

CONTINENTAL AIRCRAFT ENGINE

MAINTENANCE MANUAL

**STANDARD PRACTICE
FOR SPARK IGNITED ENGINES**



Technical Portions Accepted by the Federal Aviation Administration

Publication M-0

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CHANGE 4

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Chapter 1. Introduction

1-1. Scope and Purpose of This Manual

This manual provides maintenance instructions for spark ignition, Standard Practices operating on aviation gasoline (AvGas). These Instructions for Continued Airworthiness (ICA) are supplied to the owner with the engine. Instructions in this manual are standard practices, with differences identified by model, for A-65, A-75, C-75, C-85, C-90, C-125, C-145, E-165, E-185, E-225, O-200, GO-300, O-300, IO-240, IOF-240, IO-346, IO-360, LTSIO-360, TSIO-360, O-470, IO-470, TSIO-470, GTSIO-520, IO-520, LTSIO-520, TSIO-520, IO-550, IOF-550, TSIO-550, TSIOF-550, TSIOL-550 and TIARA (6-285 and 6-320) series aircraft engines. For information specific to the Continental Motors engine series, accessories, or the airplane, refer to the appropriate manual. For the specific instructions regarding the electronic equipment on FADEC engines, or for unlisted engine models, refer to the primary ICA.

A list of tools for all applicable engines is provided in Chapter 2. Consumables items, such as lubricants, sealants, and adhesives are listed in Chapter 3. Airworthiness limitations are in Chapter 4. Chapter 5 contains generic installation instructions applicable to our engines. Chapter 6 provides schedule inspection and service intervals and instructions, as well as unscheduled maintenance instructions. Chapter 7 contains general engine operating instructions, applicable to all models. Chapter 8 contains engine troubleshooting instructions. Engine preservation and storage instructions are in Chapter 9. Non-overhaul engine part replacement instructions are in Chapter 10. Chapter 11 contains Non-Destructive Inspection guidelines. Chapter 12 contains part cleaning instructions. Appendix A contains a glossary of common terms and acronyms used throughout the manual; Appendix B provides torque specifications, and Appendix C contains maintenance standards.

1-1.1. Instructions for Continued Airworthiness

Continental Motors Part No. M-0, is supplemental, as defined by Title 14 CFR§33.4, to the maintenance and overhaul manuals listed below. Together, this manual and those listed below comprise the instructions for continued airworthiness for applicable engines. This manual, and the overhaul manuals and component service manuals (as applicable to engine specification) listed below are delivered to the customer with the engine. Service documents and Airworthiness Directives may also affect ICAs. Refer to Section 1-2.5 for instructions to check current publication status.

Part No.	Title	Applicability
M-2	Maintenance and Overhaul Manual	O-200-D, X
M-6	Maintenance and Overhaul Manual	IO-240
M-7	Maintenance and Overhaul Manual	IO-360
M-11	Maintenance Manual	IO-520 Permold
M-16	Maintenance and Overhaul Manual	IO-550 Permold
M-18	Maintenance and Overhaul Manual	TSIO-550 Permold



6-4. .6. Engine Shutdown

Procedure

1. Perform a normal engine shutdown according to the “Engine Shutdown” instructions in Section 7-3.4.
2. Remove installed test equipment.
 - a. Disconnect the metered fuel pressure test hose from the aircraft fittings.
 - b. Disconnect the unmetered fuel pressure test hose from between the fuel pump and the fuel control assembly.
 - c. Remove any fittings added to adapt the plumbing to the test equipment.
3. Reconnect and torque the fuel system hoses to Appendix B specifications.
 - a. Connect the unmetered pressure hose between the fuel pump and the fuel control assembly.

CAUTION: Use only *N* cap on the tee fitting. Installation of a pipe thread cap on the flared fitting may damage the fitting.

- b. Install the protective caps (P/N 639494) (or airframe-installed fitting to cockpit metered pressure gauge) on the fuel manifold valve (metered pressure) or throttle body inlet tee (metered pressure) fittings, if equipped, and torque the cap to standard torque for a #4 steel fitting in Table B-8.

4. Leak Check
 - a. Master Power Switch ON
 - b. Mixture..... FULL RICH
 - c. Boost Pump Switch (if equipped)..... ON
 - d. Throttle..... WIDE OPEN
 - e. Check for leaks in the following areas and correct any discrepancies before releasing the engine for flight:
 - 1) Induction System
 - 2) Exhaust System
 - 3) Fuel System
 - 4) Lubrication System
 - f. Boost Pump..... OFF
 - g. Throttle..... IDLE
 - h. Mixture..... IDLE CUT-OFF
 - i. Master Power Switch OFF

CONTINENTAL MOTORS® AIRCRAFT ENGINE
SERVICE INFORMATION DIRECTIVE

CATEGORY 4
SID97-3G

Compliance Will Enhance Safety, Maintenance, or Economy of Operation

Supersedes SID97-3F
TECHNICAL PORTIONS
FAA APPROVED

SUBJECT: Continuous Flow Fuel Injection Systems Adjustment Specifications and Instructions

PURPOSE: Provide specifications and instructions for adjustment of Continental Motors (CM) fuel injection systems.

