TEXTRON Lycoming

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SERVICE INSTRUCTION

Service Instruction No. 1094D
(Supersedes Service Instruction No. 1094C)
Engineering Aspects are
FAA Approved

DATE: March 25, 1994

SUBJECT: Fuel Mixture Leaning Procedures

MODELS AFFECTED: All Textron Lycoming Opposed Series Engines

TIME OF COMPLIANCE: As required during aircraft operation.

Revision "D" to Service Instruction on 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.**

Textron 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 controllable pitch propellers.

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

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

A. GENERAL RULES.

1. Without exception, observe the red line temperature limits during take-off, climb and high performance cruise power operation.

(a) Cylinder head temperature-maximum limit listed in the Textron Lycoming operator's manual.

(b) Oil temperature limit - maximum limit listed in the Textron Lycoming operator's manual.

(c) TIT - maximum allowable limit specified in the Textron Lycoming operator's manual.

2. Whenever mixture is adjusted, rich or lean, it should be done slowly.

3. ALWAYS RETURN MIXTURE SLOWLY TO FULL RICH BEFORE INCREASING POWER SETTINGS.

4. 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.

B. LEANING THE NORMALLY ASPIRATED ENGINES.

1. Use full rich mixture during take-off or climb. Careful observation of engine temperature instruments should be practiced to ensure limits specified in Textron 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.

2 For 5000 ft. 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 propeller, lean to maximum RPM at full throttle prior to take-off where airports are 5000 ft. density altitude or higher. Limit operation at full throttle on the ground to a minimum. For direct drive normally aspirated engine 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.

3. For cruise powers where best power mixture operation 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.

4. 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.

4. 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.

5. 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.

6. During normal operation, maintain the following recommended temperature limits:

   (a) Cylinder head temperature - limit listed in the Textron Lycoming operator's manual.

   (b) Oil temperature - limit listed in the Textron Lycoming operator's manual.

7. For maximum service life, maintain the following recommended limits for continuous cruise operation:

   (a) Engine Power Setting - 65% of rated or less.

   (b) **Cylinder head temperatures - 400°F. or below.**

   (c) **Oil temperature - 165°F. - 220°F.**

C. LEANING THE TURBOCHARGED TEXTRON LYCOMING POWERPLANT.

1. The cylinder head temperature (CHT) and turbine inlet temperature (TIT) gages are required instruments for leaning with turbocharging by Textron Lycoming. EGT probes on individual cylinders should not be used for leaning.

2. During manual leaning, the maximum allowable TIT for a particular engine must not be exceeded. Check the POH/AFM or the Textron Lycoming operator's manual to determine these temperatures and fuel flow limits.

3. Maintaining engine temperature limits may require adjustments to fuel flow, cowl flaps, or airspeed for cooling.

4. All normal take-offs, with turbocharged powerplants must be at full rich mixture regardless of airport elevation.

5. If manual leaning of the mixture is permitted at take-off, 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.

6. Leaning to best economy mixture.

(a) Set manifold pressure and RPM for the desired cruise power setting per the aircraft POH/AFM.

(b) Lean slowly in small steps, while monitoring instrumentation, to peak TIT or maximum allowable TIT whichever occurs first.

7. Leaning to best power mixture.

Before leaning to best power mixture, it is necessary to establish a TTT reference point. This is accomplished as follows:

(a) Set manifold pressure and RPM for the highest cruise power setting where leaning to best economy is permitted per the aircraft POH/AFM.

(b) Lean slowly in small steps until peak TIT or maximum allowable is reached. Record peak TIT as a reference point.

(c) Deduct 125°F. from this reference and thus establish the TIT temperature for best power mixture operation.

(d) Return the mixture to full rich and adjust manifold pressure and RPM for the desired cruise conditions.

(e) Lean mixture to the TIT temperature for best power mixture operation established in step (c).

8. During normal operation, maintain the following limits:

(a) Engine power setting - rating listed in the Textron Lycoming operator's manual.

(b) Cylinder head temperature - limit listed in the Textron Lycoming operator's manual.

(c) Oil temperature - limit listed in the Textron Lycoming operator's manual.

(d) Turbine inlet temperature - limit listed in the Textron Lycoming operator's manual.

9. For maximum service life, maintain the following recommended limits for continuous operation:

(a) Engine power setting - 65% of rated or less.

(b) Cylinder head temperature - 400°F. or below.

(c) Oil temperature - 165°F. - 220°F.

(d) Turbine inlet temperature - maintain 100°F. on rich side of maximum allowable.

