



6-3.7. Engine Operational Check

WARNING

Flight is prohibited until the engine successfully completes the operational check and a flight check. If, during an operational check or engine warm-up, abnormal operation is observed or leaks occur, do not take-off. Determine the cause of the problem and take corrective action.

Perform an engine operational check after any of the following activities:

- Engine Installation
- Fuel Injection System parts replacement, maintenance or troubleshooting
- Post-Overhaul
- Return from storage
- After each 100-Hour/Annual, and 500-Hour Inspection

Perform the tasks listed in Table 6-2 on a newly installed, repaired or overhauled engine before the engine can be released for normal flight.

Table 6-2. Engine Operation Prerequisites

Sequence	Requirement	Section Reference
1	Prepare the engine for operation	Maintenance Preflight Inspection
2	Check Engine Operation	Engine Operational Check
3	Complete the Engine Operational Checklist	Operational Checklist
4	Perform Flight Check	"Flight Check" in Section 7-2.3 ¹

1. and according to the AFM/POH



6-3.7.1. Engine Operating Limits

Table 6-3. IO-550 Engine Operating Limits

Specification	A B C		G	N	P	R
Full Throttle Speed +/- 25 RPM	2700		2500	2700	2700	2700
Minimum Idle Speed	600		600			
Unmetered Fuel Pressure @ idle (psi)	8.0 -10.0		8.0-10.0			
Metered Fuel Pressure (psi)	A	17.7-20.0	G		14.7-16.0	
	B	16.5-18.4	N		19.0-21.3	
	C	17.6-19.6	P		19.0-21.3	
			R		19.0-21.3	
Unmetered Fuel Pressure @ Max. RPM (psi)	A	32.0-36.0	G		22.0-26.0	
	B	29.2-36.2	N		28.0-30.0	
	C	31.6-37.8	P		28.0-30.0	
			R		28.0-30.0	
Oil Pressure w/Oil Temp 75-240°F	30-60		30-60			
Oil Pressure (Min. - Max.) (psi)	10-100		10-100			
Magneto RPM Drop/Spread (RPM)	150/75		150/75			



6-3.7.2. Maintenance Preflight Inspection

Prior to starting the engine, perform a preflight inspection of the engine, propeller, nacelle, and aircraft. This inspection must be performed prior to the first flight after engine installation, inspection, troubleshooting, maintenance, or overhaul work to determine if the aircraft and engine are in an airworthy condition. Do not release a malfunctioning engine for flight.

WARNING

Operation of a malfunctioning engine can result in additional damage to the engine, possible bodily injury or death.

Procedure

1. Turn the Master Power Switch and the Ignition Switch to the OFF position.
2. Remove engine cowling according to the airframe manufacturer's instructions.
3. Check the throttle, propeller, and alternate air supply controls for freedom of movement and full range of travel.

WARNING

Ensure the propeller arc is clear of personnel and obstructions before starting the engine.

4. Drain the aircraft fuel sumps according to the airframe manufacturer's instructions.
5. Remove, clean, inspect, and reinstall the aircraft fuel screens according to the airframe manufacturer's instructions.
6. Inspect the aircraft vapor return system for proper operation in accordance with airframe manufacturer's instructions.
7. Purge the aircraft fuel system.
 - a. Disconnect the fuel supply hose from the engine driven fuel pump and terminate the fuel supply hose in a large, clean container suitable for waste fuel.
 - b. Operate the aircraft fuel boost pump to allow a minimum of one gallon of fuel to flow into the container. Inspect the fuel for contaminants; locate and correct the source of contaminated fuel, if detected.
 - c. Reconnect the fuel supply line to the fuel pump inlet fitting and torque to Appendix B specifications.

WARNING

Use of inaccurate gauges will result in incorrect fuel system adjustment, probable accelerated engine wear and possible engine damage.

8. Verify the fuel system components are properly configured (part numbers conform to type design and parts are installed properly).
9. Ensure the fuel manifold valve vent and fuel pump drain lines are properly installed, open and free of obstructions.



10. Inspect the engine control rod ends for wear, proper installation and security in accordance with airframe manufacturer's instructions.
11. Lubricate engine control rod ends and fuel system moving parts using the approved lubricants listed in Section 3-2 and the airframe manufacturer's instructions.

WARNING

The engine is certified for operation with aviation fuels specified in Section 2-3. If the minimum grade required is not available, use the next higher grade. Use of lower octane rated fuel or jet fuel will result in damage to, or destruction of, an engine the first time high power is applied. If the aircraft is inadvertently serviced with the wrong grade of fuel, or jet fuel, drain the fuel system completely and service the fuel tanks in accordance with the aircraft manufacturer's instructions and perform a "Contaminated Fuel System Inspection" inspection according to instructions in Section 6-4.5.

