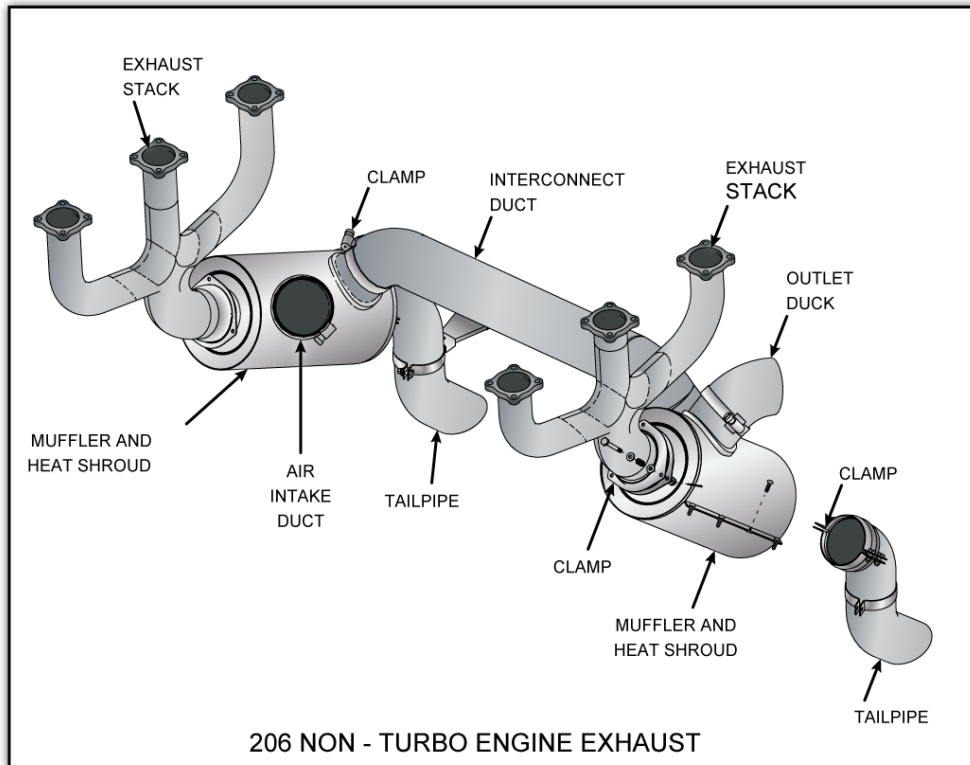
The inside of the vacuum cleaner hose must be free of contamination that can be blown into the engine exhaust system.

- With the vacuum cleaner in operation, all joints in the exhaust system can be examined manually by touch, or with a soap and water solution.
- The formation of bubbles is satisfactory; if the bubbles are blown away, the system is not satisfactory.

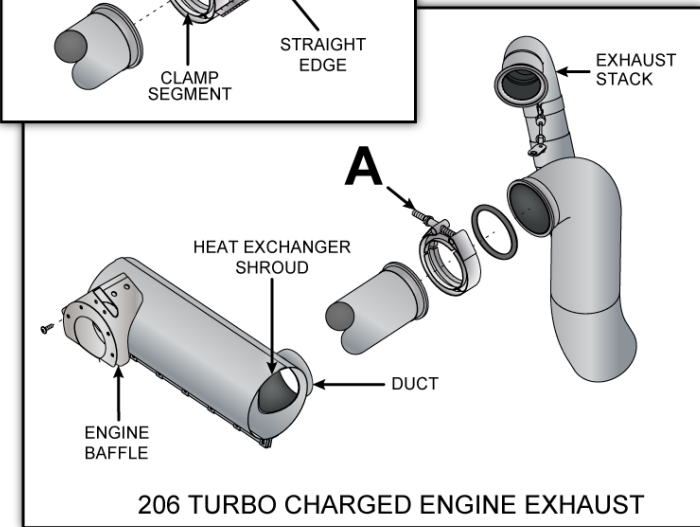
**BUBBLES**

Bubbles are satisfactory at the slip joint, but not satisfactory at weld joints.

206 DIFFERENCES - ENGINE EXHAUST



NOTE
Look carefully for cracks in all visual access areas of the installed clamp.



For the 206 - Non Turbo Charged Engine Exhaust:

- The exhaust system has two exhaust stacks, two muffler assemblies, two tailpipes, and associated hardware.
- The muffler assemblies have a heat shroud to provide cabin heat.
- The right muffler shroud has an air intake duct connected to the upper right engine baffle.
- A duct interconnects the left and right heat shrouds. The duct connected to the left heat shroud is routed to the cabin heat control valve on the firewall.

206 DIFFERENCES - ENGINE EXHAUST

For the 206 - Turbo Charged Engine Exhaust –The tailpipe and heat shroud assemblies are Cessna components.

- The exhaust system (Turbocharged) is a Textron Lycoming assembly.
- Textron Lycoming has additional information for the removal, installation and any additional maintenance necessary for the exhaust system.
- The exhaust system is an exhaust stack assembly, heat shroud, and associated hardware.
- The heat shroud gives heat to the cabin.
- The heat shroud is installed with an air intake duct, which connects to the top right engine baffle.

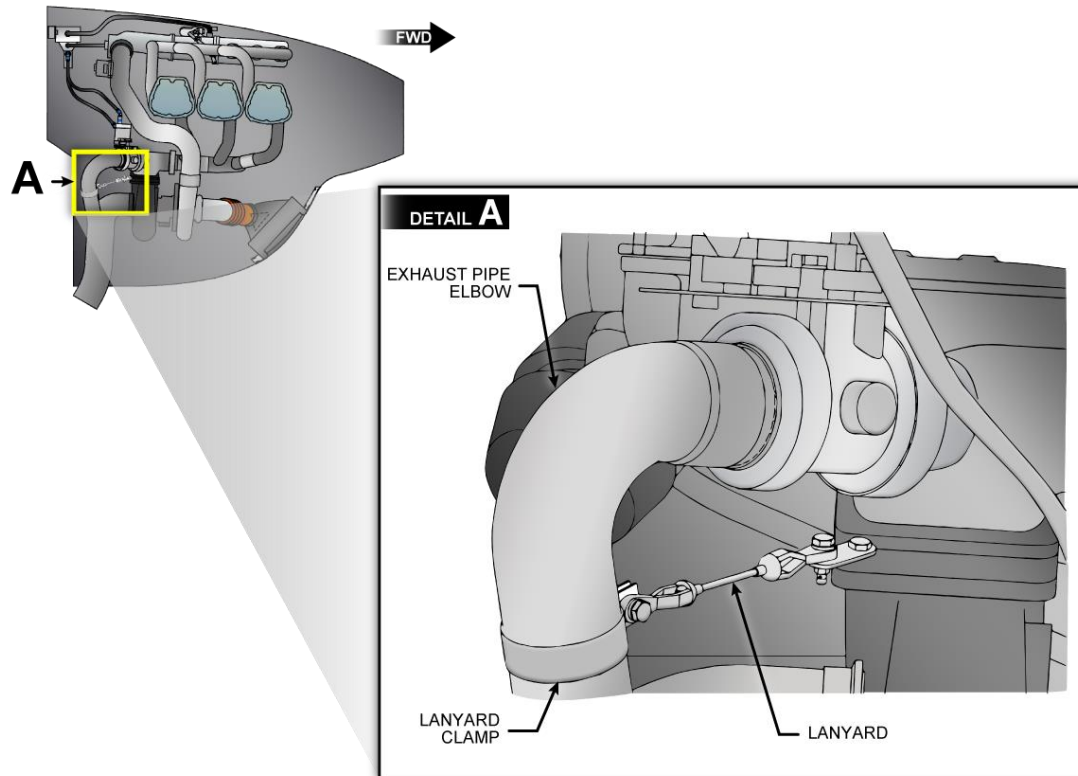
The duct routing connects to the shroud and to the cabin heat control valve on the firewall.



LYCOMING SERVICE INSTRUCTION

Reference Lycoming Service Instruction SI1204D (or latest revision) Exhaust Flange Gaskets and Lycoming SI1562 (or latest revision) Turbocharged Exhaust System Installation prior to performing any exhaust system maintenance on Lycoming turbocharged engines.

EXHAUST SYSTEM (TURBOCHARGED) - MAINTENANCE PRACTICES



V-Band Coupling Clamp Inspection

EXHAUST SYSTEM (TURBOCHARGED) - MAINTENANCE PRACTICES**CLAMPS**

You must fully inspect the clamps each time they are removed.

**CLAMPS**

- Each removal and installation of the clamps will decrease the service life.
- Deformation of the clamp is when the straightedge does not touch a sufficient area across the clamp when you do a flatness check.