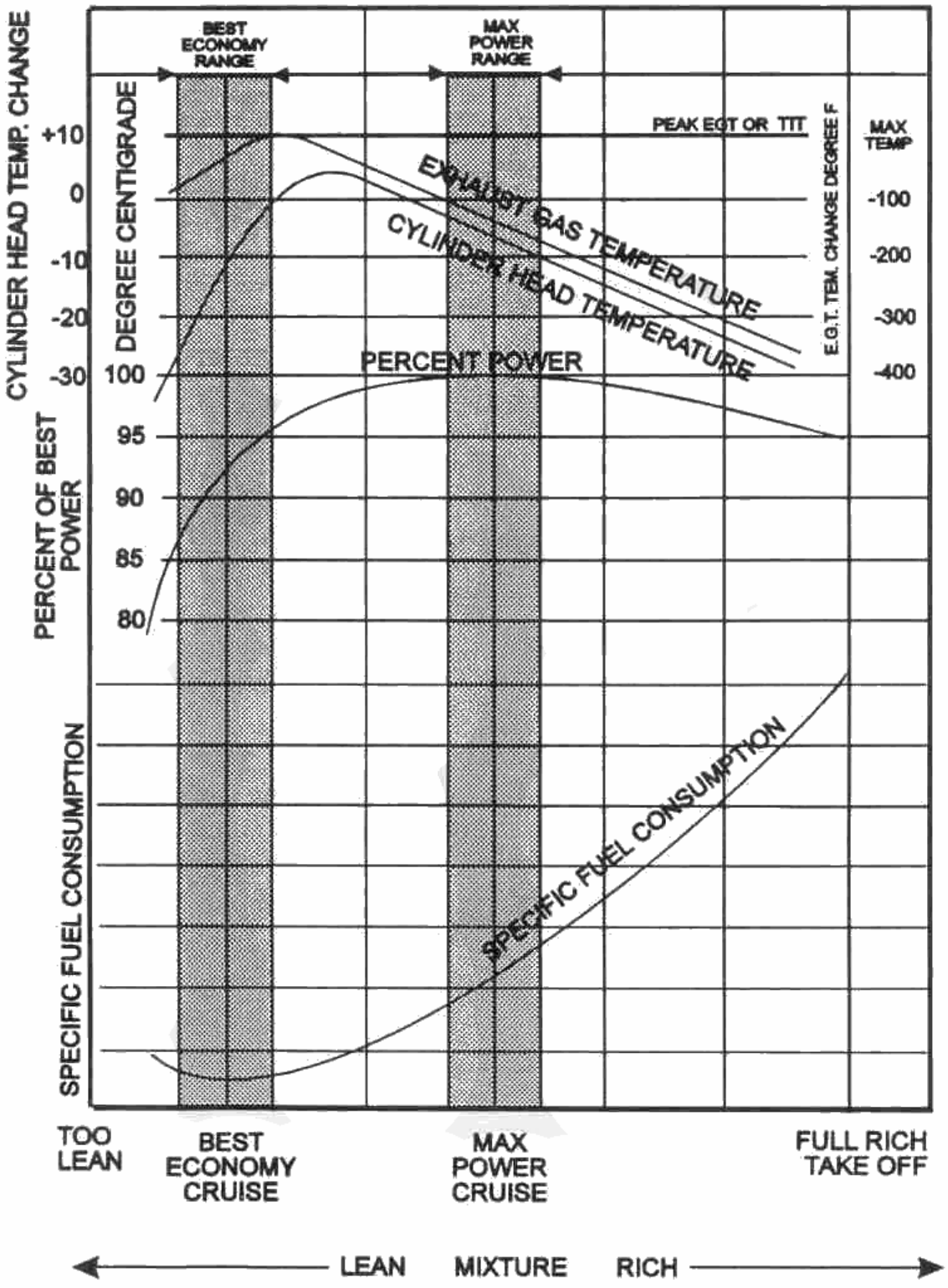
D. LEANING THE SUPERCHARGED TEXTRON LYCOMING POWERPLANTS.

1. All take-offs with supercharged powerplants must be at full rich mixture regardless of the airport elevation.

2. 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.

3. 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 limit.

4. The exhaust gas temperature (EGT) gage is a helpful instrument for leaning the supercharged engine at cruise power with a manual mixture control.



THIS REPRESENTATIVE DIAGRAM SHOWS THE EFFECT OF LEANING ON: CYLINDER HEAD TEMPERATURE, EXHAUST GAS TEMPERATURE OR TIT, ENGINE POWER, AND SPECIFIC FUEL CONSUMPTION FOR A CONSTANT ENGINE RPM AND MANIFOLD PRESSURE.

NOTE

TEXTRON LYCOMING DOES NOT RECOMMEND OPERATING ON THE LEAN SIDE OF PEAK EGT.