12. Service the aircraft fuel system according to the airframe manufacturer's instructions.
13. Check the engine oil level. Service the oil sump as required with the oil grade specified in Section 3-2.1.
14. Verify the engine crankcase breather is secured according to the airframe manufacturer's instructions and no breather air flow restrictions exist.
15. If the engine is newly installed or being returned to service after long-term storage, pre-oil the engine according to the instructions in Section 5-3.4.
16. Verify the induction air filter is clean and secured according to the airframe manufacturer's instructions. Replace the air filter with a clean one if it is dirty; tighten the filter if it is loose.
17. Visually inspect the engine, propeller hub area, and nacelle for evidence of fuel and engine oil leaks. Correct any discrepancies.
18. Visually inspect the engine and nacelle for debris, loose, missing or broken lines, hoses, fittings, clamps and connections. Inspect for restrictions to cooling airflow; remove any debris.
19. Verify all baffles and baffle seals are installed, correctly positioned, and serviceable according to the airframe manufacturer's instructions.
20. If the engine has been exposed to temperatures below 20°F (-7°C) for more than two hours, preheat the engine according to "Engine Preheating" instructions in Section 7-4.1.1. If the engine has been exposed to an ambient temperature between 20° to 40°F (-7° to 4° C), refer to the "Cold Weather Starting Without Preheating" instructions in Section 7-4.1.1.3.



6-3.7.3. Oil Pump Operational Check

1. Perform a “Maintenance Preflight Inspection” according to Section 6-3.7.2.
2. Perform a normal “Engine Start” according to instructions in Section 7-3.2 and “Ground Run-up” according to Section 7-3.3 to allow the engine to warm to normal operating temperatures (75-240°F).
3. Oil Pressure..... Check
RESULT: Verify oil pressure is between 30 and 60 psi at full power RPM. If necessary, adjust according to the “Oil Pressure Adjustment” instructions in Section 6-3.10.1. If no oil pressure is noted, shut down the engine immediately and investigate the cause.
4. If no further checks are required, proceed to “Engine Shutdown” on page 6-24.

6-3.7.4. Fuel System Operational Check

A fuel system operational check is required after replacement of fuel injection system components, such as the fuel pump, fuel manifold valve, or fuel injectors. The fuel system setup is a critical component of proper engine operation.

Setup instructions differ for the fuel system, depending on the test equipment being used. If a Porta-Test Unit will be used for the operational check, follow the test equipment setup instructions in Section 6-3.7.4.1. If using calibrated gauges for the operational check, begin with Section 6-3.7.4.2. When the test equipment is set up properly, proceed with the Operational Check Procedure in Section 6-3.7.4.3. Upon completion of the operational check, a flight check, according to instructions in Section 7-2.3, is required for engine equipped with an altitude compensating fuel pump or for engines that fail to reach rated full power engine ROM during the operational check on the ground.

NOTE: Fuel system adjustments are interactive. Once begun, perform the entire procedure for proper fuel injection system operation.

Required Test Equipment

- Portable Tachometer
- Model 20 ATM-C Porta Test Unit (Figure 3-4)

OR

- Calibrated pressure gauges

NOTE: Pressure gauges must be accurate within +/- 1%. The calibration period should not exceed one year.

- A calibrated 0-60 psi gauge graduated in 1 psi increments (unmetered pressure).
- A calibrated 0-30 psi gauge graduated in 0.2 psi increments (metered pressure and fuel flow gauge verification).
- Two P/N MS51523-B4 swivel tees used to insert gauges in line with fuel lines for metered and unmetered pressure references.
- Hoses of sufficient length to allow personnel and equipment to perform the test at a safe distance from the propeller arc and blast area.



NOTE: Engine driven fuel pump pressures vary with engine RPM. Rated FULL POWER RPM may not be achieved during ground run-up. Use the Static Ground Setup Compensation Table to adjust the metered pressures if FULL POWER RPM cannot be achieved.

Table 6-4. Static Ground Setup Compensation Table

Static Engine RPM	Correction Factor	Corrected Metered Pressure
Metered pressure vs. RPM @ 70° F fuel temperature		
Rated RPM	1	
-20	.991	
-40	.982	
-60	.973	
-80	.964	
-100	.955	
-120	.946	

Procedure

If rated full power RPM cannot be achieved during ground run-up, determine the appropriate correction factor with the following calculation:

Subtract the maximum observed static RPM from the engine model's rated RPM in Table 6-3.