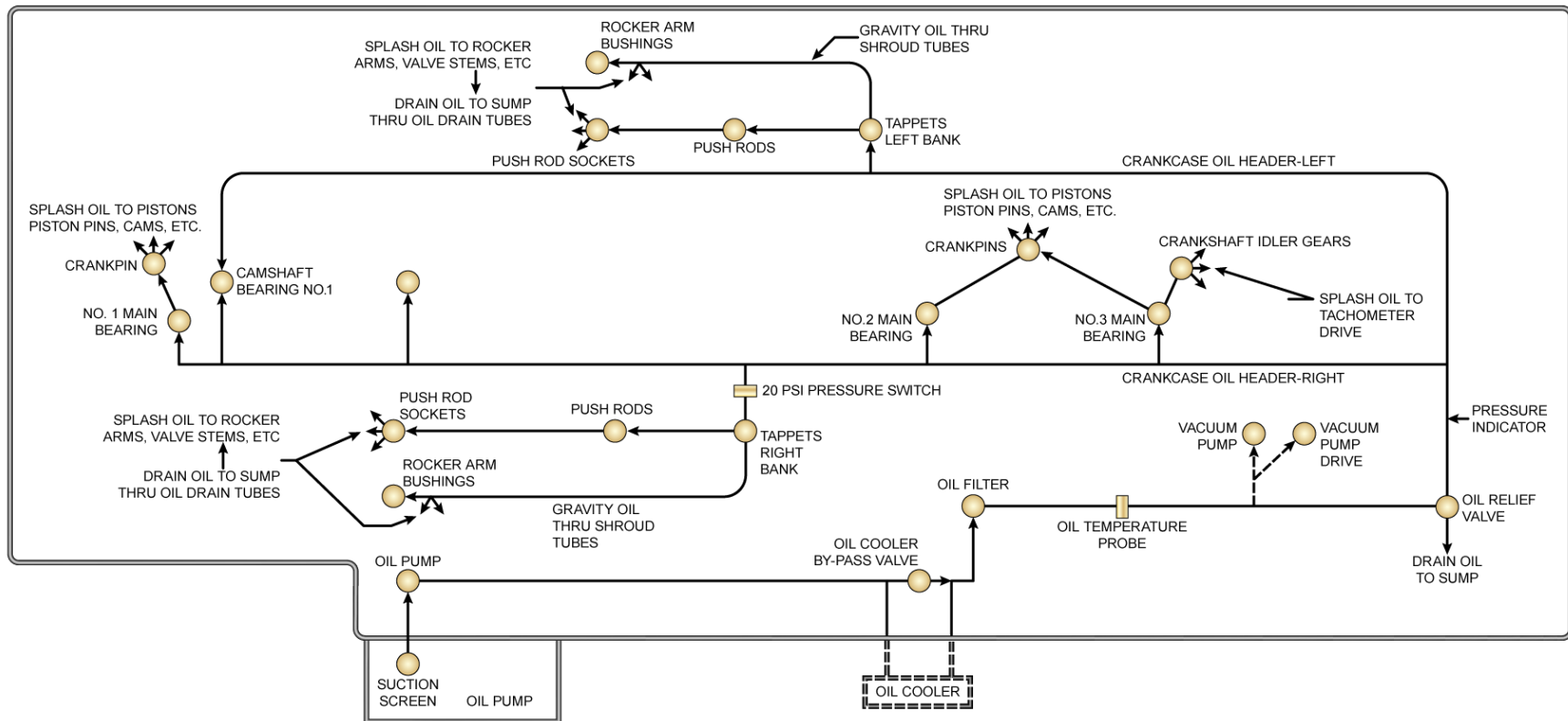
ATA79 - Oil

Overview

LESSON OBJECTIVES

- Explain safety precautions related to the oil system.
- Explain maintenance practices important to the oil cooler
- Explain troubleshooting procedure important to the oil indication
- Explain maintenance practices important to the oil indication
- Explain special tooling and test equipment used with Cessna High Wing Series Aircraft
- Explain procedures for replacement of unique components

DESCRIPTION (79-00-00)



ATA Chapter 79 provides information on troubleshooting and maintenance practices on the components that distribute and indicate oil condition.

Refer to appropriate Textron Lycoming Operator's and Overhaul Manuals, and to Chapter 71, IO-360-L2A – Troubleshooting for information beyond the scope of this material.

Refer to Lycoming Overhaul Manual Section 2 Figure 2-3 Lubrication Diagram for an overview of the oil system.

DESCRIPTION (79-00-00)

The Lycoming IO-360-L2A engine utilizes a full pressure, wet sump type lubrication system.

Oil tank capacity is eight quarts with one additional quart contained in the engine oil filter.

Lubrication System

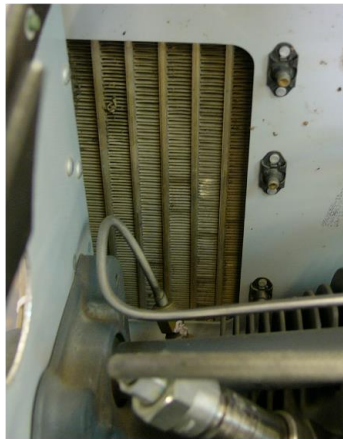
Oil from the sump passes through a filter screen on the end of a pickup tube to the engine driven oil pump and moves onward through a full-flow oil filter, a pressure relief valve at the rear of the right oil gallery, and a thermostatically controlled remote oil cooler.

- The filter adapter in the full-flow filter is equipped with a bypass valve which will cause lubricating oil to bypass the filter in the event the filter becomes plugged, or the oil temperature is extremely cold.

Oil from the remote cooler circulates into the left oil gallery to lube the engine components. After lubricating the engine, the oil returns to the sump by gravity.

Oil Cooler (79-20-00)

MAINTENANCE PRACTICES (79-20-00)



The Oil Cooler maintenance practices consist of removal and installation of the oil cooler.

Refer to Cessna's Model 172 Maintenance Manual Section 79-20-00, Figure 201 for removing and installing the oil cooler.

Refer to Cessna's Model 172 Maintenance Manual Chapter 71, Cowling - Maintenance Practices for the removal and installation of the engine cowlings.

Inspect for blockage when top cowling is off.

Oil Pressure Indicator

DESCRIPTION AND OPERATION (79-30-00)

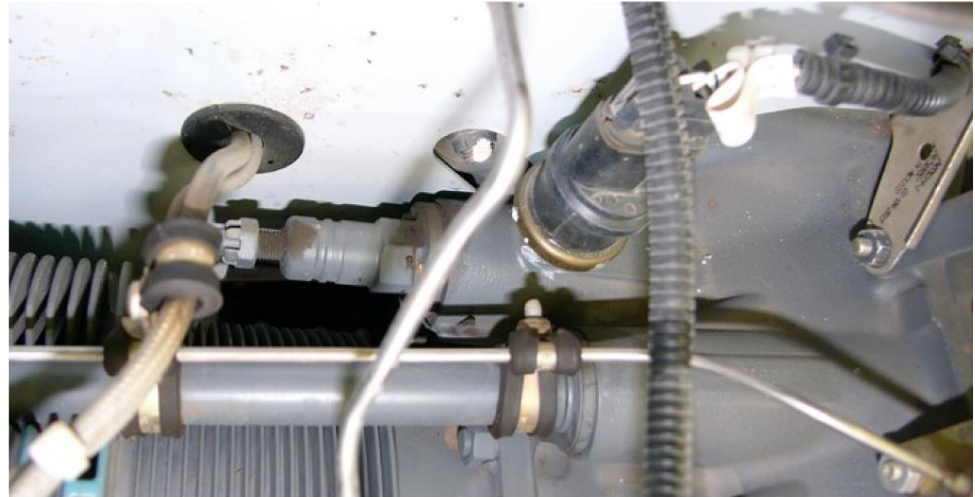


Oil pressure is measured at two points on the engine and gives both indicator readings and low oil pressure annunciation.

On airplanes with Garmin G1000, the oil pressure shows on the Multi-Function Display (MFD).

Refer to the Garmin G1000 Line Maintenance Manual for GDU 1044B troubleshooting.

TROUBLESHOOTING (79-30-00)



The Cessna's Model 172 Maintenance Manual Chapter 79 provides a Troubleshooting Chart Figure 101 and Table 101 to fix malfunctions with the oil pressure indicator system.

Refer to Cessna Maintenance Manual, models 1996 and On Wiring Diagram Manual for trouble shooting the oil pressure indicator

Refer to Cessna Maintenance Manuals Section 79-30-00 Figure 101 when troubleshooting the oil pressure indicator.

TROUBLESHOOTING (79-30-00)

**VOLTAGES**

Do not apply voltages that are more than the voltages shown in Table 101. Too much voltage can cause damage to the indicator.

**OIL PRESSURE INDICATOR**

Do not calibrate the oil pressure indicator without a calibrated pressure source.

**OIL PRESSURE TRANSDUCER**

A test of the calibration for the oil pressure transducer (JN004) can be completed at a facility that has a calibrated pressure source. Table 101 can be used to do a check of the correct output of the transducer.

The trouble shooting procedure consist of the oil pressure indicator does not operate or shows the incorrect pressure.

OIL PRESSURE INDICATOR - MAINTENANCE PRACTICES (79-30-00)



Refer to Cessna's Maintenance Manual section 79-30-00 Figure 201 for the removal and installation of the oil temperature sending unit.

Oil temperature sending unit removal and installation is typical for all avionics packages.

Remove the upper engine cowl.

Refer to Chapter 71, Cowling - Maintenance Practices for removing and installing the engine cowls.

Torque jamnut to a maximum of 20 in-lbs. (2.3 N-m).

Perform engine run to ensure the indicator operates correctly and there are no leaks.

On airplanes with Garmin G1000, the oil temperature is shown on the Multi-Function Display (MFD).

Refer to Control Display Unit - Maintenance Practices for removal and installation procedures of the MFD.

Refer to Oil Pressure Indicators - Maintenance Practices for the removal and installation of the Oil Temperature/Oil Pressure Indicator.

Oil Temperature Indicator

DESCRIPTION AND OPERATION (79-31-00)

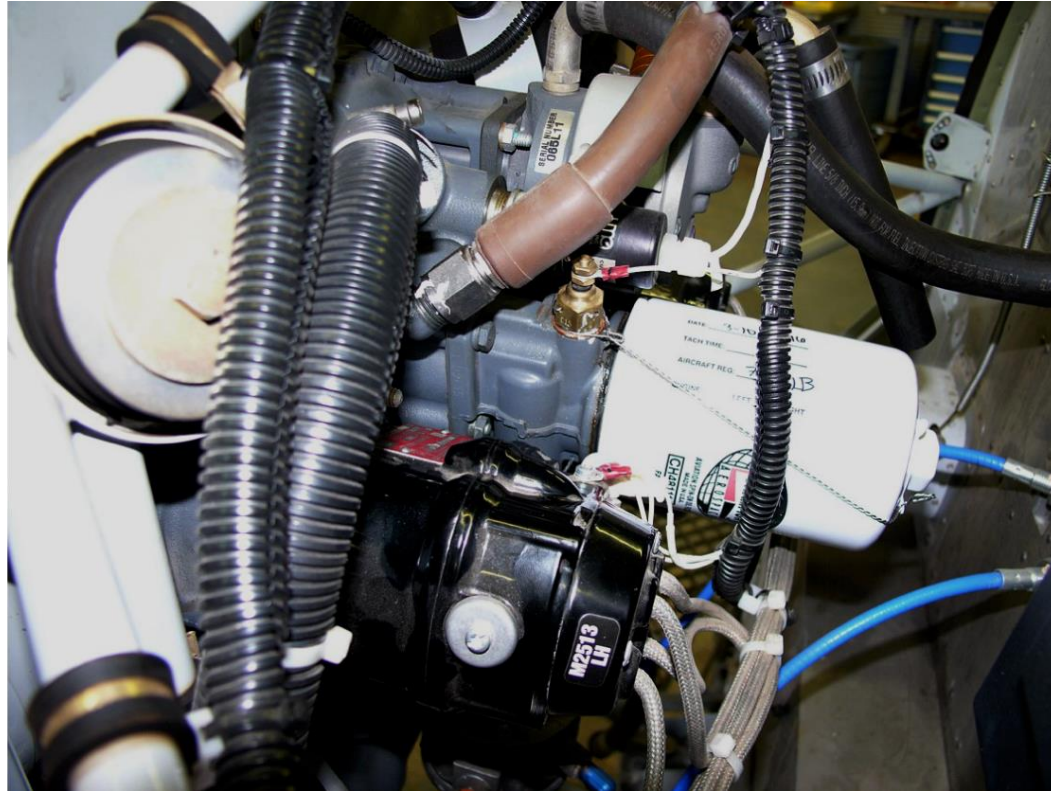


On airplanes with Garmin G1000, the oil temperature is shown on the Multi-Function Display (MFD).

The oil temperature system has a sending unit, an oil temperature/oil pressure indicator and wire between the two components.

Oil temperature is measured in the accessory case area and gives cockpit readings in °F

The oil temperature sending unit is the same for all avionics packages.