COMPLIANCE At engine installation, 100 hour/Annual Inspection, fuel system component replacement or as required if operation is not within specifications.

MODELS

AFFECTED: All CM Aviation Gasoline (AvGas) engine models equipped with CM continuous flow fuel injection systems except IO520-N, NB; L/TSIO360-RB; TSIO520-L, LB, WB; GTSIO520-D, F, K, N and GIO550-A engine models.

WARNING

The instructions and values provided in this document apply to Continental Motors (CM) gasoline fuel injected engines that conform to the original type design. Refer to the Supplemental Type Certificate (STC) holder's instructions for aircraft that have been modified from the original type design.

I. GENERAL INFORMATION

Fuel injection system components manufactured by CM are adjusted and calibrated to meet engineering specifications. Fuel injection system components installed on factory new and rebuilt engines are adjusted to meet design specifications during operation in the production engine test facility. These tests and adjustments are carried out in an environment of controlled fuel supply pressures and calibrated test equipment.

When engines are installed in aircraft, they are configured with the aircraft manufacturer's induction system, fuel supply system, and are placed in service under varied conditions. These structural and functional differences require scheduled monitoring and adjustment of the fuel injection system to meet operational specifications before flight.

CAUTION: Engine performance, service life and reliability will be compromised if the engine's fuel injection system is neglected. Requirements set forth in this document cover general areas of operation, maintenance, and servicing and do not supersede or replace the Instructions for Continued Airworthiness (ICAs) provided by the aircraft manufacturer(s). Reference the applicable Aircraft Maintenance and Overhaul Manual for detailed fuel system adjustment and maintenance procedures.

Aircraft and engines that have been modified from their original type design must have the fuel injection system maintained in accordance with the Supplemental Type Certificate Holder's FAA approved instructions.

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A fuel system operational check is required after any of the following circumstances: (1) at engine installation, (2) during 100 hour and annual inspections, (3) whenever a fuel system component is replaced or adjusted, (4) when changes occur in the operating environment.

II. ADJUSTMENT PROCEDURES

The following adjustment procedures are presented in a sequential format that must be followed to ensure proper fuel system adjustment. Any fuel system that cannot be adjusted to meet the specified values will require repair or replacement of the affected components prior to further engine operation.

The adjustment procedures provided in this document also apply to engine fuel systems equipped with Continental Motors (CM) Position Tuned Fuel Nozzles. Refer to Publication Number FI-2, “Position Tuned Fuel Injector Nozzle Installation and Maintenance Manual” for more detailed information and installation instructions.

A. REQUIRED TOOLS AND EQUIPMENT

CAUTION: Refer to the torque specifications, Table 1, “Hose End and Cap Fitting Torque Specifications,” on page 15, when applying torque to hose end fittings.

A complete set of tools and test equipment is essential for correct setup of CM fuel injection systems. Various combinations of these tools and equipment will be used for fuel system adjustment (depending on the engine model), to include the following general items:

1. CM recommends the Model 20 ATM-C *Porta-Test* unit (P/N 630045-20, ATM-C, or equivalent), to ensure the fuel injection system meets all pressure and flow specifications. The Model 20 ATM-C *Porta-Test* unit is available from the following manufacturer:

Approved Aircraft Accessories
29300 Goddard Road
Romulus, Michigan 48174
1-734-946-9000

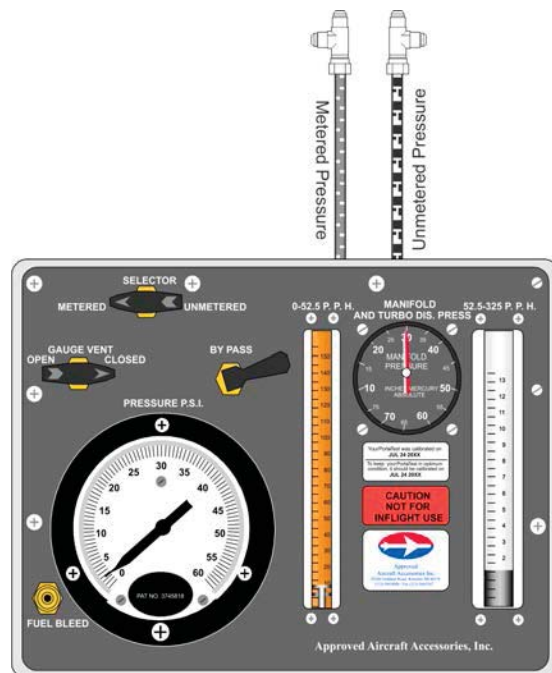


Figure 1. Model 20 ATM-C Porta-Test Unit

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GAUGE METHOD: Calibrated gauges may be used as an optional tool to the Model 20 ATM-C *Porta-Test Unit*. Calibrated pressure and differential pressure gauges may be purchased from various suppliers.

CAUTION: Pressure gauges must be accurate within $\pm 1\%$. Pressure gauges must be checked for accuracy and calibrated in accordance with the manufacturer's instructions.

