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SERVICE INSTRUCTION

DATE: February 8, 1993

Service Instruction No. 1427B
(Supersedes Service Instruction No. 1427A
and Service Instruction No. 1124B)
Engineering Aspects are
FAA Approved

SUBJECT: Textron Lycoming Reciprocating Engine Break-In and Oil Consumption Limits

MODELS AFFECTED: All fixed wing and rotary wing aircraft (horizontal installations only) with Textron Lycoming reciprocating aircraft engines installed.

TIME OF COMPLIANCE: 1. When installing factory overhauled, rebuilt or new Textron Lycoming engines.

2. After field overhaul (field overhauled engine or engine with piston ring change after one or more cylinders are honed or replaced).

3. When one or more cylinders have rings replaced or cylinders are replaced (requiring new rings).

NOTE

All engines that have had initial run-in conducted in a test cell (including all Textron Lycoming factory new, rebuilt and overhauled) should proceed directly to the FLIGHT TEST section of this Service Instruction that is applicable to your aircraft.

Ideally, a newly overhauled aircraft engine should be tested in a test cell where operating conditions can be closely monitored. If the engine is test cell run, the engine must have intercylinder baffles in place, cooling shroud and club propeller to provide engine RPM requirements. Where a test cell is not available, the engine should be tested on a test stand with a club propeller and a cooling shroud. However, it is not always convenient to test an engine in this manner.

If a test cell or a test stand is not available, the engine should be properly tested after it has been installed in the aircraft. If the engine is run in the aircraft, it should still use a club propeller for proper airflow cooling. However, the aircraft propeller may be used. In either case, the intercylinder baffles must be in place. The engine to cowling baffles must be new or in good condition to assure proper cooling air flow differential across the engine. The cylinder head temperature gage, oil temperature gage, oil pressure gage, manifold pressure gage and tachometer must be calibrated to assure accuracy.

The purpose of a test cell or ground run test if done in the aircraft is to assure that the engine meets all specifications, RPM, manifold pressure, fuel flow and oil pressure. The oil cooler system must hold oil temperatures within limits shown in applicable Textron Lycoming Operator's Manual.

NOTE

Extended ground operation can cause excessive cylinder and oil temperatures. Prior to start of a ground run, the oil cooler system should be inspected for metal contamination and be free from air locks. When the engine oil is at operating temperature, oil goes through cooler first then through oil filter. If a previous engine failed, the oil cooler, propeller and governor may be contaminated and should be replaced or cleaned and inspected by an approved repair facility.

The purpose for engine break-in is to seat the piston rings and stabilize the oil consumption. There is no difference or greater difficulty in seating the piston rings of a top overhauled engine versus a complete engine overhaul.

NOTE

The maximum allowable oil consumption limits for all Textron Lycoming aircraft engines can be determined by using the following formula:

$$.006 \times BHP \times 4 \div 7.4 = Qt./Hr.$$

The following procedure provides a guideline for testing a newly overhauled engine that is mounted in the aircraft. Information on the "ground run after top overhaul or cylinder change with new rings" and the "flight test after top overhaul or cylinder change with new rings" procedures are published in the applicable Textron Lycoming Operator's Manual.

I. FIXED WING

A. PREPARATION FOR TEST WITH ENGINE INSTALLED IN AIRCRAFT.

1. Pre-oil the engine in accordance with latest revision of Service Instruction No. 1241.

2. It is particularly important that the cylinder head temperature gage, oil temperature gage, oil pressure gage, manifold pressure gage, and tachometer be calibrated prior to testing.

3. Engine accessories, such as the fuel pump, fuel metering unit, and magnetos, should be overhauled in accordance with accessory manufacturer's recommendations, or replaced with new units before testing engine. This applies to overhauled engines only.

CAUTION

CHECK THAT ALL VENT AND BREATHER LINES ARE PROPERLY INSTALLED AND SECURED AS DESCRIBED IN THE AIRFRAME MAINTENANCE MANUAL.

4. Install all intercylinder baffles. Install all airframe baffles and cowling.

5. For optimum cooling during ground testing, a test club should be used. Where this is not possible, the regular flight propeller can be substituted but cylinder head temperature must be monitored closely.

B. GROUND TEST.

1. Face the aircraft into the wind.

2. Start the engine and observe the oil pressure gage. If adequate pressure is not indicated within 30 seconds, shut the engine down and determine the cause. Operate the engine at 1000 RPM until the oil temperature has stabilized or reached 140°F. After warm-up, the oil pressure should not be less than the minimum specified in the applicable operator's manual.

3. Check magneto drop-off as described in the latest revision of Service Instruction No. 1132.

4. Continue operation at 1000/1200 RPM for 15 minutes. Insure that cylinder head temperature, oil temperature and oil pressure are within the limits specified in the operator's manual. Shut the engine down and allow it to cool if necessary to complete this portion of the test. If any malfunction is noted, determine the cause and make the necessary correction before continuing the test.