TROUBLESHOOTING (79-31-00)

The Cessna Maintenance Manual Chapter 79 provides a Troubleshooting Chart Figure 101 and Table 101 to fix malfunctions with the oil temperature indicator system function correctly.

Refer to the Model 172 1996 and On Wiring Diagram Manual for troubleshooting the oil temperature indicator.

The trouble shooting procedure consist of the oil temperature indicator does not operate or shows the incorrect temperature.

ADJUSTMENT/TEST (79-31-00)

Refer to Cessna's Maintenance Manual section 79-30-00 Figure 201 for the removal and installation of the oil temperature-sending unit.

Oil temperature sending unit removal and installation is typical for all avionics packages.

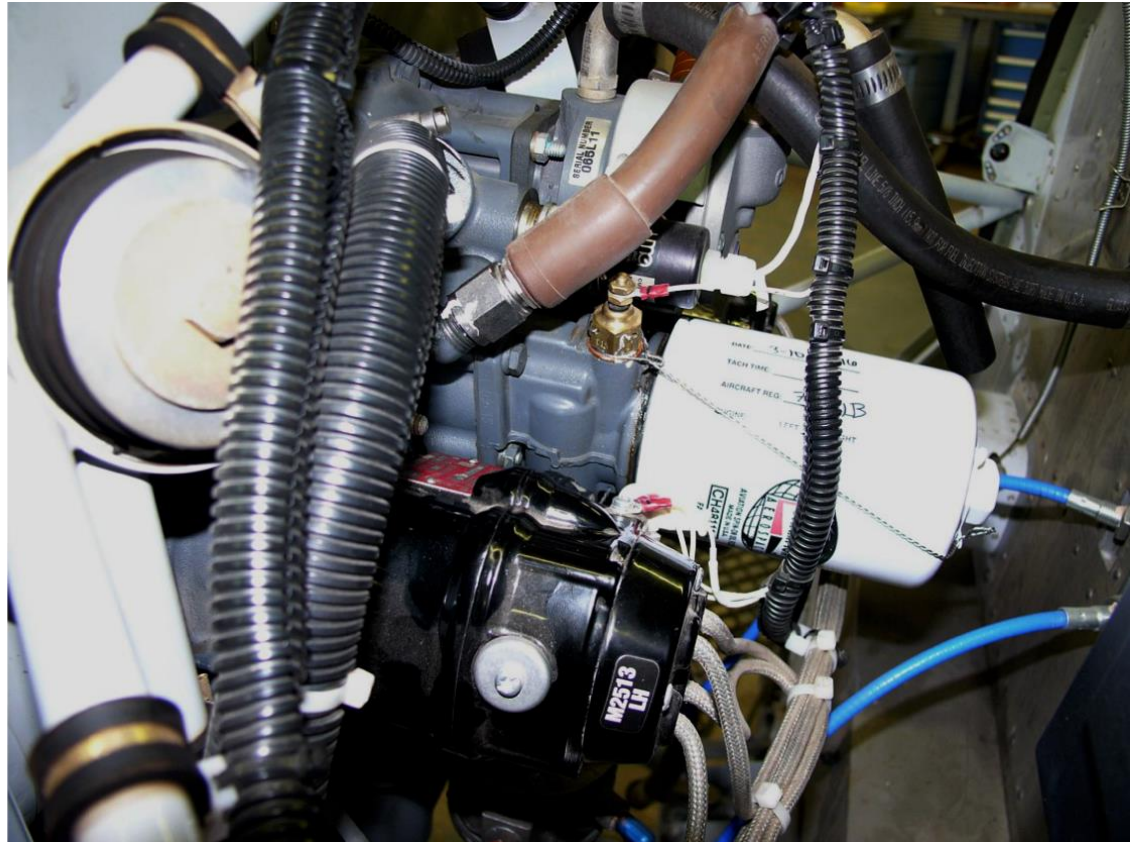
Remove the upper engine cowl. Refer to Chapter 71, Cowling - Maintenance Practices for removing and installing the engine cowl.

Torque jam-nut to a maximum of 20 in-lbs. (2.3 N-m). Perform engine run to ensure the indicator operates correctly and there are no leaks.

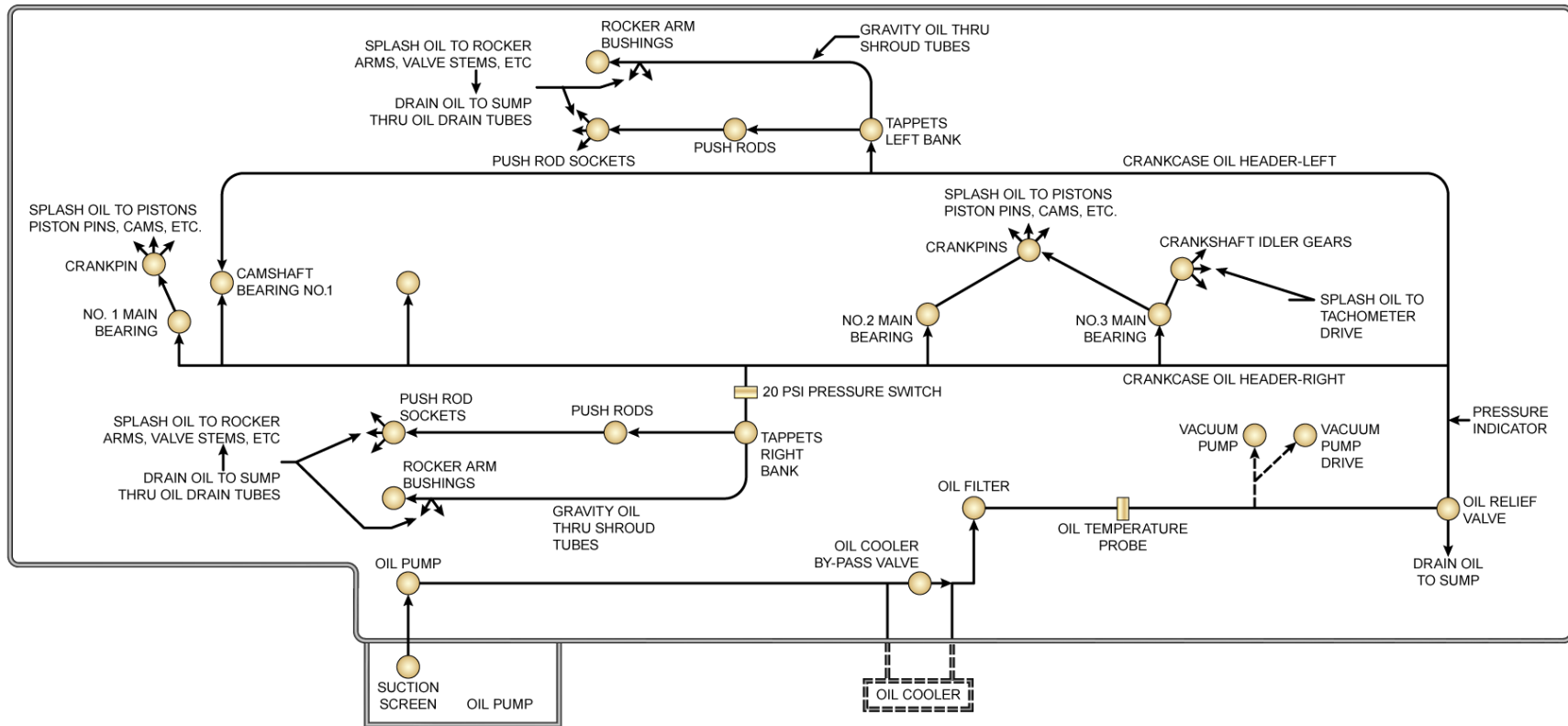
On airplanes with Garmin G1000, the oil temperature is shown on the Multi-Function Display (MFD).

Refer to Control Display Unit - Maintenance Practices for removal and installation procedures of the MFD.

Refer to Oil Pressure Indicators - Maintenance Practices for the removal and installation of the Oil Temperature/Oil Pressure Indicator.



Oil System Review



ATA Chapter 79 provides information on troubleshooting and maintenance practices on the components that distribute and indicate oil condition.

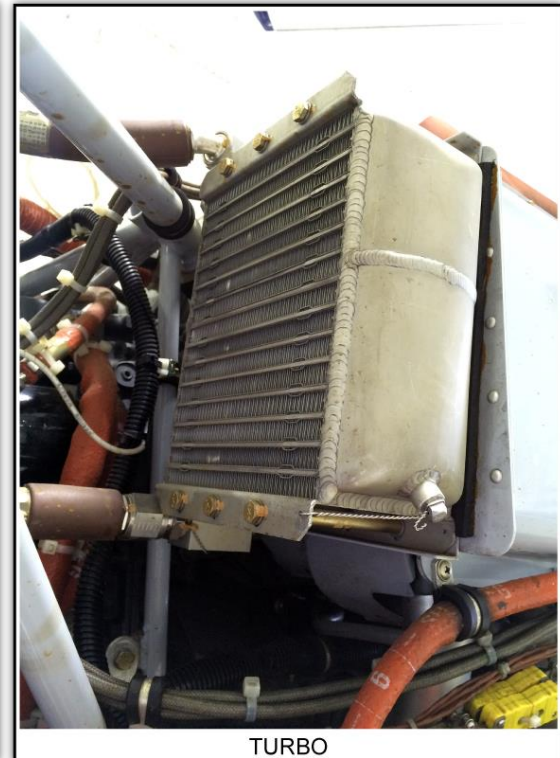
The Lycoming IO-360-L2A engine utilizes a full pressure, wet sump type lubrication system.

Model Differences

182 DIFFERENCES - TURBO/NON TURBO OIL COOLERS (79-20-00)



NON-TURBO



TURBO

Differences of the 182 Turbo and Non-Turbo oil coolers.

- Size
- Location

206 DIFFERENCES - TURBO OIL COOLERS (79-20-00)



NON-TURBO



TURBO

Differences of the 206 Turbo oil coolers compared to the 182.

- Size
- Location

206 DIFFERENCES - TURBO OIL / AIR SEPARATOR (79-20-10)

Turbocharged airplanes have an oil/air separator assembly installed in the breather system.

- During engine operation, air pressure collects in the crankcase and it is necessary to release that pressure.
- The air/oil separator removes oil from the air before it is released through the breather overboard line.
- After the air/oil separator removes the oil from the air, the oil is put back in the crankcase where it is used again.
- The separator assembly has three hoses. One connects to the separator to the crankcase breather line, one connects the separator to the crankcase oil return line, and one connects the separator to the breather overboard line.
- Based on serial ranges, two different part numbers of air/oil separators are made for the turbocharged T206H and T182T.
- The 172 does not have an air/oil separator like the Turbo charged 182 and 206.



