Shock Cooling

An aircraft engine spends much more time developing near full power than does an automobile engine. The wear on an aircraft engine is made shorter through negligent operation, non-operation, corrosion, and the shocking effect of hot and cold cycles. Shock heating cycles the metals of an engine just as much as does shock cooling.

Heat shock can be reduced by starting the engine at idle leaning to reduce oil dilution by excess fuel and then allowing the oil pressure to rise before aggressive leaning. The start of an engine its most damaging cycle of operation. A sudden reduction of engine power after a period of increased power causes a rapid reduction of engine heat being generated. This heat change inside the cylinders is reflected in the heat released by the cooling fins and increased cooling airflow through the engine plenum. The result is called shock cooling. Lycoming says that shock cooling results in worn piston grooves, broken rings, warped exhaust valves, bent pushrods, and plug fouling. *Recommended cooling rate is no greater than 50-degrees per minute.*

Shock cooling occurs when the pilot reduces power to off and goes into a descent. The effect of this is to suddenly reduce the internal heat of the engine and greatly increasing the cooling effect of the air over the cooling fins of the engine. This may be a damaging shock to the bimetallic cylinder blocks. The principal effects of shock cooling are cylinder-head cracking, valve seat to valve seat, plug to plug. Anywhere inside the engine where tool marks, sharp edges and other stress points are liable to damage. Any engine operation that makes it possible for the valve guide to shrink faster than the valve will cause sticking. Valves stick open and the pushrod bends. A raised valve hits the piston dome, breaks and is redistributed throughout the engine and turbo if any. *This situation often occurs when poor navigational planning causes the pilot to arrive over his destination at several thousand feet too high.* Never make descents that will shock cool the engine. It may not fail on your but it will on some pilot down the road.

To prevent all these bad things from happening to your engine keep some power on the engine, re-lean during altitude changes to keep the EGT near cruise values. If you have CHT on all cylinders maintain a controlled (slow) decrease rate. Use of factory CHT on one cylinder is a very poor second. ***Regardless, always reduce power in increments so that engine temperature changes will be gradual.*** Retard the throttle during descents. Do not enter a descent that will both give a throttle reduction and an increase in engine cooling air. Use landing gear and flaps to keep the speed down. control the thermal changes of the engine to limit temperature and cooling related damage.

When on the ground, take advantage of any cooling wind, lean the mixture, open cowl flaps on the ground and during climb. All engines should be run for at least two or three minutes on the ground after a long flight to allow the oil to carry heat away from the engine. In hot weather or with a turbo engine allow more time. *Before killing the engine run it up to 1200 and lean to but not into roughness for 20 seconds.* This will clean the plugs from any residue of lead or carbon.