- a. One calibrated 0-60 PSI gauge, graduated in 1 PSI increments. This gauge will be used for unmetered pressure measurement, *and*
- b. To perform metered pressure measurements and verification of aircraft fuel flow indications:
 - 1) *on normally aspirated engines*, one calibrated 0-30 PSI gauge, graduated in 0.2 PSI (maximum) increments, *or*
 - 2) *on turbocharged engines*, one calibrated differential pressure gauge, 0-30 PSID maximum, graduated in 0.2 PSI (maximum) increments
2. One digital hand-held tachometer capable of verifying aircraft tachometer accuracy prior to fuel system adjustment.
3. Two swivel tees (P/N MS51523-B4). These fittings are typically used to connect fuel lines for unmetered and metered pressure reference.



Figure 2. Tee (P/N MS51523-B4)

4. Hoses of appropriate diameters and sufficient lengths to allow personnel and equipment to provide proper clearance from the propeller arc and blast area. Hose connection requirements will vary by engine model.
5. Common hand tools including: 7/8", 11/16", 9/16", 1/2", 3/8", 7/16", 11/32", and 5/16" wrenches. A 1/4" drive ratchet and sockets, universal swivel, extension, and a 5/32" hex key (Allen) wrench, common screw driver, a calibrated torque wrench, an oil can, mirror and flashlight.
6. Airframe boost pump.
7. General shop equipment and supplies including shop towels and a 2-5 gallon container free of contaminants.
8. Safety equipment including hearing and eye protection must be used.

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B. PRE-SETUP REQUIREMENTS

WARNING

Stand clear of the propeller arc prior to proceeding and **DO NOT** stand or place equipment within the arc of the propeller. Do not smoke or expose the work area to ignition sources while performing this procedure.

B.1. Fuel System Purge and Inspection

1. Remove the engine cowling according to the aircraft manufacturer's instructions.

WARNING

Fuel system contamination may lead to fuel system component damage, erratic engine operation, loss of power, or engine shutdown. Reference Service Bulletin SB08-4, "Fuel Injection System Contamination," anytime a CM continuous flow fuel injection system component is removed for replacement, repair, or maintenance.

NOTE: This procedure is not required for a newly installed factory engine or fully overhauled engine that has been previously ran.

2. During engine installation, purge the fuel system according to the following instructions. The following steps involve utilizing the airframe boost pump to flush and inspect specified quantities of fuel into an uncontaminated container. If contamination exists, always locate the source and correct the issue before proceeding to the next inspection step.
 - a. Flush a minimum of one gallon of fuel from the fuel pump inlet fuel line into a clean, dry container. Inspect the flushed fuel. If free from contamination connect the airframe boost pump **outlet fuel line** to the fuel pump at the inlet using the appropriate maintenance instructions. If contamination exists, correct the issue before proceeding.
 - b. Flush a minimum of one quart of fuel through the **fuel pump** (*on fuel pumps with integral mixture control*) and outlet fuel line into a clean, dry container while working the mixture control through its full range of operation. Inspect the flushed fuel. If free from contamination, connect to the throttle and control unit using the appropriate maintenance instructions. If contamination is found, correct the issue before proceeding.
 - c. Flush the **fuel transducer hose** (where installed) into a clean dry container. Inspect the flushed fuel. If free from contamination, install the fuel transducer according to the aircraft maintenance instructions. If contamination is found, correct the issue before proceeding.
 - d. Flush a minimum of one quart of fuel through the **throttle and fuel control unit** into a clean, dry container while working the throttle control through its full range of operation. Inspect the flushed fuel. If free from contamination connect to the **fuel manifold valve** using the appropriate maintenance instructions. If contamination is found, correct the issue before proceeding.
 - e. Flush **each fuel injector line** separately into individual clean, dry containers. If the flushed fuel is free from contamination, connect to the fuel injectors using the appropriate maintenance instructions. If contamination is found, correct the issue before proceeding.

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3. Locate the idle speed stop screw on the throttle body and turn it counter-clockwise two complete turns (see Figure 11 through Figure 13). During fuel system adjustment, IDLE RPM will be controlled manually using the cockpit throttle control.
4. Ensure all fuel system components are of the correct part number and are installed properly. Correct any discrepancies noted.
5. Remove, inspect, clean, and reinstall or replace the aircraft and **engine fuel screens** according to the aircraft manufacturer's instructions.

B.2. Engine Installation Inspection

WARNING

Use of inaccurate gauges will result in incorrect adjustment of the engine fuel system, possible cylinder wear due to lean operation, pre-ignition, detonation, loss of power and severe engine damage.

1. Before making any checks or adjustments, verify the accuracy of the aircraft tachometer, manifold pressure gauge, and fuel flow gauge. Any gauge found to be inaccurate must be repaired or replaced before adjusting the fuel system.
2. Inspect all lines, hoses, and wire bundles for chafing, loose connections, leaks and stains. Correct any discrepancies noted.