ATA81 - Turbines

LESSON OBJECTIVES

- Identify safety precautions related to ATA Chapter 81
- Identify maintenance practices important to ATA Chapter 81
- Describe the general layout of ATA Chapter 81
- Describe normal system operations
- Interpret system indications
- Identify special tooling and test equipment used with ATA Chapter 81
- Perform system and component functional checks
- Correlate information for fault diagnosis and rectification decisions
- Describe procedures for replacement of unique components

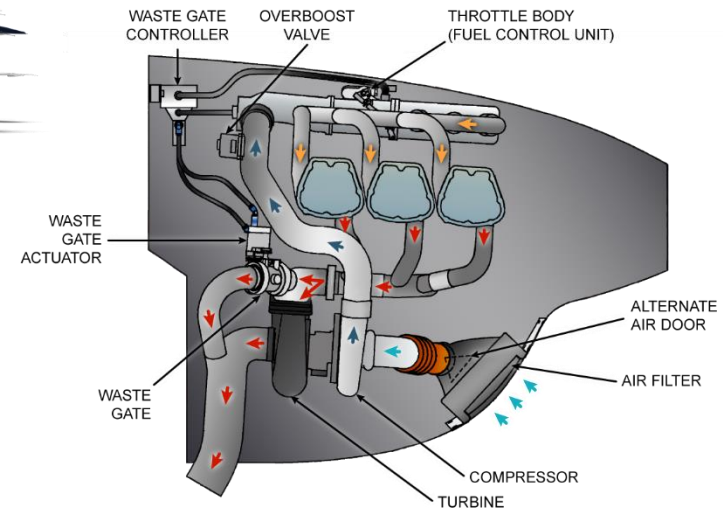
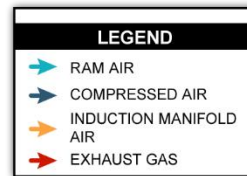
206 DIFFERENCES - TURBINE SYSTEM (81-00-00)

The T206H engine with a turbocharger system: TIO-540-AJ1A

The purpose of the turbocharger system is to increase manifold pressure and engine power.

How the turbine operates: Engine induction air travels through an opening in the lower cowl, ducted through an air filter and into the compressor where it is compressed.

The pressurized induction air then passes through the throttle body and induction manifold into the cylinders.



Air and fuel is burned and exhausted through the turbine. The exhaust gases drive the turbine that in turn drives the compressor to complete the cycle.

If the turbocharger system fails, the result could be an overboost condition or some degree of power loss. The manifold pressure indicator shows an overboost condition, which can be controlled by reducing throttle position.

Because an engine is turbocharged, some of its characteristics are different from a normally-aspirated engine.

- Manifold Pressure Variation with Engine Operation
- Altitude Operation
- High Altitude Engine Acceleration
- Manifold Pressure Variation with Altitude
- Manifold Pressure Variation With Airspeed
- Fuel Flow Variations with Changes In Manifold Pressure
- Manifold Pressure Variations with Increasing or Decreasing Fuel Flow and Momentary Overboost of Manifold
- Pressure

206 DIFFERENCES - TURBINE SYSTEM (81-00-00)

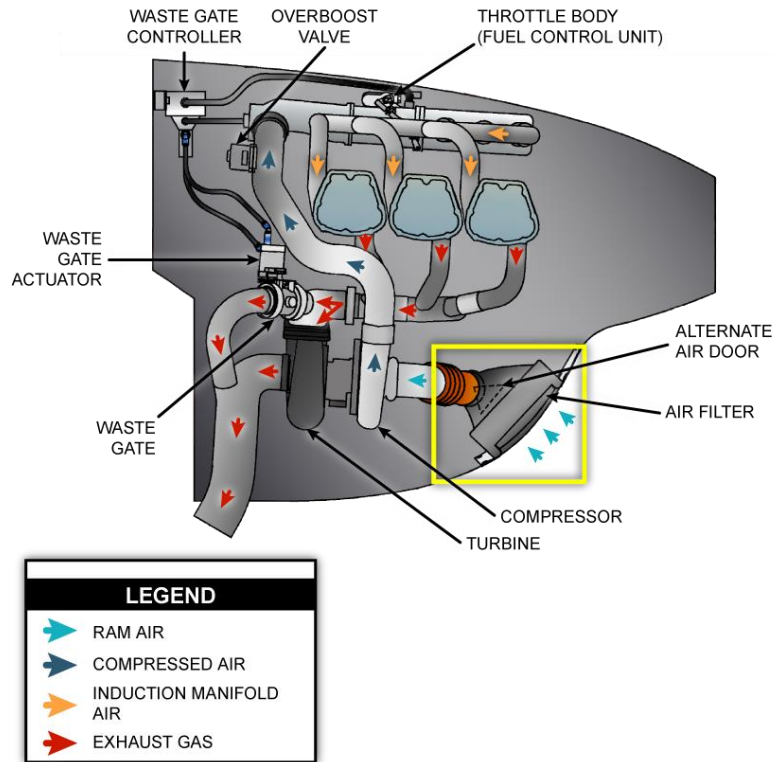
Turbine System Components:

- Compressor
- Turbine
- Waste Gate
- Waste Gate Controller
- Waste Gate Actuator

How the turbine operates:

- Engine induction air travels through an opening in the lower cowl, ducted through an air filter and into the compressor where it is compressed.
- The pressurized induction air then passes through the throttle body and induction manifold into the cylinders. Air and fuel is burned and exhausted through the turbine.
- The exhaust gases drive the turbine that in turn drives the compressor to complete the cycle.

206 DIFFERENCES - TURBINE SYSTEM (81-00-00)



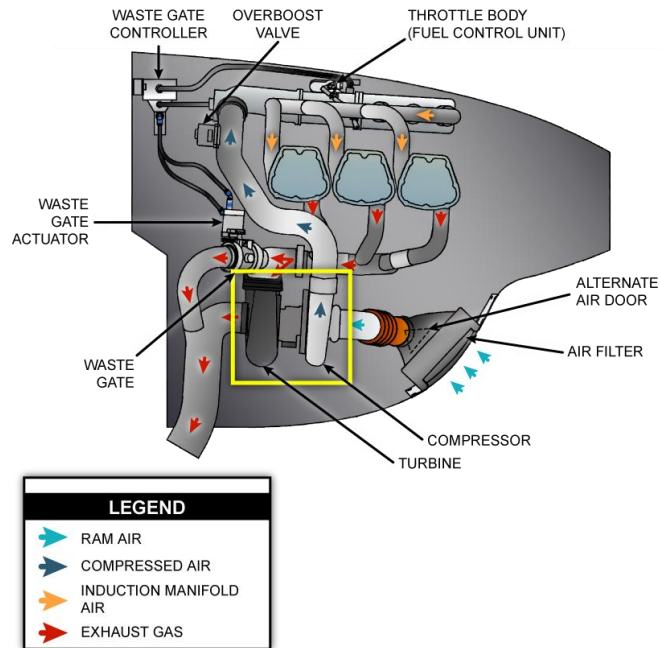
The Engine Air Induction System receives ram air through an intake on the lower front portion of the engine cowl. An air filter covers the intake and removes dust and other foreign matter from the induction air. Airflow passing through the filter enters an air box that has a spring-loaded alternate air door.

If the air induction filter becomes blocked, the engine creates suction that opens the door to draw unfiltered air from inside the lower cowl area. With the alternate air door open, there will be approximately 10% power loss at full throttle.

206 DIFFERENCES - TURBINE SYSTEM (81-00-00)

An external inspection of the turbocharging system is to be completed every 50 hours for general condition, leakage or damage, and security of attachment. Included in this is inspection on the multi-segment V-Band coupling clamps. Also check waste gate return spring for condition and security.

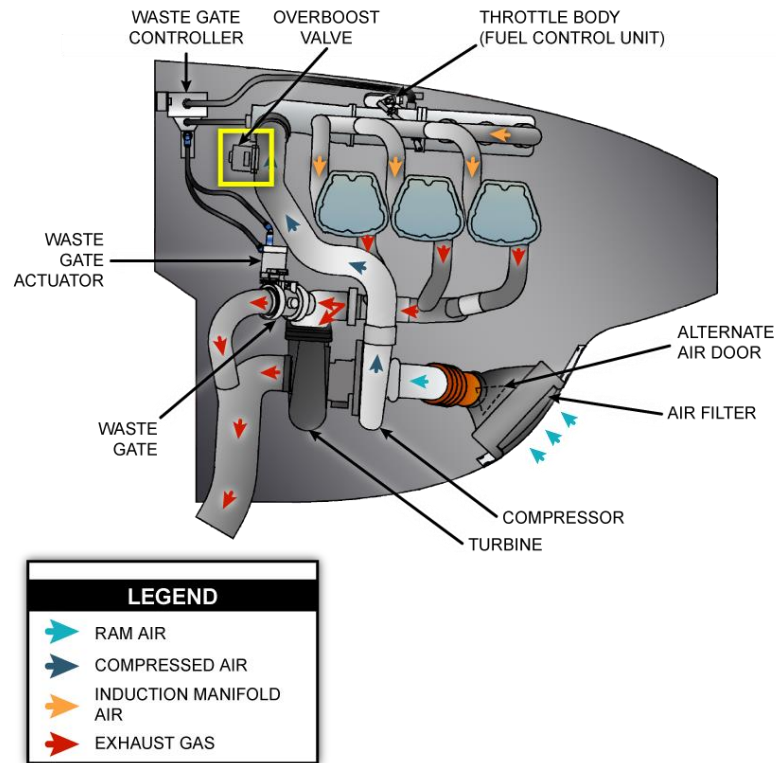
At 100 hour intervals conduct a visual inspection of the turbine (hot side) of the turbocharger examine the turbine for coking, carbonization, oil deposits, and turbine impellers for damage. Also examine the turbocharger housing for burned areas, bulges, or cracks. Examine the compressor (cold side) for blade condition on the impeller and oil deposits in the turbocharger. Make sure the compressor turns freely with no rubbing.



HIGH ALTITUDE ENGINE ACCELERATION

The engine accelerates normally from idle to full throttle with full rich mixture at any altitude below 22,000 feet. At higher altitudes, it is usually necessary to lean the mixture to get smooth engine acceleration from idle to maximum power. At altitudes above 25,000 feet, and with temperatures above standard, it takes up to two minutes for the turbine to accelerate from idle to maximum RPM although adequate power is available in 20 to 30 seconds.