Locate the number closest to the difference between the engine model's rated RPM and observed static RPM in the first column in Table 6-4.

Multiply the correction factor in the second column adjacent to the static RPM by the engine model's rated metered fuel pressure to determine the corrected metered pressure.

Example: IO-550-C rated RPM 2700
 Maximum static RPM 2660
 Difference 40

Maximum Static RPM	Metered Pressure Range	Correction Factor	Corrected Metered Pressure
2660 (-40)	17.6-19.6 X	.982=	17.28-19.25



6-3.7.4.1. Fuel System Operational Checkout with the Port-Test Unit

Procedure

1. Connect the unmetered fuel test hose to one of the following:
 - a. **A B C** Loosen and remove the unmetered fuel supply hose from the fuel pump outlet fitting or the fuel control unit inlet fitting, depending on access to connections.
 - b. **G N P R** Remove and set aside the protective cap from the tee fitting on the integral throttle body metering unit. The cap will be reinstalled when the test and any necessary adjustments are complete.
2. Connect one MS51523-B4 swivel tee to the fuel connection loosened in step 1.

NOTE: Some installations may require a number of fittings to adapt the metered and unmetered test equipment to the fuel injection system. Connect the unmetered fuel supply hose to the straight end of the tee connector.
3. Connect the unmetered fuel supply hose to the straight end of the tee connector.
4. Connect the Porta-Test Unmetered Pressure hose to the 90° side of the swivel tee fitting.
5. Connect the metered pressure test hose to one of the following:
 - a. **G N P R** Remove the cap from the metered fuel port fitting on the fuel manifold valve.
 - b. **A B C** Loosen and remove the metered pressure fuel supply hose from the manifold valve inlet fitting. Connect one MS51523-B4 swivel tee to the manifold valve inlet fitting. Connect the metered pressure fuel supply hose to the straight end of the tee connector.
6. Connect the Porta Test Unit metered pressure test hose to fitting left open in step 5.
7. Torque all connections to Appendix B specifications.
8. Position the throttle control to the FULL OPEN position and the mixture control to FULL RICH. Operate the aircraft boost pump in accordance with the aircraft manufacturer's instructions. Bleed the air from the test unit and hoses according to the Porta-Test unit instructions.

WARNING

Allow excess fuel to drain from the induction/cylinder drains prior to attempting engine start. Failure to comply may result in hydraulic lock and subsequent engine failure.