B.3. Induction and Exhaust System Inspection

1. Inspect the exhaust and induction systems for proper installation, security and leaks. Correct any discrepancies noted.
 - a. Inspect the aircraft **vapor return system** for proper operation according to the aircraft manufacturer's instructions. Correct any discrepancies noted.
 - b. Ensure the fuel **manifold valve vent and fuel pump drain lines** are properly installed, open and free of obstruction. Correct any discrepancies noted.
2. Inspect the aircraft **induction air filter and alternate air system** for condition, operation and cleanliness. Repair or replace any component that is not airworthy according to the aircraft manufacturer's instructions.

B.4. Linkage Inspection and Lubrication

WARNING

Failure to correctly install and maintain engine controls can result in loss of system control and subsequent loss of engine power.

1. Inspect all **engine control rod ends** for wear, freedom of movement, proper installation and security according to the aircraft manufacturer's instructions. Correct any discrepancies noted.
2. Inspect the **throttle and control assembly link rods** (where used) for correct installation, security and wear at the attach points. Correct any discrepancies noted.
3. Ensure all engine controls operate freely throughout their full range of travel and are properly adjusted according to the aircraft manufacturer's instructions.
4. Lubricate all control rod ends and fuel system components according to the latest revision of CM Service Bulletin SB95-2 and the Aircraft Maintenance and Overhaul Manual.

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C. SETUP PROCEDURES

WARNING

Failure to properly support and stabilize component fittings can result in fitting and/or component damage and loss of system pressure. Reference the latest revision of SIL95-5.

NOTE: Adjustments to any component of the fuel injection system can affect other system settings. Always verify the performance of the entire fuel injection system whenever any fuel injection system component is adjusted.

1. Loosen and remove the unmetered fuel supply hose from either the fuel pump outlet fitting, the fuel control unit inlet fitting, or the throttle body/metering unit inlet tee (*whichever is most accessible*). Some engine models have a fuel pressure connection fitting in the fuel control inlet screen that may be utilized for unmetered pressure gauge attachment.
2. For engine models with integral throttle body/metering units (see Figure 11), remove and set aside the cap fitting (P/N 639494) from the inlet tee. This cap will be reinstalled after setup is complete.
3. Install the tee fitting (P/N MS51523-B4) directly to the fuel pump outlet fitting or to the fuel control inlet fitting (see Figure 9 through Figure 13 as applicable). Torque the tee fitting to the value specified in Table 1.

NOTE: Some installations may require combinations of different fittings and hoses to facilitate installation of unmetered and metered test equipment connections.

4. Attach the unmetered fuel supply hose to the straight end of the tee fitting (P/N MS51523-B4) and torque to the value specified in Table 1.
5. Connect the unmetered test hose from the *Porta-Test Unit* to the tee fitting and torque to the value specified in Table 1.

GAUGE METHOD: If using the 0 to 60 PSI gauge, connect the gauge to the tee fitting using a length of hose which will provide proper clearance from the engine cowling and propeller arc. Torque connections to the value specified in Table 1.

6. Loosen and remove the metered fuel supply hose from the manifold valve inlet fitting.
7. Install and torque the second tee fitting directly to the fuel manifold valve inlet fitting.
8. Attach the metered fuel supply hose to the straight end of the second tee fitting and torque to the value specified in Table 1. On certain models there is an optional capped fitting on the manifold valve in lieu of second tee fitting.
9. Connect the metered pressure test hose from the *Porta-Test Unit* to the second tee fitting and torque to the value specified in Table 1.

GAUGE METHOD: If using the 0 to 30 PSI gauge, connect to the swivel end of the tee fitting using a hose long enough to provide proper clearance from the engine cowling and propeller arc. Torque all connections to the value specified in Table 1.

10. On turbocharged engine models; connect the *Porta-Test* manifold pressure hose and the upper deck pressure hose to the engine following the instructions provided with the *Porta-Test* unit.

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GAUGE METHOD: If using the 0 to 30 PSID differential gauge pressure fitting, connect to the metered pressure tee fitting using a hose of sufficient length to provide clearance from the aircraft and propeller arc. Connect an equal length of hose to the “suction” side of the gauge and connect the other end to a location to reference turbocharger compressor discharge (upper deck) pressure (see Figure 17 and Figure 18).

Turbocharged engine models (incorporating a fuel pressure regulator) must have the regulator deactivated during the initial fuel system adjustment. (see Figure 14).

- a. To deactivate the fuel pressure regulator, loosen and remove the fuel line or hose from the “center” port fitting at the pressure regulator.
 - b. Install a cap on the “center” port fitting.
 - c. Install a plug in the removed line.
 - d. Torque the cap and plug to the values specified in Table 1.
 - e. Perform a pressurized leak test on the connections prior to proceeding with fuel system adjustments.
11. Position the throttle control in the FULL OPEN position and the mixture control to FULL RICH. Operate the aircraft boost pump in accordance with the aircraft manufacturer's instructions. Following the instructions provided with the *Porta-Test* unit, bleed all air from the test unit and hoses.