206 DIFFERENCES - TURBINE SYSTEM (81-00-00)

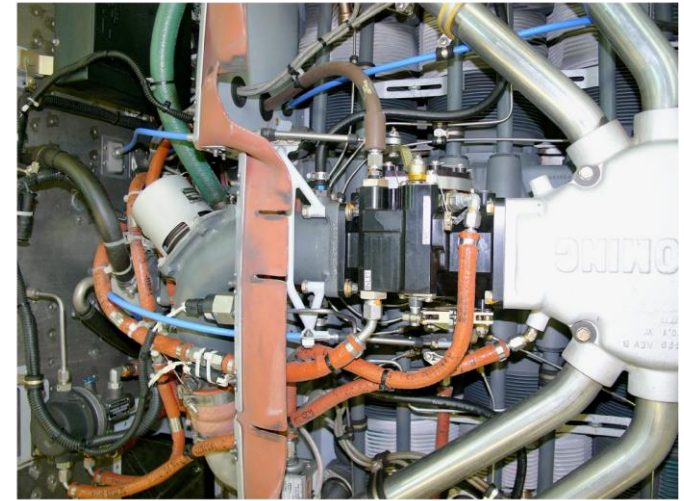
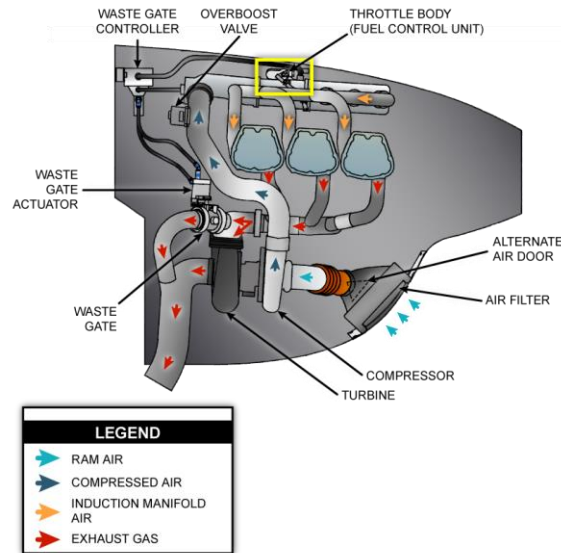


Manifold pressure is 39 ± 0.5 inches Hg. (ACFT 206). The pressure relief valve is set to open at 41.5 inches of Hg. (ACFT- 206)

206 DIFFERENCES - TURBINE SYSTEM (81-00-00)

The nice feature of the automatic system for the busy pilot during climb is that once the throttles are set, there is a minimum of adjustment required. During letdown, there is no worry about high MP because the pilot merely retards his throttles, and the automatic system does the work for him.

Since the turbocharger is operating during takeoff, all takeoffs at any altitude require full-rich mixture because the turbocharger provides full-rated horsepower, and full-rich mixture is required for that amount of power.



FUEL FLOW VARIATIONS WITH CHANGES IN MANIFOLD PRESSURE

Engine speed and compressor discharge pressure regulate the engine-driven fuel pump output. Fuel pump output and the metering effects of the throttle and mixture control regulate engine fuel flow. When the waste gate is open, fuel flow varies directly with manifold pressure, engine speed, mixture, or throttle control position. In this case, the waste gate controller and throttle position control the manifold pressure, while fuel flow varies with throttle movement and manifold pressure.

When the waste gate is closed and manifold pressure changes are due to turbocharger output, fuel flow follows manifold pressure even though the throttle position is unchanged. This minimizes fuel flow adjustments required of the pilot:

- Small initial adjustments on takeoff or climb-out for the proper rich climb setting.
- Lean-out in cruise
- Return to full rich position for approach and landing.

206 DIFFERENCES - TURBINE SYSTEM (81-00-00)

MANIFOLD PRESSURE VARIATION WITH ALTITUDE

At full throttle, the turbocharger can maintain the maximum continuous manifold pressure of 39in.hg. to above 17,000 feet depending on engine and atmospheric conditions. However, engine operating limitations establish the maximum manifold pressure that may be used. Manifold pressure should be reduced above 17,000 feet, as noted on the operating placard in the airplane (subtract 1in.hg. from 39in.hg. for each 1000 feet above 17,000 feet).

At part throttle, the turbocharger can maintain cruise climb power of 2400 RPM and 30in.hg. from sea level to 22,000 feet in standard temperatures, and from sea level to 17,000 feet under hot day conditions without changing the throttle position, once the power setting is established after takeoff.

Under hot day conditions, this climb power setting maintains above 17,000 feet by advancing the throttle as necessary to maintain 30in.hg. in the same manner as a normally aspirated engine during climb.

MANIFOLD PRESSURE VARIATION WITH AIRSPEED

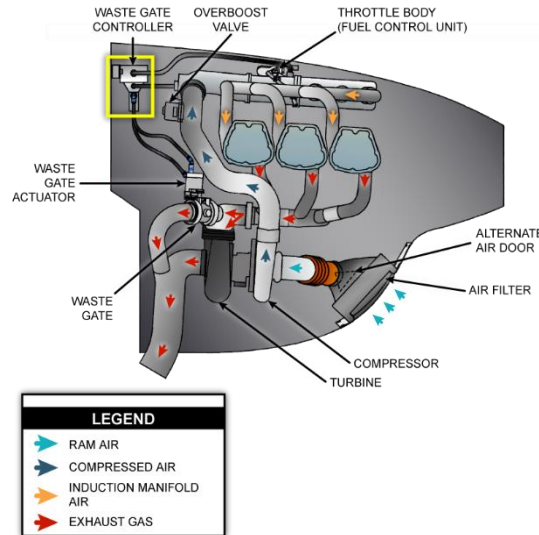
When the waste gate is closed, manifold pressure changes with variations in airspeed. This is because the compressor side of the turbocharger operates at pressure ratios of up to 3 to 1 and any change in pressure at the compressor inlet is magnified at the compressor outlet with a resulting effect on the exhaust flow and turbine side of the turbocharger.

ALTITUDE OPERATION

Because a turbocharged airplane climbs faster and higher than a normally-aspirated airplane, fuel vaporization may occur. When fuel flow variations of ± 1 GPH or more are observed (as a nervous fuel flow needle), or if a full rich mixture setting does not provide the desired fuel flow, placing the auxiliary fuel pump switch in the ON position will control vapor. However, it will also increase fuel flow, making it necessary to adjust the mixture control for the desired fuel flow. Leave the auxiliary fuel pump on for the remainder of the climb. Turn it off when fuel flow remains steady with it off, and adjust the mixture accordingly. Turn the auxiliary fuel pump off and reset the mixture prior to descent.

206 DIFFERENCES - TURBINE SYSTEM (81-00-00)

The waste gate controls the turbocharger and absolute pressure sloped controller. The sloped controller maintains the rated deck pressure at wide-open throttle and maintains a reduced deck pressure at part-throttle settings. The controller senses both deck and manifold pressure and monitors the differential between them. If either the deck pressure or differential pressure rises above the pre-determined values for a given throttle setting, the controller opens the exhaust bypass valve to reduce compressor speed and output.



Lycoming TIO-540 series, utilize a density controller that will maintain a set power output at full throttle regardless of variations in altitude and in temperatures above or below standard; as a result, manifold pressures at full throttle may indicate several inches above or below that setting specified for standard day conditions.

- Sloped Controller Adjustments.
- Maximum manifold pressure. Do not exceed 39.5 inches Hg.
- Pressure relief valve is set to open at 41.5 inches of Hg.
- After final adjustment aircraft must be flight tested.

206 DIFFERENCES - TURBINE SYSTEM (81-00-00)



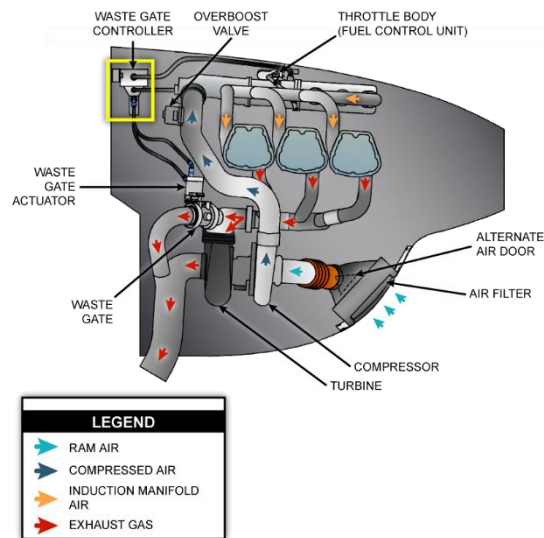
NOTE

ADJUSTMENTS

When adjusting rotate in VERY small increments as this is an extremely sensitive adjustment. Approximately 13 degrees rotation will change the manifold pressure reading about one inch Hg.

MANIFOLD PRESSURE VARIATION WITH INCREASING OR DECREASING FUEL FLOW

When the waste gate is open, movement of the mixture control has little or no effect on the manifold pressure of the turbocharged engine. When the waste gate is closed, any change in fuel flow to the engine has a corresponding change in manifold pressure. That is, increasing the fuel flow increases the manifold pressure and decreasing the fuel flow decreases the manifold pressure. This is because an increased fuel flow to the engine increases the mass flow of the exhaust. This turns the turbocharger faster, increasing the induction airflow and raising the manifold pressure.

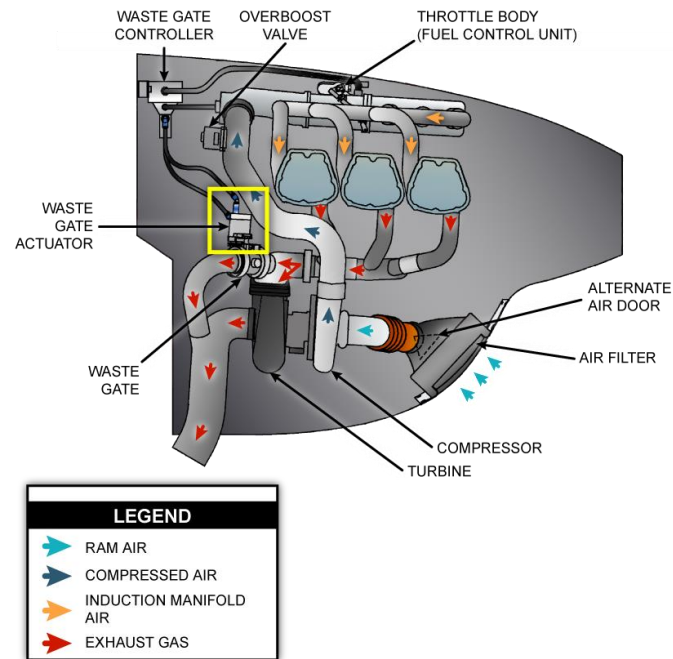


206 DIFFERENCES - TURBINE SYSTEM (81-00-00)

MOMENTARY OVERBOOST OF MANIFOLD PRESSURE

Under some circumstances, such as rapid throttle movement, especially with cold oil, it is possible to overboost the engine slightly above the maximum takeoff manifold pressure of 39 inches hg. This most likely would occur during the takeoff roll or during a change to full throttle operation in flight. The induction air pressure relief valve normally limits the overboost to 2 to 3 inches. A slight overboost of 2 to 3 inches of manifold pressure is not detrimental to the engine as long as it is momentary. No corrective action is required when momentary overboost corrects itself followed by normal engine operation. However, if an overboost of this nature persists when oil temperature is normal or if the amount of overboost tends to exceed 3 inches or more, reduce the throttle to eliminate the overboost and the controller system. The waste gate and relief valve should be checked for necessary adjustment or replacement of components.

