



Leaning Lycoming Engines

TIPS

Revision “D” to Service Instruction No. 1094 supersedes all previous recommendations and should be used for engine leaning during normal flight operations. **All leaning recommendations are based on calibrated instrumentation.**

Lycoming strongly recommends that all engine instrumentation be calibrated annually. All instrumentation for manifold pressure, engine RPM, oil temperature, cylinder head temperature, exhaust gas temperature and turbine inlet temperature in the aircraft should be included in this annual calibration.

Regardless of the fuel metering device, fuel management of normally aspirated engines is primarily dependant on the instrumentation available. The method is the same for both fixed- and controllablepitch propellers.

Lycoming recommendations for leaning turbocharged engines in this Service Instruction refer to Lycoming-supplied turbocharged engines. For aftermarket turbocharger installations, contact the STC holder for proper leaning instructions.

CHT (cylinder head temperature) and TIT (turbine inlet temperature) probes are required for leaning turbocharged engines. Refer to the latest edition of Service Instruction No. 1422 for proper TIT probe locations and depth.

General Rules

- Without exception, observe the red-line temperature limits during takeoff, climb and high-performance cruise power operation.
- Cylinder head temperature – maximum limit listed in the Lycoming Operator’s Manual.
- Oil temperature limit – maximum limit listed in the Lycoming Operator’s Manual.
- TIT - maximum allowable limit specified in the Lycoming Operator’s Manual.
- Whenever mixture is adjusted, rich or lean, it should be done slowly.
- Always return mixture slowly to full before increasing power setting.
- At all times, caution must be taken not to shock-cool the cylinders. The maximum recommended temperature change should not exceed 50° F per minute.

Leaning the Normally Aspirated Engines

- Use full-rich mixture during takeoff or climb. Careful observation of engine temperature instruments should be practiced to ensure the limits specified in Lycoming Operator's Manual are never exceeded. Refer to the aircraft POH (Pilot's Operating Handbook) or AFM (Aircraft Flight Manual) for more specific instructions.
- For 5,000 feet density altitude and above, or high ambient temperatures, roughness or reduction of power may occur at full rich mixture. The mixture may be adjusted to obtain smooth engine operation. For fixed-pitch propellers, lean to maximum RPM at full throttle prior to takeoff where airports are at 5,000-feet density altitude or higher. Limit operation at full throttle on the ground to a minimum. For direct-drive and for normally aspirated engines with a prop governor, but without fuel flow or EGT, set throttle at full power and lean mixture at maximum RPM with smooth operation of the engine as a deciding factor.
- For cruise powers where best power mixture is allowed, slowly lean the mixture from full rich to maximum power. Best power mixture operation provides the most miles per hour for a given power setting. For engines equipped with fixed-pitch propellers, gradually lean the mixture until either the tachometer or the airspeed indicator reading peaks. For engines equipped with controllable pitch propellers, lean until a slight increase of airspeed is noted.
- For a given power setting, best economy mixture provides the most miles per gallon. Slowly lean the mixture until engine operation becomes rough or until engine power rapidly diminishes as noted by an undesirable decrease in airspeed. When either condition occurs, enrich the mixture sufficiently to obtain an evenly firing engine or to regain most of the lost airspeed or engine RPM. Some engine power and airspeed must be sacrificed to gain a best economy mixture setting. *NOTE: When leaned, engine roughness is caused by misfiring due to a lean fuel/air mixture which will not support combustion. Roughness is eliminated by enriching slightly until the engine is smooth.*
- The exhaust gas temperature (EGT) offers little improvement in leaning the float-type carburetor over the procedures outlined above because of imperfect mixture distribution. However, if the EGT probe is installed, lean the mixture to 100° F on the rich side of peak EGT for best power operation. For best economy cruise, operate at peak EGT. If roughness is encountered, enrich the mixture slightly for smooth engine operation.
- When installing an EGT probe, the probe must be installed in the leanest cylinder. Contact the airframe or kit manufacturer for the correct location. In experimental or custom applications, multiple probe instrumentation is required, and several power settings should be checked in order to determine the leanest cylinder for the specific application.
- During normal operation, maintain the following recommended temperature limits:
 - Cylinder head temperature – limit listed in the Lycoming Operator's Manual.
 - Oil temperature – limit listed in the Lycoming Operator's Manual.