GAUGE METHOD: If using the alternative calibrated test gauges, loosen the test connections at each gauge to bleed the lines of any air. Hold the gauge at or slightly above the height of the fuel system component during the bleeding operation. Operate the boost pump only long enough to allow purging of air from the installed test equipment. Verify that all fuel lines, hoses and fittings are securely torqued and that no fuel leaks exist before proceeding. Ensure test hoses have been routed clear of the exhaust system and are securely supported over their entire length to avoid inaccurate gauge readings.

WARNING

Verify all fuel has drained from the induction system prior to attempting engine start. Failure to do so could cause “hydraulic lock” and subsequent engine failure.

12. Install the engine cowlings or cooling shroud during ground operation.

D. GROUND ADJUSTMENT PROCEDURES

The Operational Check form (included on the last page of this service bulletin) should be reproduced and will be used to record adjustments and actual test indications. Also, transcribe the applicable (baseline) IDLE and FULL POWER **specified** adjustment points from Table 3 to the Operational Check form:

- a. Propeller RPM
- b. Manifold Absolute Pressure (MAP)
- c. Fuel Pressures (unmetered and metered)
- d. Fuel Flow
- e. IDLE MIXTURE RISE (recorded in the “Remarks” area)

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D.1. Important Setup Notes

CAUTION: For L/TSIO360 and TSIO520 engine models equipped with a fixed (ground adjustable) exhaust bypass, verify that the wastegate is adjusted according to the aircraft manufacturer's instructions. Failure to do so can result in an improperly adjusted fuel system and possible engine damage.

1. Test gauge readings must be taken with the gauges held at the same height above the ground as the fuel system component being measured.
2. Engine driven fuel pump output pressures vary with engine RPM. During ground operation, full power RPM may not be obtained. Use the **Corrected Metered Pressures** found in Table 2 to correct the specified metered pressures if full power RPM cannot be achieved.
3. *On turbocharged engines*, ensure manifold pressure is adjusted according to the aircraft manufacturer's instructions. Engine driven fuel pumps installed on turbocharged engines are referenced to turbocharger compressor discharge pressure (upper deck pressure) to achieve FULL POWER fuel pump pressure.
4. Turbocharged engines equipped with fuel pressure regulators must indicate a full power metered pressure and fuel flow five (5) percent higher than the maximum specified limit **when the regulator is disconnected**. This is required to ensure adequate part-throttle fuel flow.

D.2. Recording Fuel System Performance

WARNING

Ensure the aircraft brakes are set and wheel chocks are properly placed Forward and Aft of the main landing gear tires before engine start. Do not stand or place equipment in the arc of the propeller.

1. Prepare the aircraft for ground run and start the engine in accordance with the aircraft manufacturer's instructions. Advance the throttle to 1500 to 1800 RPM. While monitoring all engine gauges, operate the engine at this power setting until the engine temperatures and pressures have stabilized in the operational range.

CAUTION: Turn aircraft boost pump OFF to prevent adverse affects to the adjustments (these instructions do not supersede or replace the Instructions for Continued Airworthiness (ICAs) provided by the aircraft manufacturer.

2. With the mixture control in the FULL RICH position, reduce the throttle to the **specified IDLE RPM**. Record the unmetered fuel pressure indicated on the gauge.
3. Check the IDLE fuel/air mixture by *slowly* moving the mixture control from the FULL RICH position toward the IDLE CUTOFF position until you've achieved the **maximum IDLE RPM**. Record the IDLE MIXTURE RISE after returning the mixture control back to the FULL RICH position.

NOTE: The IDLE MIXTURE RISE is the difference (or RISE) between the IDLE RPM at FULL RICH and the maximum achievable IDLE RPM. It is generally consistent for most engines (25-50 RPM) except for the IO240-B (50-75 RPM). *Refer and use requirements for mixture checks and values requirements provided in your aircraft manufacturer's instructions.* I.E. More than 50 RPM rise indicates the mixture is too rich and less than 25 RPM or no rise indicates too lean.

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4. Slowly advance the throttle control (while monitoring all gauges) to full rated power for the engine and allow the engine to stabilize for 15 seconds. Record all engine and test gauge indications. Return the engine to the specified IDLE RPM.

CAUTION: DO NOT ALLOW ENGINE TEMPERATURES TO EXCEED 420°F CHT OR 210°F OIL TEMP. *After FULL POWER operation, turbocharged engines must be operated at 800 to 1000 RPM for a minimum of five (5) minutes to allow engine temperatures to stabilize prior to engine shutdown.*

5. Compare the recorded IDLE fuel pressure, IDLE MIXTURE RISE, FULL POWER RPM, manifold pressure (as applicable), unmetered fuel pressure, metered fuel pressure, and fuel flow indications against the specified values.
 - a. *If all recorded values are within specifications, set the IDLE RPM according to Section D.3, step 6.*
 - b. *If any of the recorded readings are **not** within specifications, you must perform **ALL** steps in “Section D.3.*
6. Shut down the engine.

D.3. Fuel System Corrective Adjustments

WARNING

Make all corrective adjustments with the engine STOPPED and the IGNITION and MASTER switches in the OFF positions.

NOTE: Install the engine cowling or cooling shroud during all ground operation.

