

# ENGINE BREAK-IN PROCEDURES FOR OVERHAULED AND REPAIRED ENGINES

Proper engine break-in is the most important process to ensure the longevity of the engine. The break-in process is accomplished by metal to metal contact between the rings and the cylinder wall. Rings are manufactured with a narrow contact surface, which under the right conditions, allow the ring profile to breach the oil film on the cylinder wall to wear in. As wear progresses the ring contact surface widens to a point where this is no longer possible and oil consumption stabilizes and the engine is then broken in. High pressure in the combustion chamber puts additional force behind the rings, allowing the metal to metal contact, which is why low power settings will not allow for proper break-in. Sustained low power settings during break-in can result in cylinder wall glazing, which cannot be corrected without honing the cylinder and fitting new rings.

Engines that have been overhauled or repaired by Airmark Overhaul, Inc. have been carefully run-in on our test stand; therefore, no further ground run-in is necessary, other than what is required by the approved aircraft manual prior to flight. All engines repaired by Airmark Overhaul, Inc. are furnished with honed/deglazed cylinder bores and new rings, and therefore require the same break-in procedures as an overhauled engine to ensure proper ring to barrel seating.

All engines that have had a cylinder or multiple cylinders replaced must also follow break in procedures.

## **Break-in procedure for a Fixed Wing Application Lycoming engine is as follows.**

**ENGINE OIL MUST BE ADDED BEFORE START UP. FOR SHIPPING PURPOSES THE ENGINE IS SHIPPED WITHOUT OIL.**

**THE USE OF AUTOMOTIVE PUMP GASOLINE IS NOT RECOMMENDED AND WILL VOID THE ENGINE WARRANTY.**

**THE ENGINE OIL SYSTEM MUST BE PRE-OILED IN ACCORDANCE WITH THE LATEST VERSION OF SERVICE INSTRUCTION 1241 PRIOR TO FIRST START UP. FAILURE TO ACCOMPLISH THIS STEP CAN LEAD TO OIL STARVATION DAMAGE. OIL STARVATION WILL VOID THE WARRANTY.**

## **THE LATEST VERSION OF LYCOMING SERVICE INSTRUCTION 1427 CAN BE REFERENCED FOR FURTHER DETAILS ON BREAK IN PROCEDURES.**

For Lycoming engines, specific oil requirements for engine break-in can be referenced in the latest version of Service Instruction 1014. For naturally aspirated engines straight mineral oils that conform to MIL-L-6082 or SAEJ1966 is the oil that must be used during break in, Aeroshell 100 is our recommendation for naturally aspirated engines during break-in, except in extreme environments. The latest version of Service Instruction 1014 shows the appropriate oils to be used under these circumstances.

For turbocharged Lycoming models, ashless dispersant oil that conforms to MIL-L-22851 or SAEJ1899 must be used to eliminate the risk of oil coking in the turbocharger, Aeroshell W100 is our recommendation for turbocharged Lycoming engines during break-in, except in extreme environments. The latest version of Service Instruction 1014 shows the appropriate oils to be used under these circumstances.

Once the engine has been installed ground running should be kept to the minimum required to inspect the installation for any discrepancies prior to the first flight. Hoses and lines installed must, at a minimum, be properly flushed to eliminate the possibility of contamination. It is highly recommended, and may be required by the aircraft manufacturer, to replace all hoses at overhaul. A failed hose will quickly pump oil overboard resulting in oil starvation and catastrophic engine failure. Any component that circulates oil outside the engine, such as remote oil coolers and remote filter adapters must be properly flushed by a qualified facility. All airframe baffles must be inspected for proper integrity to ensure proper airflow for cooling.

Once the steps above have been completed follow the instructions below for in-flight break-in procedures.

Take off at full power in accordance with the Pilot Operating Handbook (POH). As soon as possible decrease power to climb power in accordance with the POH. Monitor all engine operating parameters for any abnormalities.

Climb at a shallow angle to reach cruise altitude, and adjust the mixture per the POH. Cruise altitude is recommended at 5000 ft, and not to exceed 8000 ft density altitude as available power above this elevation prevents proper break-in.

At cruise altitude decrease power to 75% and continue to fly for 2 hours. For the second hour alternate power settings between 65 and 75 percent.

If all engine parameters are normal increase power to maximum that is allowed by the airframe manufacturer's recommendations for 30 minutes, and continue to monitor onboard instruments.

Decrease power to low cruise while monitoring the instruments, while avoiding long descents at low manifold pressures, and do not decrease altitude to rapidly, as this can cause rapid cooling of the engine and subsequent engine damage.

Upon landing the engine must be examined for oil, fuel and hydraulic leaks. Fuel and oil consumption must be calculated and compared to the applicable Lycoming Engine Operators Manual. If all parameters are in limits as specified, repeat steps 1 through 6 for one more flight.