5. Start the engine again and monitor oil pressure. Increase engine speed to 1500 RPM for a 5 minute period. Cycle propeller pitch and perform feathering check as applicable per airframe manufacturer's recommendation.

6. Run engine to full-static airframe recommended power for a period of no more than 10 seconds.

7. After operating the engine at full power, allow it to cool down moderately. Check idle mixture adjustment prior to shutdown.

8. Inspect the engine for oil leaks.

9. Remove the oil suction screen and the oil pressure screen or oil filter to determine any contamination. If no contamination is evident, the aircraft is ready for flight testing.

NOTE

Compile a log of all pertinent data accumulated during both the ground testing and flight testing.

C. FLIGHT TEST.

WARNING

ENGINE TEST CLUBS MUST BE REPLACED WITH APPROVED FLIGHT PROPELLERS BEFORE FLYING AIRCRAFT.

1. Start the engine and perform a normal preflight run-up in accordance with the engine operator's manual.

2. Take off at airframe recommended take off power, while monitoring RPM, fuel flow, oil pressure, oil temperature and cylinder head temperatures.

3. As soon as possible, reduce to climb power specified in operator's manual. Assume a shallow climb angle to a suitable cruise altitude. Adjust mixture per pilot's operating handbook (POH).

4. After establishing cruise altitude, reduce power to approximately 75% and continue flight for 2 hours. For the second hour, alternate power settings between 65% and 75% power per operator's manual.

NOTE

If the engine is normally aspirated (non-turbocharged), it will be necessary to cruise at the lower altitudes to obtain the required cruise power levels. Density altitude in excess of 8,000 feet (5,000 feet is recommended) will not allow the engine to develop sufficient cruise power for a good break-in.

5. Increase engine power to maximum airframe recommendations and maintain for 30 minutes, provided engine and aircraft are performing within operating manual specifications.

CAUTION

AVOID LOW-MANIFOLD PRESSURE DURING HIGH ENGINE SPEEDS (UNDER 15" HG.) AND RAPID CHANGES IN ENGINE SPEEDS WITH ENGINES THAT HAVE DYNAMIC COUNTERWEIGHT ASSEMBLIES. THESE CONDITIONS CAN DAMAGE THE COUNTERWEIGHTS, ROLLERS OR BUSHINGS, THEREBY CAUSING DETUNING.

6. Descend at low cruise power while closely monitoring the engine instruments. Avoid long descents at low manifold pressure. Do not reduce altitude too rapidly or the engine temperature may drop too quickly.

CAUTION

AVOID ANY CLOSED THROTTLE DESCENTS. CLOSED THROTTLE OPERATION DURING DESCENTS WILL CAUSE RING FLUTTER CAUSING DAMAGE TO THE CYLINDERS AND RINGS.

7. After landing and shutdown, check for leaks at fuel and oil fittings and at engine and accessory parting surfaces. Compute fuel and oil consumption and compare the limits given in operator's manual. If consumption exceeds figures shown in manual, determine the cause before releasing the aircraft for service.

8. Remove oil suction screen and oil pressure screen or oil filter to check again for contamination.

NOTE

To seat the piston rings in a newly overhauled engine, cruise the aircraft at 65% to 75% power for the first 50 hours, or until oil consumption stabilizes.

II. ROTARY WING (HORIZONTAL INSTALLATIONS ONLY)

Proper break-in of helicopter engines is accomplished by following a sequence of steps ranging from servicing the engine on the ground to progressively increasing its power output during operation. Although this Service Instruction contains detailed information pertaining to break-in, it is impossible to cover all aspects of break-in for individual helicopter models. For that reason, consult the pilot's flight manual or pilot operating handbook (POH) for a particular helicopter model. Also, refer to the Textron Lycoming Operator's Manual for the engine.

Some facts should be kept in mind regarding break-in of piston engines employed in helicopters. They are as follows:

Because helicopters always operate at a fixed or rated engine speed, any reduced engine RPM required during break-in must be undertaken with the helicopter on-ground and with the rotor engaged. During flight, all power reductions must be made by manifold pressure alone.

Manifold Pressure Values. Some helicopters do not have red line on the manifold pressure gage and therefore use all rated power. Some are red lined to airframe limitations and not to engine performance parameters. In the case of Textron Lycoming model HIO-360-D1A, it has graduated manifold pressure values that can be obtained from the Textron Lycoming Operator's Manual.

The method of rotor engagement, centrifugal clutch or manually operated belt drive must also be considered.

NOTE

Because of the difference in helicopter models, refer to the helicopter pilot's operating handbook (POH) for specific methods of operation for a particular helicopter concerning rotor engagement and manifold pressure ratings.