1. To set the specified **IDLE RPM** and unmetered pump pressure:
 - a. Loosen the jam nut on the low pressure relief valve (see Figure 5 through Figure 13). Turning the adjustment clockwise (CW) will increase pressure and counterclockwise (CCW) will decrease pressure.
 - b. Operate the engine at 1500 to 1800 RPM for 15 seconds after each adjustment to clear the engine, then reduce the throttle to the specified IDLE RPM.
 - c. Repeat adjustment (Section D.3, step 1) until pressure is within specified limits.

NOTE: Maximum part throttle full rich fuel flow will be achieved by setting the idle rpm (low) unmetered fuel pump pressure to the minimum value specified. **With the idle rpm fuel/air mixture properly adjusted (after completing Section D.3, step 2, below) the fuel control metering plate orifices are indexed to the maximum open position.**

2. To adjust the **IDLE fuel/air mixture** to operate within specification:
 - a. Identify the correct mixture control assembly that is to be adjusted (see Figure 11 to Figure 13). Make the necessary adjustment and record in the “Remarks” area of the Operational Check form.
 - b. Operate the engine at 1500 to 1800 RPM for 15 seconds after each adjustment to clear the engine, then reduce the throttle to the specified IDLE RPM
 - c. Repeat this adjustment (Section D.3, step 2) until the specified IDLE MIXTURE RISE is achieved.

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3. Recheck IDLE RPM unmetered pump pressure. If pressure is not within limits, repeat step 1 and step 2 until the specified values for both steps are achieved.
4. To set the specified **FULL POWER** metered fuel pressure:
 - a. *On naturally aspirated engines with an adjustable orifice screw*, turn the adjustable orifice screw clockwise to increase or counterclockwise to decrease metered fuel pressure (see Figures 5, 6, and 8).

NOTE: If installed, cut and remove the safety wire from the adjustable orifice. It is not necessary to replace the safety wire to the adjustable orifice housing after adjustment has been completed.
 - b. *On naturally aspirated engines without an adjustable orifice screw or on turbocharged engines without a fuel pressure regulator*:
 - 1) Loosen the aneroid adjustment screw jam nut (see Figures 7, 9, and 10.
 - 2) Turn the aneroid adjustment screw counterclockwise to increase or clockwise to decrease metered fuel pressure.
 - 3) After final adjustment is accomplished, torque the jam nut to 25-30 inch pounds. **DO NOT EXCEED JAM NUT TORQUE LIMITS.** Exceeding the jam nut torque specification will result in damage to the aneroid housing threads and subsequent maladjustment.
 - c. *On turbocharged engines equipped with a fuel pressure regulator*, perform a final adjustment to the FULL POWER metered fuel pressure and fuel flow as follows (see Figure 14):
 - 1) Reconnect the regulator and torque connections to the value specified in Table 1.
 - 2) Loosen the jam nut on the regulator adjustment set screw.
 - 3) Turn the regulator adjustment screw clockwise to increase or counterclockwise to decrease metered fuel pressure and fuel flow. **On turbocharged engines equipped with a fuel pressure regulator, the FULL POWER metered fuel pressure and fuel flow must be adjusted to five (5) percent higher than the maximum specified limit when regulator is disconnected.** This is required to ensure adequate part-throttle fuel flow.
 - 4) After final adjustments are completed, torque the jam nut to 21-25 inch pounds.
5. When FULL POWER metered fuel pressure has been adjusted to the specified values, recheck:
 - a. IDLE RPM
 - b. Unmetered pump pressure
 - c. IDLE fuel/air mixture

If any values are not within specified limits, repeat adjustment procedures (Section D.3, step 1 through step 5).
6. With the fuel system now set to the specified metered fuel pressure, set the IDLE RPM to the aircraft manufacturer's specified value by adjusting the idle speed stop screw (reference Figure 11 through Figure 13; turn idle speed stop screw clockwise to increase RPM or counterclockwise to decrease RPM).

E. FOLLOW-ON MAINTENANCE

1. Ensure the master switch, ignition switch and fuel selector are in the **OFF** positions.
2. Remove the engine cowling or cooling shroud in accordance with the aircraft manufacturer's instructions.
3. Remove all test gauges, fittings and hoses that were installed for fuel system setup.
4. Reconnect all fuel hoses and cap fittings to their original locations.
5. Torque all fittings to the value specified in Table 1.
6. Verify cap assembly (P/N 639494, (see Figure 11)) is correctly installed on the inlet tee fitting on throttle body/metering units. Torque the cap to **135-190 inch pounds** according to Table 1. This cap is cadmium plated and yellow chromate treated. **DO NOT** install any cap other than P/N 639494 on the tee fitting under any circumstance.
7. Perform a complete fuel system leak check according to the aircraft manufacturer's instructions. If the aircraft manufacturer does not provide specific instructions, the instructions below may be used. Correct any discrepancies noted.
 - a. Turn aircraft master switch to **ON** position.
 - b. Adjust mixture control to **FULL RICH**.
 - c. Adjust throttle control to 1/4 inch open.
 - d. Activate the aircraft boost pump to **ON**.
 - e. Inspect entire fuel system for fuel leakage
 - f. Return mixture and throttle to **IDLE/CLOSED** position
 - g. Turn aircraft boost pump **OFF**
 - h. Turn the aircraft master switch **OFF**
 - i. Allow fuel to drain from the cylinders prior to engine start; follow aircraft manufacturer's instructions/ pilot's operating handbook (AFM/POH).
8. Install engine cowling in accordance with the aircraft manufacturer's instructions.
9. Perform a complete operational ground run-up and verify that all fuel system performance specifications are achieved.