206 DIFFERENCES - TURBINE SYSTEM (81-00-00)



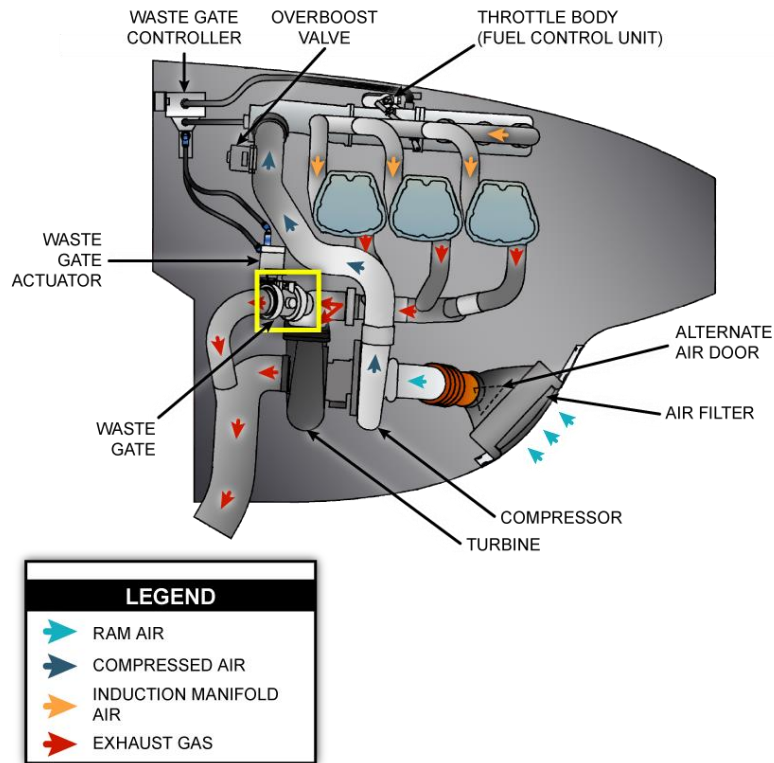
TURBOCHARGING SYSTEM (DIFFERENT MANIFOLD PRESSURE VARIATIONS) (T206H) NAV III

MANIFOLD PRESSURE VARIATION WITH ENGINE RPM

When the waste gate is open, the turbocharged engine will react the same as a normally aspirated engine when the engine RPM is varied.

However, when the waste gate is closed, manifold variation with engine RPM is just opposite of the normally aspirated engine. An increase in engine RPM will result in an increase in manifold pressure, and a decrease in engine RPM will result in a decrease in manifold pressure.

206 DIFFERENCES - TURBINE SYSTEM (81-00-00)

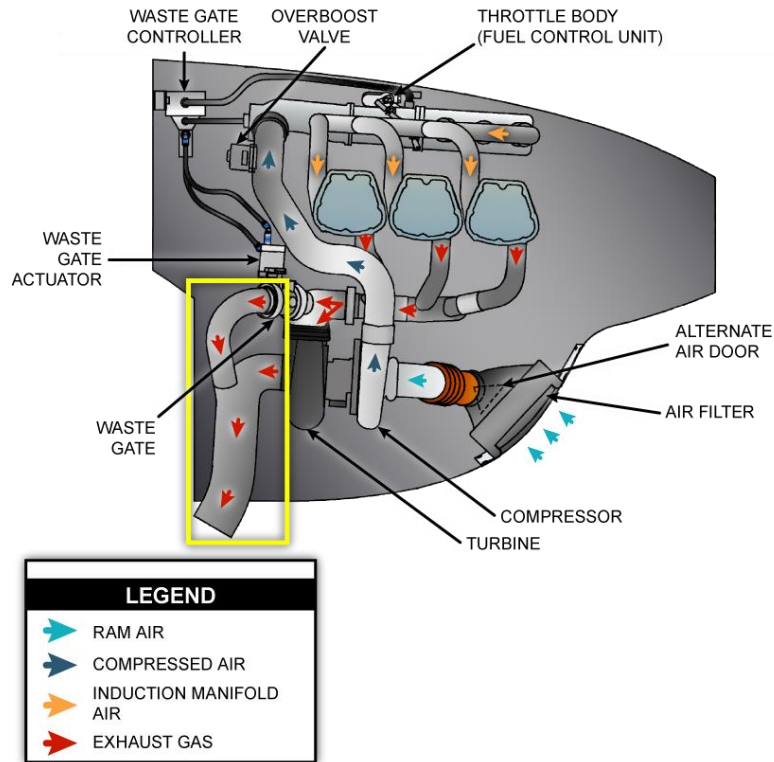


TURBOCHARGING SYSTEM (DIFFERENT MANIFOLD PRESSURE VARIATIONS) (T206H) NAV III

MANIFOLD PRESSURE VARIATION WITH ENGINE RPM

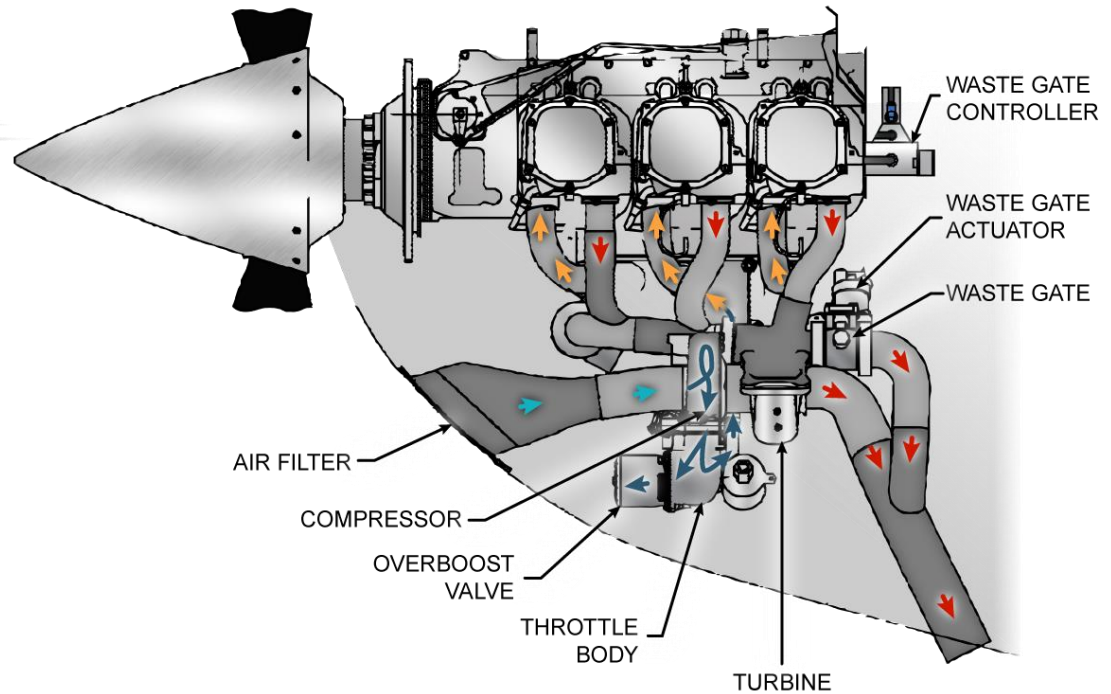
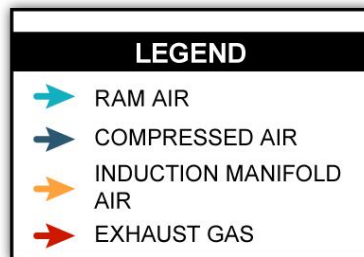
When the waste gate is open, the turbocharged engine will react the same as a normally aspirated engine when the engine RPM is varied. However, when the waste gate is closed, manifold variation with engine RPM is just opposite of the normally aspirated engine. An increase in engine RPM will result in an increase in manifold pressure, and a decrease in engine RPM will result in a decrease in manifold pressure.

206 DIFFERENCES - TURBINE SYSTEM (81-00-00)



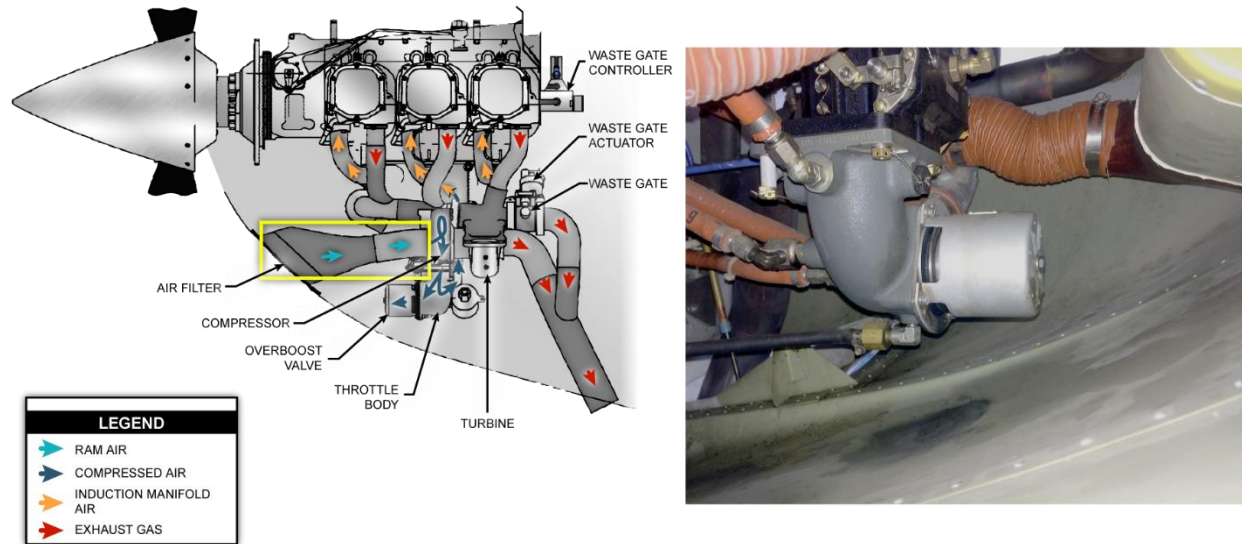
The compressor can produce manifold pressure in excess of the takeoff maximum of 39 in. Hg. To avoid exceeding 39 in. Hg. a waste gate bypasses the turbine and exhausts some of the fumes through the tailpipe.

182 DIFFERENCES - TURBINE SYSTEM (81-00-00)



The T182T uses Lycoming's TIO-540-AK1A engine. This is a parallel series engine much like the naturally aspirated engine but with lower compression engine and weighing in at 90 pounds more.