9. Install the engine cowling or cooling shroud during ground operation.
10. Proceed to Section 6-3.7.4.3.

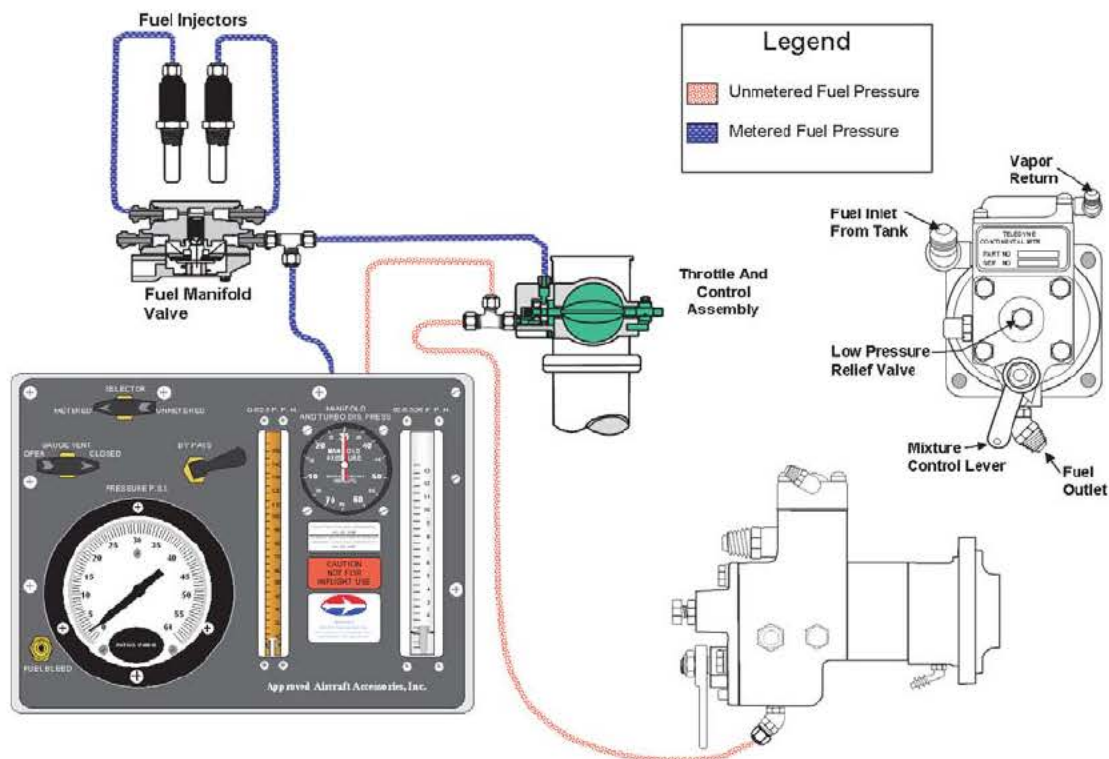


Figure 6-1. Porta-Test Connections to Integral Throttle Body/Metering Unit

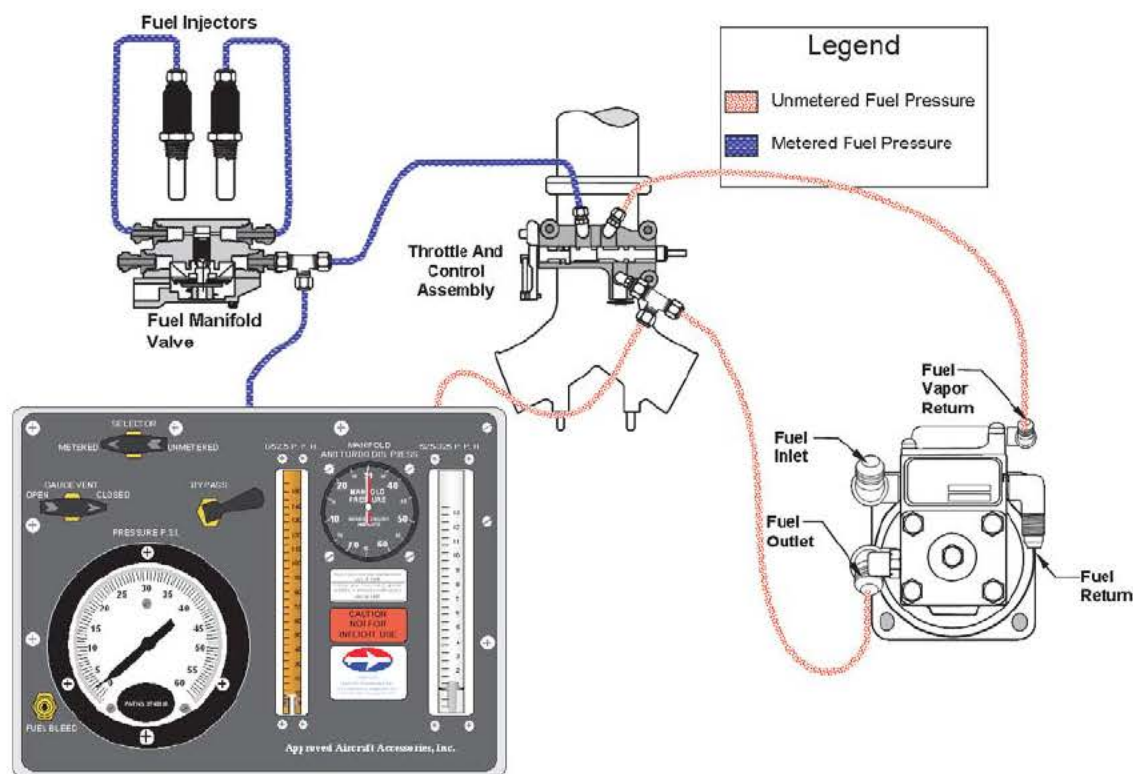


Figure 6-2. Porta-Test Connections to Fuel Control Unit



6-3.7.4.2. Fuel System Operational Checkout with Calibrated Gauges

Procedure

1. Connect the unmetered fuel test hose to one of the following:
 - a. **A B C** Loosen and remove the unmetered fuel supply hose from the fuel pump outlet fitting or the fuel control unit inlet fitting, depending on access to connections.
 - b. **G N P R** Remove and set aside the protective cap from the tee fitting on the integral throttle body metering unit. The cap will be reinstalled when the test and any necessary adjustments are complete.

2. Connect one MS51523-B4 swivel tee to the fuel connection loosened in step 1.

NOTE: Some installations may require a number of fittings to adapt the metered and unmetered test equipment to the fuel injection system. Connect the unmetered fuel supply hose to the straight end of the tee connector.