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F. FLIGHT CHECK

1. All naturally aspirated engines (*except those with an altitude compensating fuel pump*)
 - a. Refer to the AFM/POH, supplied by the aircraft manufacturer or Supplemental Type Certificate (STC) holder, for aircraft operating instructions. A Flight Check is required whenever:
 - 1) an adjustment is made that may affect engine operational characteristics or performance,
 - 2) if FULL POWER RPM was not obtained during fuel injection system setup or ground run-up adjustment.
 - b. Repeat the setup and adjustments as required until the fuel injection system is performing within specifications for the aircraft and engine.
2. Naturally aspirated engines (*with altitude compensating fuel pumps (Auto-lean)*)
 - a. All naturally aspirated engines utilizing an altitude compensating fuel pump require a Flight Check after:
 - 1) engine installation, fuel system repairs or adjustments,
 - 2) significant changes in geographic location from the last operational check,
 - 3) if the auto-leaning function is suspect,
 - 4) and at twelve month intervals, in conjunction with the Annual/ 100-hour inspection.

NOTE: Ensure the accuracy of aircraft fuel flow gauge and tachometer has been verified. These gauges must be accurate or the data recorded during flight check will not be valid.
 - b. Record the appropriate fuel flow vs. pressure altitude specifications from the correct **Engine Altitude Leaning Schedules** and **Auto-Leaning Chart** on the Operational Check Form (provided on the last page of this document). *Reference:*
 - 1) M-7, "Maintenance and Overhaul Manual" for all IO360 engines.
 - 2) Table 5 and Figure 4 for all other applicable engines.
3. Perform a complete preflight inspection, engine start, and ground run-up according to the AFM/POH.
4. Set the aircraft altimeter to **29.92 In. Hg.**
5. In accordance with the AFM/POH, conduct a normal take-off.
6. Climb must be accomplished using full throttle, FULL RICH mixture, and maximum rated full power RPM.
7. Using the aircraft fuel flow gauge and altimeter, record fuel flows at all pressure altitudes specified.
8. Compare the recorded fuel flows with the specified fuel flows for all pressure altitudes.
 - a. If fuel flow is within the minimum and maximum limits at all altitudes, no adjustments are required.
 - b. If the fuel flow is not within specified limits at all pressure altitudes, the fuel injection system auto-leaning schedule requires adjustment (see Section G).

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H. ADJUSTMENT SPECIFICATIONS

Table 3. Fuel System Adjustment Values

Idle and FULL POWER Fuel Pressures and Flows						
Engine ¹	Prop. RPM	Manifold Absolute Pressure (MAP)	Unmetered Pump PSI ²	Metered Nozzle PSI ³	Fuel (lbs/hr) ⁴	Fuel (gal/hr) ⁴
IO-240-A, B	1000 Table 4	29.5 Table 4	9.4- 9.8 Table 4	- Table 4	- -	- -
IO-346-A, B	600 2700	-	7.0 - 7.5 19.0 - 21.0	- 12.5 - 14.0	- 78 - 85	- 13.3 - 14.5
IO-360-A, AB, AF, C CB, D, DB, ES (ES CIRRUS), G, GB, H, HB, J, JB, K, KB	See Maintenance and Overhaul Manual M-7					
TSIO-360-A, AB	600 2800	32.0	6.5- 7.5 27.2 - 31.2	15.8 - 16.7	119 - 124	20.1 - 21.0
TSIO-360-B, BB	600 2800	32.0	6.5 - 7.5 27.2 - 31.2	15.8 - 16.7	115 - 124	20.1 - 21.0
TSIO-360-C, CB	600 2800	37.0	6.5 - 7.5 34.0 - 37.0	16.7 - 19.3	135 - 145	23.0 - 24.7
TSIO-360-D, DB	600 2800	36.0	6.5 - 7.5 34.0 - 37.0	16.7 - 19.3	135 - 145	23.0 - 24.7
L/TSIO-360-E, EB	700 2575	40.0	6.25 - 6.75 43.0 - 46.0	15.8 - 18.3	130 - 140	22.1 - 23.8
TSIO-360-F, FB	700 2575	41.0	6.25 - 6.75 40.0 - 43.0	15.8 - 18.3	130 - 140	22.1 - 23.8
TSIO-360-G, GB	700 2700	40.0	6.25 - 6.75 45.0 - 49.0	16.7 - 19.3	135 - 145	23.0 - 24.7
TSIO-360-H, HB	600 2800	34.5	6.5 - 7.5 29.0 - 33.0	14.9 - 17.3	125 - 135	21.3 - 23.0
TSIO-360-JB	600 2800	37.0	6.5 - 7.5 34.5 - 37.5	16.7 - 19.3	134 - 145	22.8 - 24.7
L/TSIO-360-KB	700 2800	40.0	6.5 - 7.5 36.0 - 39.0	17.7 - 21.2	140 - 155	23.8 - 26.4
TSIO-360-LB	700 2700	40.0	6.25 - 6.75 34.0 - 38.0	14.7 - 16.7	135 - 145	23.0 - 24.7
TSIO-360-MB	700 2700	36.0	6.25 - 6.75 28.0 - 32.0	13.6 - 15.3	125 - 135	21.3 - 23.0
L/TSIO-360-RB	700 2600	38.0	25 Minimum 35.0 - 45.0	MFG ⁵ -	140 - 150	23.3 - 25.5
TSIO-360-SB	700 2600	39.0	6.25 - 6.75 31 - 36	15.1 - 17.8	131 - 151	22.3 - 25.7
O-470-GCI	600 2600	-	9.0 - 11.0 23.8 - 25.3	14.7 - 16.9	122 - 129	20.8 - 22.0
IO-470-C, G, P, R	600 2600	-	9.0 - 11.0 24.7 - 27.7	14.8 - 17.3	123 - 130	21.0 - 22.1
IO-470-D, E, F, H, L, M, N, S, U	600 2625	-	9.0 - 11.0 25.0 - 28.0	15.0 - 17.5	124 - 131	21.1 - 22.3
IO-470-J, K	600 2600	-	5.5 - 7.0 24.7 - 27.7	14.8 - 17.3	123 - 130	21.0 - 22.1
IO-470-V	600 2625	-	6.5 - 7.5 28.3 - 29.8	17.8 - 18.8	123.5 - 131	21.0 - 22.3