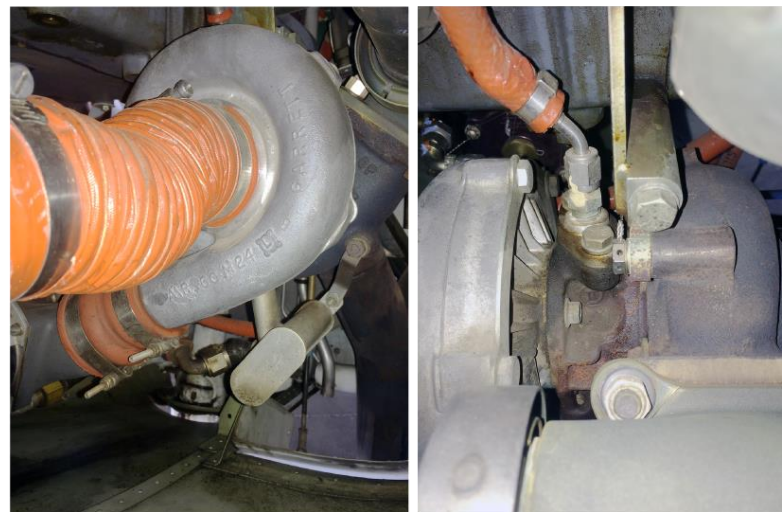
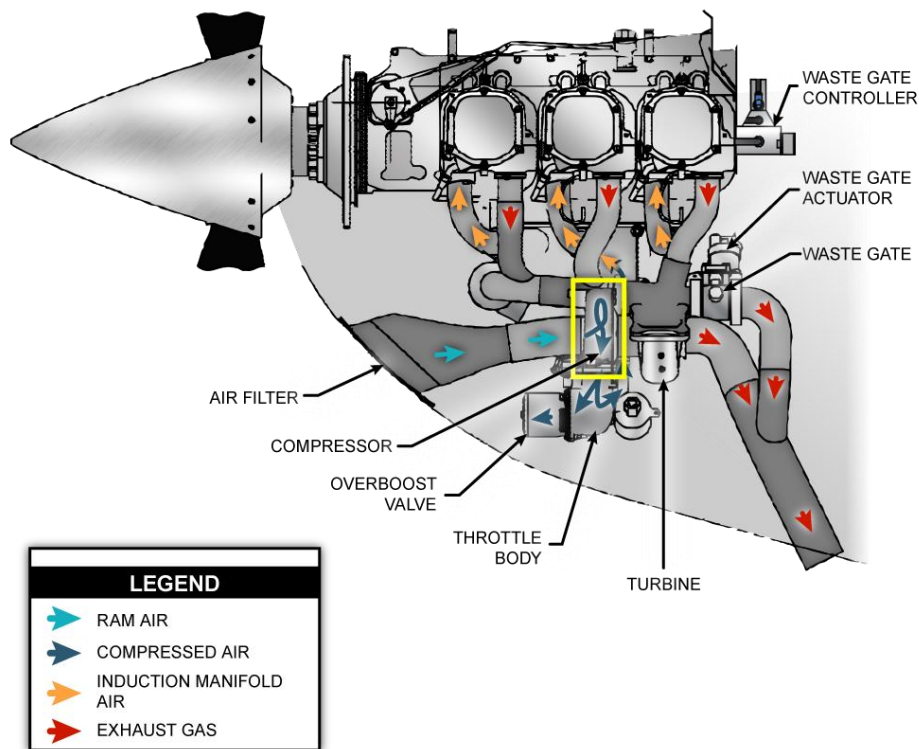
182 DIFFERENCES - TURBINE SYSTEM (81-00-00)



Maximum manifold pressure is 32 ± 0.5 inches Hg. (ACFT- 182) A pressure relief valve, set slightly in excess of maximum deck pressure, prevents excessive overboost in the event of a system malfunction. (AFCT 182)

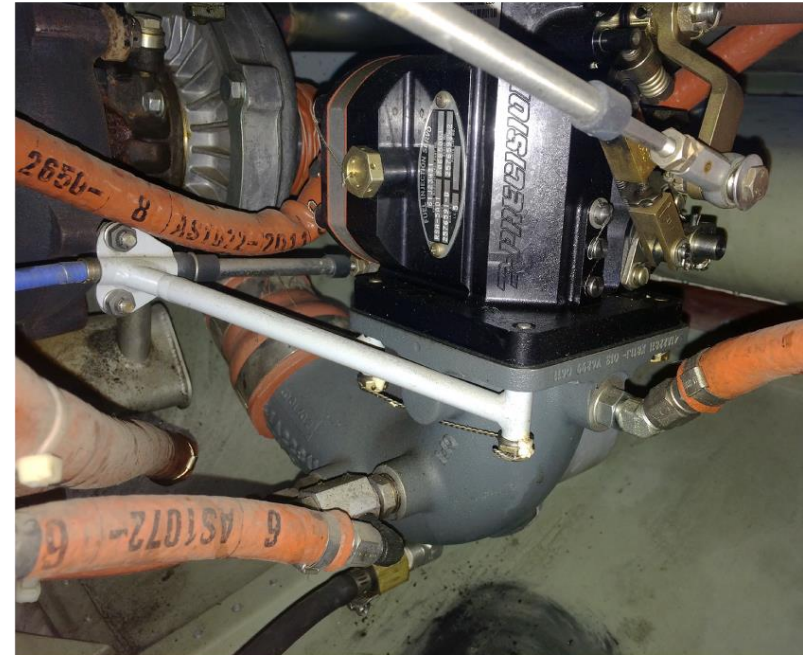
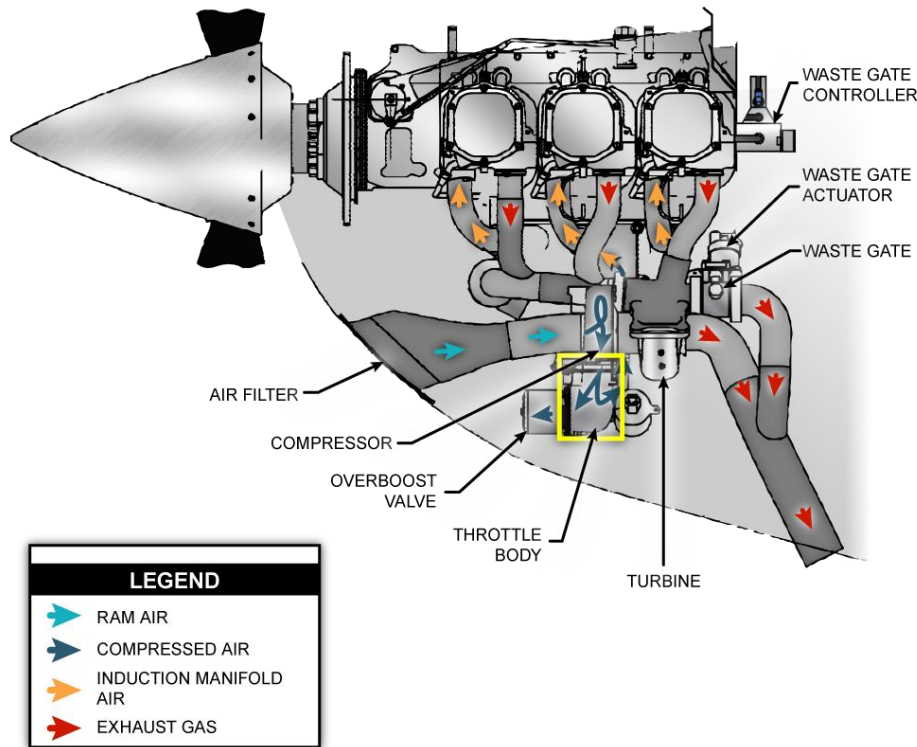
Under some circumstances, such as rapid throttle movement, especially with cold oil, it is possible that the engine can be overboosted slightly above the maximum takeoff manifold pressure of 32 in.hg. This would most likely be experienced during the takeoff roll or during a change to full throttle operation in flight. The induction air pressure relief valve will normally limit the overboost to 2 to 3 inches. A slight overboost of 2 to 3 inches of manifold pressure is not considered detrimental to the engine as long as it is momentary. No corrective action is required when momentary overboost corrects itself and is followed by normal engine operation. However, if overboosting of this nature persists when oil temperature is normal or if the amount of overboost tends to exceed 3 inches or more, the throttle should be reduced to eliminate the overboost and the controller system, including the waste gate and relief valve, should be checked for necessary adjustment or replacement of components.

182 DIFFERENCES - TURBINE SYSTEM (81-00-00)



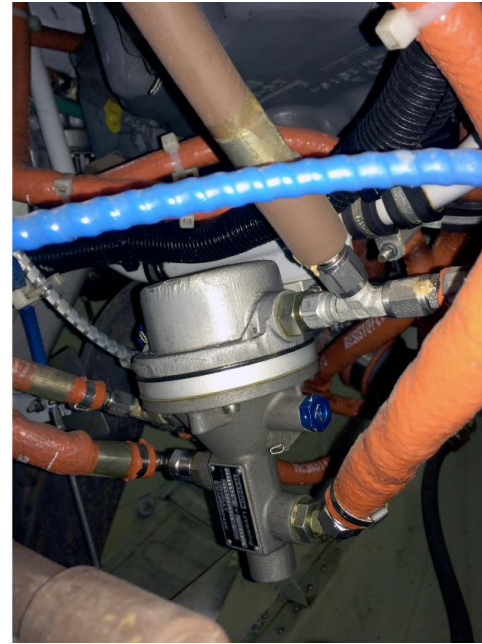
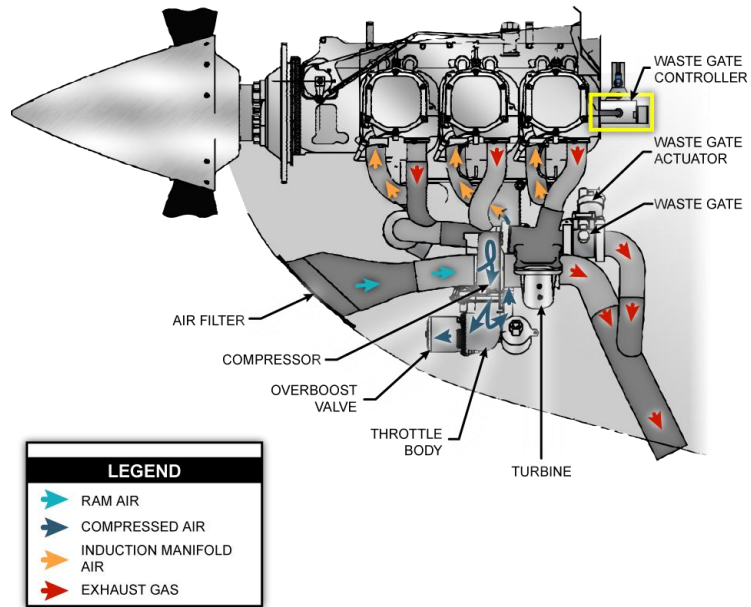
At 100 hour intervals - Examine the turbocharger for burned areas, bulges, or cracks. Use a flashlight and mirror in the tailpipe to examine the turbine for coking, carbonization, oil deposits, and turbine impellers for damage.