- For maximum service life, maintain the following recommended limits for continuous cruise operation:
- Engine power setting – 65% of rated or less.
- Cylinder head temperatures – 400° F. or below.
- Oil temperature – 165° F. – 220° F.

Leaning the Turbocharge Lycoming Power Plant

- The cylinder head temperature (CHT) and turbine inlet temperature (TIT) gauges are required instruments for leaning with turbocharging by Lycoming. EGT probes on individual cylinders should not be used for leaning.
- During manual leaning, the maximum allowable TIT for a particular engine must not be exceeded. Check the POH/AFM or the Lycoming Operator's Manual to determine these temperatures and fuel-flow limits.
- Maintaining engine temperature limits may require adjustments to fuel flow, cowl flaps or airspeed for cooling.
- All normal takeoffs, with turbocharged power plants, must be at full-rich mixture regardless of airport elevation.
- If manual leaning of the mixture is permitted at takeoff, climb power or high-performance cruise, it will be specified in the POH/ AFM and will list required ranges for fuel flow, power settings and temperature limitations.
- Leaning to best economy mixture:
 1. Set manifold pressure and RPM for the desired cruise power setting per the aircraft POH/AFM.
 2. Lean slowly in small steps, while monitoring instrumentation, to peak TIT or maximum allowable TIT, whichever occurs first.
- Leaning to best power mixture (before leaning to best power mixture, it is necessary to establish a TIT reference point):
 1. Set manifold pressure and RPM for the highest cruise power setting where leaning to best economy is permitted per the aircraft POH/AFM.
 2. Lean slowly in small steps until peak TIT or maximum allowable TIT is reached. Record peak TIT as a reference point.
 3. Deduct 125° F. from this reference, and thus establish the TIT temperature for best power-mixture operation.
 4. Return the mixture to full-rich, and adjust manifold pressure and RPM for the desired cruise conditions.
 5. Lean mixture to the TIT temperature for best power/mixture operation established in step 3.
- During normal operation, maintain the following limits:

- Engine power setting – rating listed in the Lycoming Operator’s Manual.
- Cylinder head temperature – limit listed in the Lycoming Operator’s Manual.
- Oil temperature – limit listed in the Lycoming Operator’s Manual.
- Turbine inlet temperature – limit listed in the Lycoming Operator’s Manual.
- For maximum service life, maintain the following recommended limits for continuous operation:
 - Engine power setting – 65% of rated or less.
 - Cylinder head temperatures – 400° F. or below. c. Oil temperature – 165° F. – 220° F.
 - Turbine inlet temperature – maintain 100° F. on rich side of maximum allowable.

Leaning the Supercharged Lycoming Power Plants

- All takeoffs with supercharged power plants must be at full-rich mixture regardless of the airport elevation.
- If manual leaning of the mixture is permitted at climb power, it will be specified in the POH/AFM and will list required ranges for fuel flow, power settings and temperature limitations.
- Recommended standard cruise power for the supercharged engine is 65%. At 65% power or less, this type of engine may be leaned as desired as long as the engine operates smoothly, and temperatures and pressures are within manufacturer’s prescribed limits.
- The exhaust gas temperature (EGT) gauge is a helpful instrument for leaning the supercharged engine at cruise power with a manual mixture control.

Product Support Network

Lycoming has a worldwide product support network so you can access the technical, training, and service information you need at your own convenience.

We are here to help. As a Lycoming customer, you have access to our worldwide team of authorized distributors and service centers. The Lycoming team helps you stay up-to-date on industry insights, and provides information about how to care for your engine.

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Fuel Mixture Leaning Procedures

For more information on leaning Lycoming engines, view Service Instruction No. 1094.

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