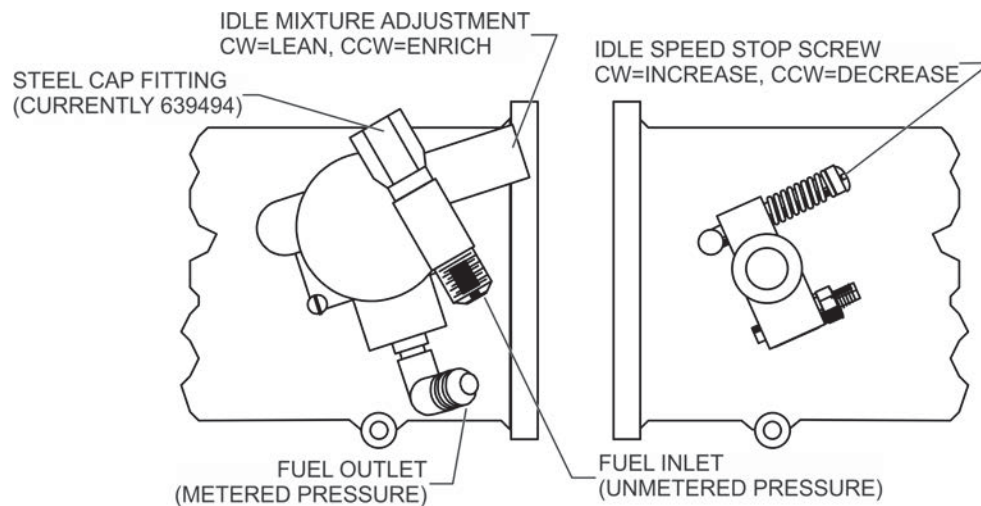


Figure 11. Throttle and Metering Assembly

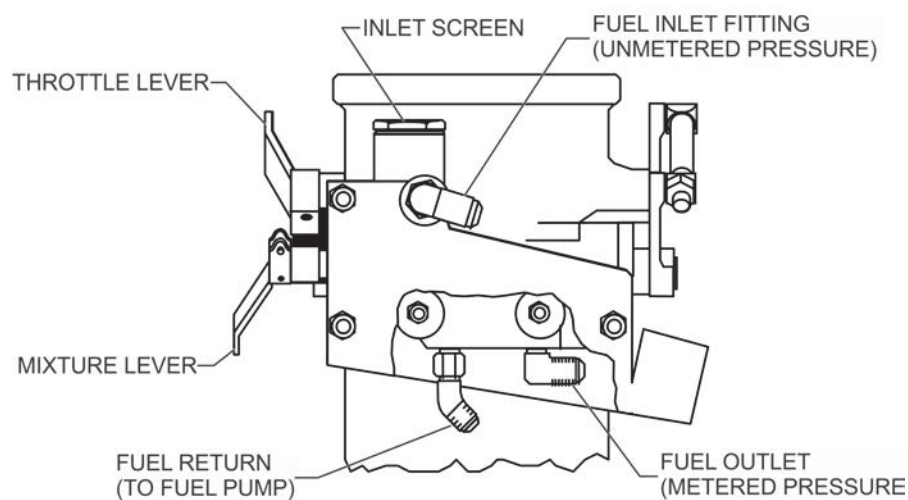


Figure 12. Throttle and Control Assembly, Front View