3. Connect the unmetered fuel supply hose to the straight end of the tee connector.
4. Connect the 0-60 psi unmetered fuel pressure gauge to the 90° side of the swivel tee fitting.
5. Connect the metered pressure test hose to one of the following:
 - a. **G N P R** Remove the cap from the metered fuel port fitting on the fuel manifold valve.
 - b. **A B C** Loosen and remove the metered pressure fuel supply hose from the manifold valve inlet fitting. Connect one MS51523-B4 swivel tee to the manifold valve inlet fitting. Connect the metered pressure fuel supply hose to the straight end of the tee connector.
6. Connect the 0-30 psi pressure gauge metered pressure test gauge to the hose to fitting left open in step 5.
7. Torque all connections to Appendix B specifications.
8. Position the throttle control to the FULL OPEN position and the mixture control to FULL RICH. Operate the aircraft boost pump in accordance with the aircraft manufacturer's instructions.

NOTE: Gauges must remain at the same height or above the fuel injection system components under test for the duration of the operational check. Indicated fuel pressure at the gauge will increase if the gauges are below the fuel injection system, causing erroneous indications.

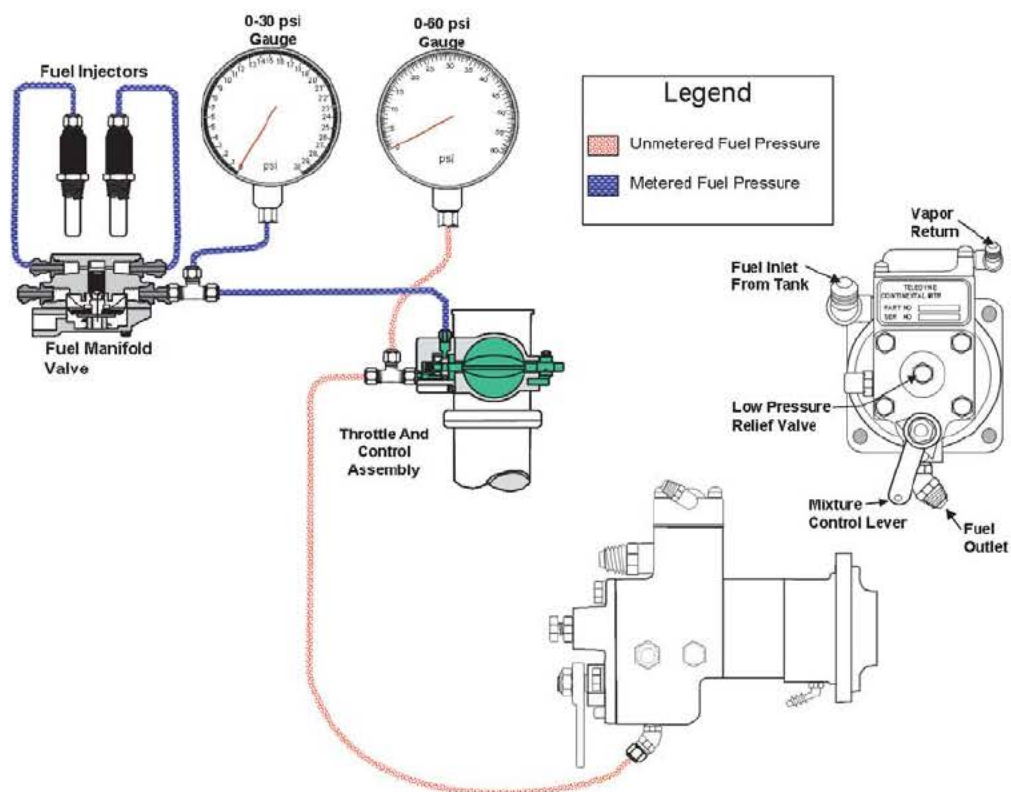


Figure 6-3. Calibrated Gauge Connections to Integral Throttle Body/Metering Unit

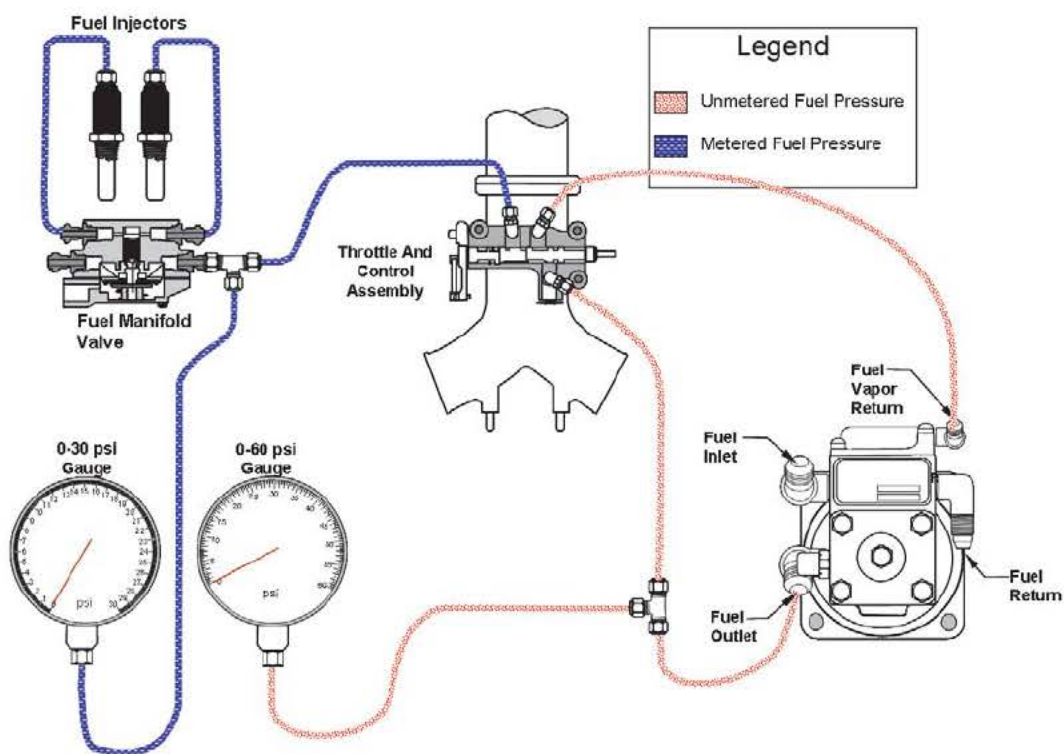


Figure 6-4. Calibrated Gauge Connections to Fuel Control Unit



9. Loosen the test connections at each gauge to bleed the lines of air. Hold the gauge at, or slightly above, the height of fuel system components to allow the fuel to force the air out of the lines. Operate the boost pump only long enough to purge the air from the fuel system. Torque all loosened fittings to Appendix B specifications.