A. GROUND TEST.

1. Check that engine is serviced with proper grade and quantity of oil.
2. Review the appropriate starting procedure detailed in the helicopter pilot's operating handbook (POH).
3. Position the helicopter to take advantage of prevailing wind to assist in engine cooling.
4. Insure that throttle and mixture control are at the full off position.

NOTE

In the following step, if adequate oil pressure is not indicated within 30 seconds, shut the engine down and determine the cause.

5. Refer to helicopter pilot's operating handbook (POH) for proper starting procedures. Start engine and run 5 minutes at idle RPM (1200-1450 RPM).
6. Adjust idle mixture and oil pressure as required.
7. Shut engine off.
8. Inspect the engine for oil and fuel leaks.
9. If plug fouling is noted on magneto check, remove, inspect and test spark plugs. Clean oil and lead from plug. Reinstall spark plugs and leads. Torque as required. (Refer to latest revision of Service Instruction No. 1042.)
10. Restart engine and run for 5 minutes at idle speed (1200-1450 RPM).
11. Engage rotor, if required, and increase RPM to 50%-60% if rated engine speed for 5 minutes with rotor blades at flat pitch (collective full down).
12. Then increase engine RPM to 80% of rated engine speed for 5 minutes, followed by 100% airframe manufacturer's rated engine speed for another 5 minutes, provided that oil pressure is normal and that oil temperature is between 180°F-200°F, with the cylinder head temperatures between 350°F-400°F.

NOTE

For proper break-in, do not exceed 420°F cylinder head temperature.

13. After running engine for the last 5 minute segment, cool down as recommended in helicopter pilot's operating handbook (POH), then shut engine down.
14. Drain oil and clean the suction screen in the sump. Also clean oil pressure screen, or replace pressure oil filter. Make proper oil pressure adjustments at this time.
15. After installing the suction screen and pressure screen (or new oil filter) to proper torque, service engine with correct grade and quantity of oil. (Refer to latest revision of Service Instruction No. 1014.)

16. Start engine and idle at 1450 RPM.

17. Engage rotor, if required, and increase engine RPM to 2000 RPM. Warm engine to ground-run check as described in helicopter pilot's operating handbook (POH).

18. At this time perform magneto check per helicopter pilot's operating handbook (POH).

B. FLIGHT TEST.

Start engine and warm up at 1450 RPM. Engage rotor, if required, increase engine speed to 75% RPM. Warm up the engine and conduct a ground check in accordance with the helicopter pilot's flight manual, including magneto check.

NOTE

It is advisable to have two qualified crew members aboard to perform the various control operations and to monitor the engine instruments. All aircraft and engine operating temperatures and pressures are to be monitored. If any exceed the helicopter pilot's flight manual or engine and aircraft operating manuals limitations, the break-in is to be discontinued until corrective maintenance has been performed.

1. Put helicopter into a hover mode for 10 minutes while charting manifold pressure, fuel pressure, oil temperature, oil pressure and cylinder head temperature, etc.

2. If engine instruments prove satisfactory, climb to cruise altitude.

3. Cruise at 70%-75% of engine rated power for 30 minutes at an airspeed that will allow for a constant safe altitude.

4. At termination of 30 minute flight at 70%-75% power, chart manifold pressure and engine temperature. Increase engine RPM and manifold pressure to maximum limits allowed in helicopter pilot's operating handbook (POH). Maintain this power setting for 45 minutes at a constant safe altitude.

5. At the end of 45 minutes, again chart manifold pressure and engine temperatures.

6. Return to base and hover aircraft for 10 minutes or cool down time recommended in helicopter pilot's operating manual. Again chart manifold pressure and engine temperatures.

C. AFTER FLIGHT – ON GROUND.

NOTE

Reference helicopter pilot's operating handbook (POH) for cool down and shut down procedures.

1. Inspect engine for leaks.

2. Compute fuel and oil consumption. If figures exceed limits, determine cause(s) and correct before releasing aircraft.

3. Remove oil suction screen and pressure screen (or oil filter). Inspect for contamination.

4. After reinstalling the suction screen and pressure screen (or new filter) to proper torque, service engine with correct grade and quantity of oil. (Refer to latest revision of Service Instruction No. 1014).

After the aircraft has been released, the engine must be operated on straight mineral oil during the first 50 hours of operation or until the oil consumption stabilizes. (Refer to latest revision of Service Instruction No. 1014.) During this time, maintain engine power above 65% and insure that all aircraft and engine operating temperatures and pressures are monitored and maintained within limits. Refer to NOTE under step II. B. FLIGHT TEST.

NOTE: Revision “B” adds engine break-in for rotary wing aircraft (horizontal installations only) and adds the oil consumption limits formula for all Textron Lycoming aircraft engines.