Remove suction screen and the oil filter/screen as applicable, and examine for blockages or contamination. If contamination or a blockage is found refer to the latest version of Lycoming Service Bulletin 480. Provided that no contamination or blockage is found the aircraft can be cleared for service.

During the first 50 hours of operation power levels must be maintained at 65% or above in cruise. Avoid any abusive operation of the engine during the first 50 hours as well. While it can be recommended to change to Ashless Dispersant oils after oil consumption stabilizes, it is good practice to use Straight Mineral Oil for the first 50 hours to ensure complete break-in.

## **Break-in procedure for a Horizontal Helicopter Lycoming engine is as follows.**

**ENGINE OIL MUST BE ADDED BEFORE START UP. FOR SHIPPING PURPOSES THE ENGINE IS SHIPPED WITHOUT OIL.**

**THE USE OF AUTOMOTIVE PUMP GASOLINE IS NOT RECOMMENDED AND WILL VOID THE ENGINE WARRANTY.**

**THE ENGINE OIL SYSTEM MUST BE PRIMED IN ACCORDANCE WITH THE LATEST VERSION OF SERVICE INSTRUCTION 1241 PRIOR TO FIRST START UP. FAILURE TO ACCOMPLISH THIS STEP CAN LEAD TO OIL STARVATION DAMAGE. OIL STARVATION WILL VOID THE WARRANTY.**

Refer to the latest version of Lycoming Service Instruction of 1427 and the POH for the helicopter for information on proper break-in procedures, since many helicopter applications have specific break-in procedures. The use of a straight mineral which conforms with MIL-L-6082 or SAEJ1966, is recommended for all naturally aspirated models. Aeroshell 100 is our recommended oil to use.

## ENGINE BREAK-IN FOR OVERHAULED AND REPAIRED CONTINENTAL ENGINES

**Break-in procedure for a Continental engine is as follows.**

**ENGINE OIL MUST BE ADDED BEFORE START UP. FOR SHIPPING PURPOSES THE ENGINE IS SHIPPED WITHOUT OIL.**

**THE USE OF AUTOMOTIVE PUMP GASOLINE IS NOT RECOMMENDED AND WILL VOID THE ENGINE WARRANTY.**

**THE ENGINE OIL SYSTEM MUST BE PRE-OILED PRIOR TO START UP. AIR MUST BE PURGED FROM ANY EXTERNAL COMPONENTS SUCH AS REMOTE OIL COOLERS AND REMOTE FILTER ADAPTERS TO PREVENT A DRY START UP. FAILURE TO ACCOMPLISH THIS STEP CAN LEAD TO OIL STARVATION DAMAGE. OIL STARVATION WILL VOID THE WARRANTY.**

**CONTINENTAL ENGINES WITH CONTINUOUS FLOW INJECTION SYSTEMS MUST BE ADJUSTED USING APPROPRIATE DATA PRIOR TO FIRST FLIGHT. THESE FUEL SYSTEMS REQUIRE ADJUSTMENT IN THE AIRFRAME FOR PROPER OPERATION.**

Straight mineral oil that conforms to SAE J1966 Aviation must be used for the first 25 hours after overhaul and for a Continental engine that has had a cylinder or multiple cylinders replaced.

Once the engine has been installed ground running should be kept to the minimum required to inspect the installation for any discrepancies prior to the first flight. Hoses and lines installed must, at a minimum, be properly flushed to eliminate the possibility of contamination. It is

highly recommended, and may be required by the aircraft manufacturer, to replace all hoses at overhaul. A failed hose will quickly pump oil overboard resulting in oil starvation and catastrophic engine failure. Any component that circulates oil outside the engine, such as remote oil coolers and remote filter adapters must be properly flushed by a qualified facility. All airframe baffles must be inspected for proper integrity to ensure proper airflow for cooling.

Once the steps above have been completed follow the instructions below for in-flight break-in procedures.

Conduct a normal engine start, ground run up and take off in accordance with the Airframe Manufacturers Pilot Operating Handbook.

Monitor all indicator gauges for any abnormalities. Reduce engine power to climb according to the Airframe Manufacturers Pilot Operating Handbook. Maintain shallow climb rate to achieve optimum airspeed and cooling. Maintain 75 percent power with best power or richer mixture for the first hour. Best power setting is 100-150 degrees rich of peak egt. The second hour of flight power settings should be varied between 65 and 75 percent. Descend at low cruise power settings. Avoid long descents, manifold pressures below 18" Hg, and maintain cylinder head temperatures at above 300 degrees F.

All subsequent flights should be performed as above, alternating between 65 to 75 percent power, until an accumulation of 25 hours since overhaul. Oil consumption may stabilize before 25 hours but Airmark's recommendation that the engine be operated on Straight Mineral Oil (non-dispersant) for the full first 25 hours. If oil consumption has not stabilized after 25 hours continue using straight mineral oil until consumption is stable. Aeroshell 100 is Airmark's recommendation for the break in period. For extreme climates refer to the engine operating manual for the correct weight oil to use.