WARNING

Drain all fuel from the induction system prior to attempting engine start. Failure to comply may result in hydraulic lock and subsequent engine failure.

10. Install the engine cowling or cooling shroud during ground operation.
11. Proceed to Section 6-3.7.4.3.

6-3.7.4.3. Fuel System Operational Checkout Procedure

Procedure

1. Verify the accuracy of the tachometer and fuel flow gauges prior to making any fuel system adjustments; replace faulty gauges.
2. Locate the IDLE speed stop screw (Figure 6-5 or Figure 6-6) on the throttle body and turn it counter-clockwise two complete turns. During the operational check, IDLE RPM will be controlled manually using the cockpit throttle control.

WARNING

Ensure the propeller area is clear before starting the engine.

3. Fuel Selector Valve ON
4. Mixture Control FULL RICH
5. Boost Pump ON (according to AFM/POH)
6. Perform a normal "Engine Start" according to instructions in Section 7-3.2 and "Ground Run-up" according to Section 7-3.3 to allow the engine to warm to normal operating temperatures.

NOTE: A puff of white smoke from a new or rebuilt engine, or an engine returned from storage is normal. The source of the smoke is the remaining preservation oil in the burning off in the combustion chamber. The smoke should dissipate quickly; if smoke persists, shut down the engine and investigate the cause.

7. Throttle 600-1000 RPM (One minute)
RESULT: Operate the engine for one minute, gradually increasing the speed to 1000 RPM in 3 minutes.

CAUTION: Operating the engine without oil pressure will result in engine malfunction or failure.

8. Oil Temperature Check
RESULT: Allow the engine oil to reach normal operating temperature (75°F (24°C)) before proceeding to the next step.