182 DIFFERENCES - TURBINE SYSTEM (81-00-00)



The engine driven fuel pump output is regulated by engine speed and compressor discharge pressure. Engine fuel flow is regulated by fuel pump output and the metering effects of the throttle and mixture control. When the waste gate is open, fuel flow will vary directly with manifold pressure, engine speed, mixture, or throttle control position. In this case, manifold pressure is controlled by throttle position and the waste gate controller, while fuel flow varies with throttle movement and manifold pressure. When the waste gate is closed and manifold pressure changes are due to turbocharger output, as discussed previously, fuel flow will follow manifold pressure even though the throttle position is unchanged. This means that fuel flow adjustments required of the pilot are minimized to (1) small initial adjustments on takeoff or climb-out for the proper rich climb setting, (2) lean-out in cruise, and (3) return to full rich position for approach and landing.

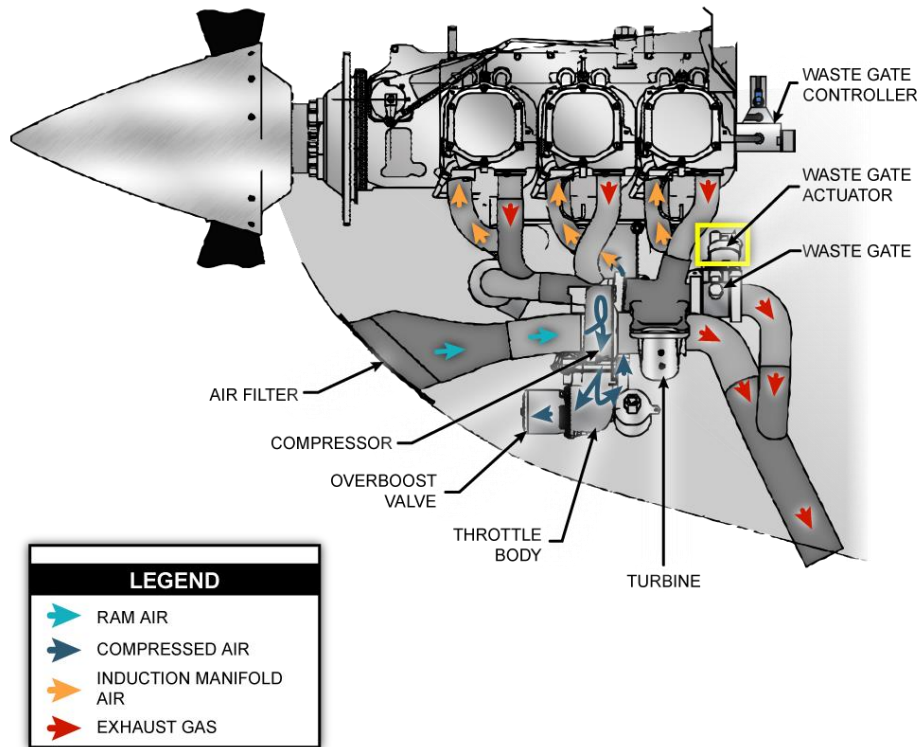
182 DIFFERENCES - TURBINE SYSTEM (81-00-00)



Sloped Controller Adjustments.

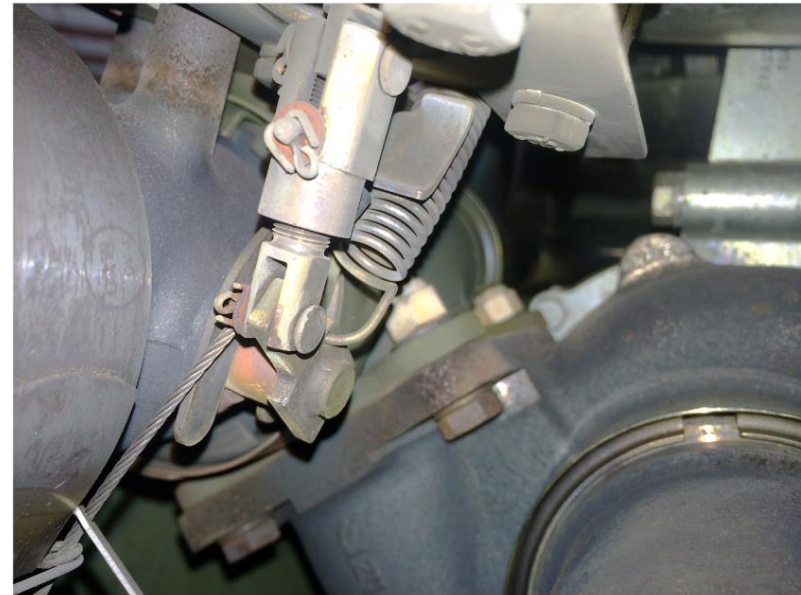
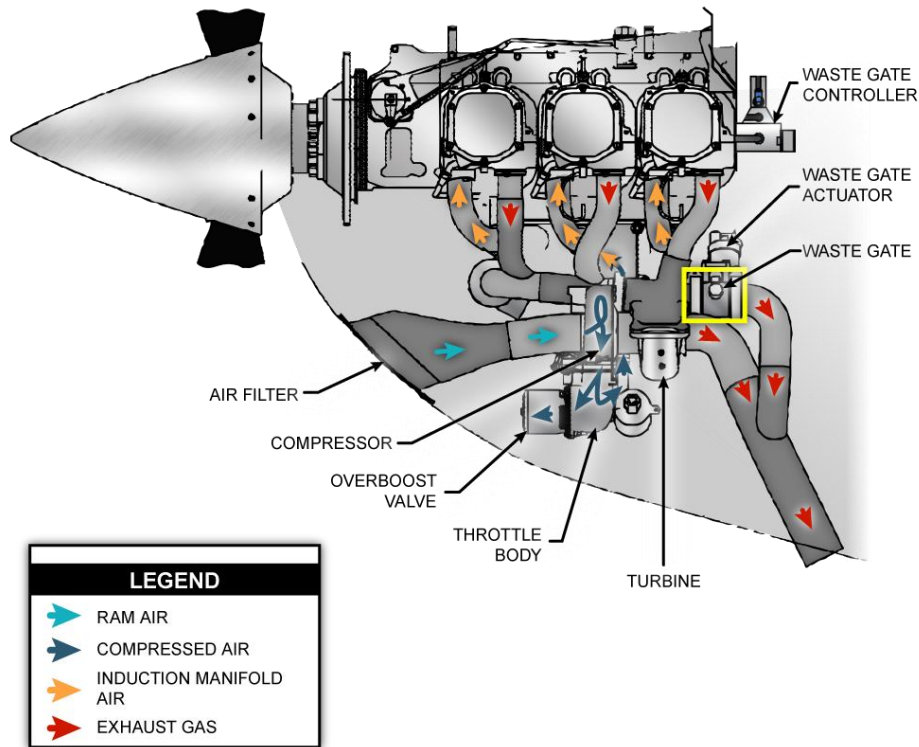
- Maximum manifold pressure. Do not exceed 32.5 inches Hg.
- Pressure relief valve is set to open at 41.5 inches of Hg. or Slightly above deck pressure
- After final adjustment aircraft must be flight tested.

182 DIFFERENCES - TURBINE SYSTEM (81-00-00)



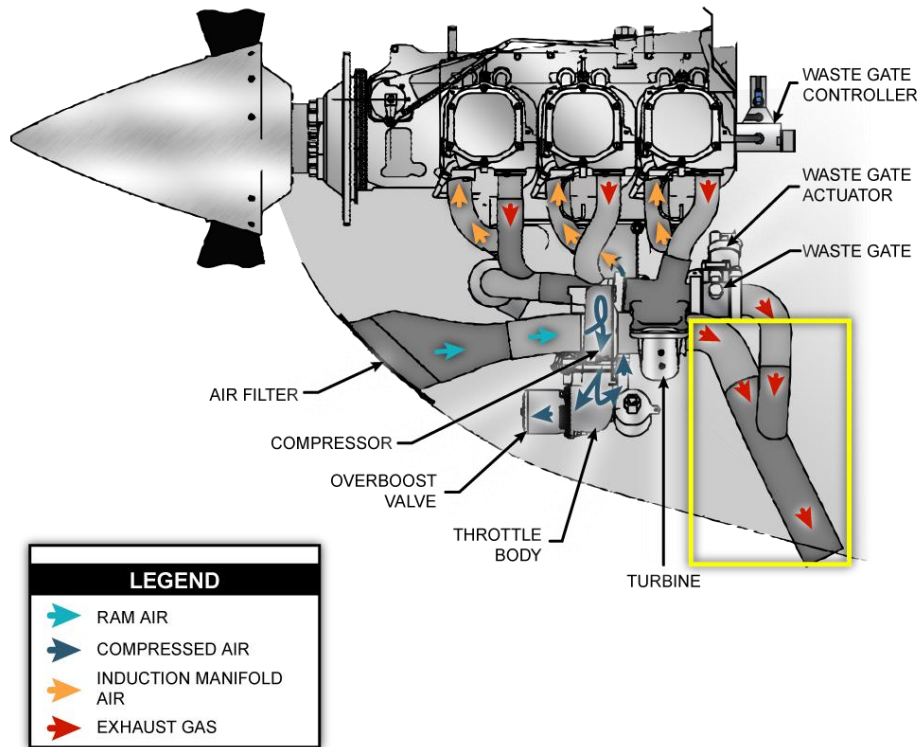
When the waste gate is fully closed, any change in turbocharger speed will mean a change in engine operation. Thus, any increase or decrease in turbine speed will cause an increase or decrease in manifold pressure and fuel flow. If turbine speed increases, the manifold pressure increases; if the turbine speed decreases, the manifold pressure decreases. Since the compression ratio approaches 3 to 1 at high altitude, any change in exhaust flow to the turbine or ram induction air pressure will be magnified proportionally by the compression ratio and the change in flow through the exhaust system.

182 DIFFERENCES - TURBINE SYSTEM (81-00-00)



At high altitude, part throttle, or low RPM, the exhaust flow is not capable of turning the turbine and compressor fast enough to maintain maximum compressor discharge pressure, and the waste gate will close to force all of the exhaust flow through the turbine.

182 DIFFERENCES - TURBINE SYSTEM (81-00-00)



At 50 hour intervals: Inspect turbocharger mounting brackets, ducting, linkage, and attaching parts for general condition, leakage or damage, and security of attachment. Check waste gate, actuator, controller, oil and vent lines, overboost relief valve, and compressor housing for leakage, apparent damage, security of attachment, and evidence of wear. Check waste gate return spring for condition and security. For the exhaust system: Inspect couplings, seals, clamps, and expansion joints for cracks. Special check in area of heat exchanger.

At 100 hour intervals - Examine the turbocharger for burned areas, bulges, or cracks. Use a flashlight and mirror in the tailpipe to examine the turbine for coking, carbonization, oil deposits, and turbine impellers for damage.