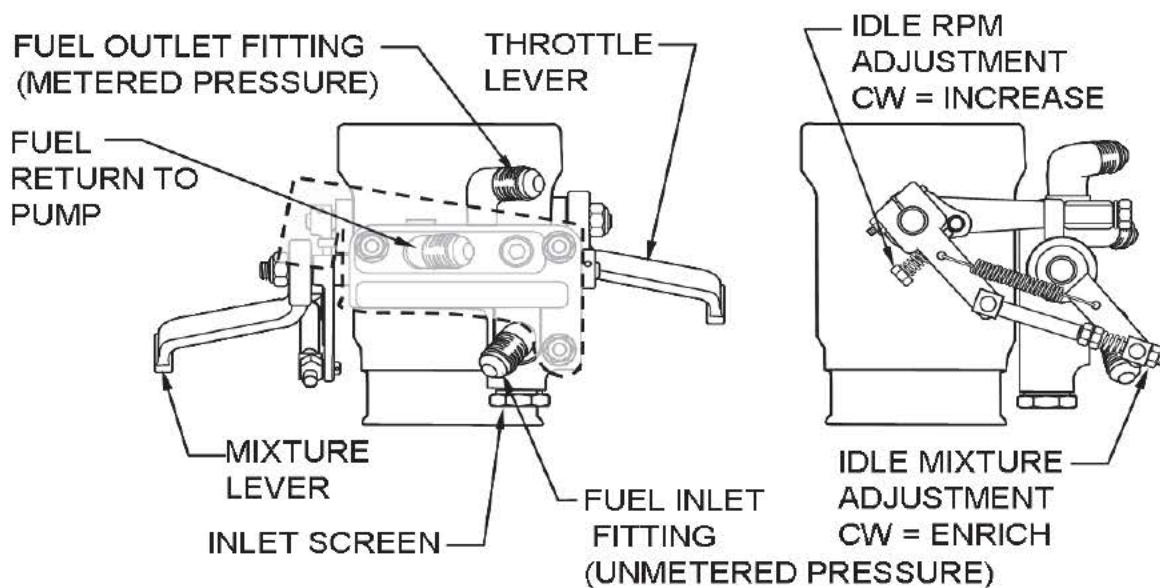


Figure 6-5. IO-550-A, B & C Throttle Body Adjustments

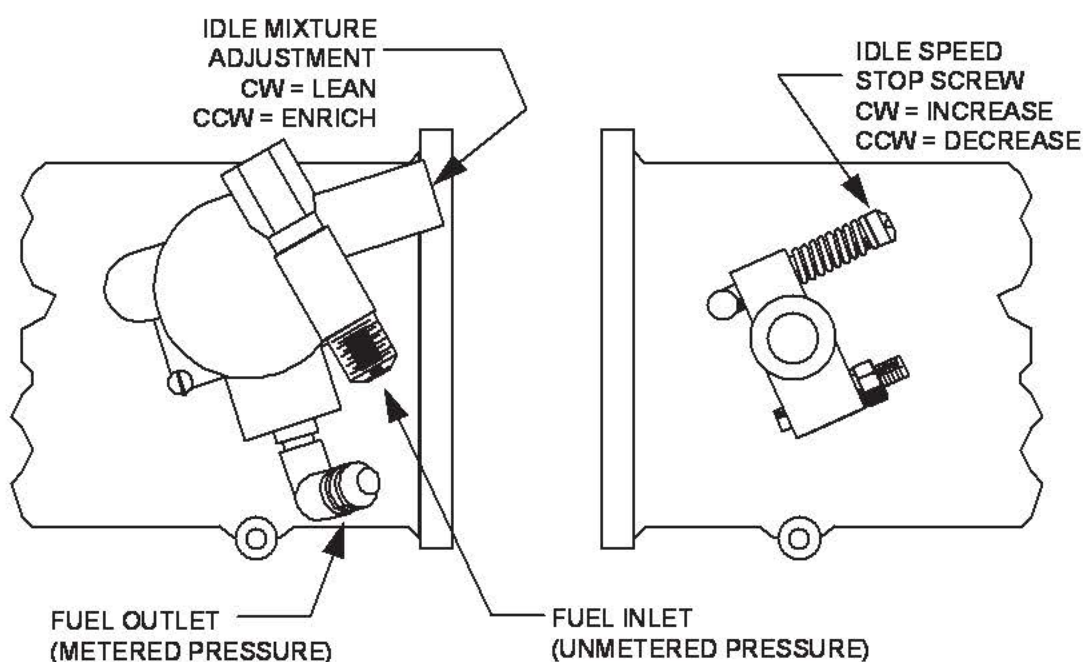


Figure 6-6. IO-550-G, N, P & R Throttle Body Adjustments

9. Boost Pump..... OFF
10. Mixture Control FULL RICH
11. Throttle..... 600±25 RPM
12. Unmetered Fuel Pressure Gauge..... Check

RESULT: Unmetered fuel pressure is within the range specified in Table 6-5.
Maintain engine speed until CHT is 250°F to 350°F. Record the unmetered fuel



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pressure, regardless of setting. If the unmetered fuel pressure is not within the limits specified in Table 6-5, adjust the fuel pressure according to the instructions in Section 6-3.10.2.

Table 6-5. IO-550 Fuel Injection System Pressures

Specification	A B C		G	N	P	R
Full Throttle Speed +/- 25 RPM	2700		2500	2700	2700	2700
Minimum Idle Speed	600		600			
Unmetered Fuel Pressure @ idle (psi)	8.0 -10.0		8.0-10.0			
Metered Fuel Pressure (psi)	A	17.7-20.0	G		14.7-16.0	
	B	16.5-18.4	N		19.0-21.3	
	C	17.6-19.6	P		19.0-21.3	
			R		19.0-21.3	

WARNING

Do not operate the engine at speeds above 1700 RPM until the oil temperature is at least 75°F (24°C) and oil pressure is within the normal operating range. Operating at speeds above 1700 RPM before reaching the minimum oil temperature may result in engine malfunction or engine failure.

NOTE: to eliminate rough idling after the mixture rise check, increase engine RPM to 1500-1800 RPM for 15 seconds before returning to IDLE RPM.

13. Mixture Control Retard slowly toward IDLE
RESULT: The engine speed should increase 25 to 50 rpm before beginning to decrease. If the rise is less than 25 rpm, the mixture is too lean. If the engine speed increases more than 50 rpm, the mixture is too rich. Adjust the idle fuel pressure mixture rise according to Section 6-3.10.2.
14. Mixture Control FULL RICH
15. Propeller Governor WIDE OPEN
16. Throttle..... WIDE OPEN
RESULT: Check the engine RPM with a portable tachometer. Record the engine speed on the checklist. If the engine does not reach the rated, full power RPM, calculate the corrected metered fuel pressure (Table 6-4).
17. Metered Fuel Pressure Gauge Check
RESULT: The full power, metered fuel pressure should equal the value in Table 6-5, with Table 6-4 correction factor, if applicable. Record the metered fuel pressure, regardless of setting. If full power, metered fuel pressure is not within the specified limits, adjust the metered fuel pressure according to Section 6-3.10.2.
18. Throttle..... Position to desired IDLE RPM
RESULT: adjust IDLE RPM according to instructions in Section 6-3.10.2.
19. If no further checks are required, proceed to "Engine Shutdown" on page 6-24.



6-3.7.5. Magneto RPM Drop Check

WARNING

Absence of RPM drop during magneto check may be an indication of a faulty ignition circuit (Hot Magneto). Should the propeller be turned by hand (as in during preflight), the engine could inadvertently start and cause personal injury or death. Flight is prohibited until the condition is corrected.

CAUTION: When operating on single ignition, some RPM drop and slight engine roughness as each magneto is switched off should be noted. Excessive (greater than 150 RPM) RPM drop may indicate a faulty magneto or fouled spark plugs.

NOTE: If the engine runs roughly after single magneto operation, increase engine speed to 2200 RPM in the BOTH position and lean the mixture control until the RPM peaks for ten seconds before returning to the full rich position to clear the spark plugs and smooth operation before returning to single magneto operation.

Procedure

1. Start the engine according to the “Engine Start” instructions in Section 7-3.2.
RESULT: No defects noted. Allow the engine oil to warm to minimum normal (75°F (24°C)) operating temperature.
CAUTION: Avoid prolonged single magneto operation to preclude spark plug fouling.
2. Throttle..... 1700 RPM
3. Magneto Switch R
RESULT: RPM drop does not exceed 150 RPM; record Left Magneto RPM drop result. Maximum allowable RPM drop spread between magnetos is 75 RPM.
4. Magneto Switch BOTH
5. Magneto Switch L
RESULT: RPM drop does not exceed 150 RPM; record Right Magneto RPM drop result. Maximum allowable RPM spread between magnetos is 75 RPM.
6. Magneto Switch BOTH
7. Throttle..... Reduce to IDLE
8. If no further checks are required, proceed to “Engine Shutdown” on page 6-24.



6-3.7.6. 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 engine fittings.
 - b. Disconnect the unmetered fuel pressure test hose from the engine fittings.
 - c. Remove the tee fittings and any additional test fittings installed 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 the protective cap designed for the integrated throttle body/metering unit (Part No. 639494). Aftermarket cap assemblies may damage the fitting.

- b. Install protective caps (or airframe-installed fitting to cockpit metered pressure gauge) on the fuel manifold valve (metered pressure) and integrated throttle body/metering unit fittings.
4. Leak Check
 - a. Master Power Switch..... ON
 - b. Ignition Switch..... BOTH
 - c. Boost Pump Switch..... ON (according to AFM/POH)
 - d. Throttle..... WIDE OPEN
 - e. Mixture..... FULL RICH
 - f. 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
 - g. Boost Pump Switch..... OFF (according to AFM/POH)
 - h. Mixture..... IDLE/CUT-OFF
 - i. Throttle..... IDLE
 - j. Ignition Switch..... OFF
 - k. Master Power Switch..... OFF