



Aircraft Engine Heaters

By Dave McFarlane

I would like to explain how the oil pan heaters work as there is a lot of misinformation circulated in the aviation circles about engine heaters and what effect preheating has on engine starts. This propaganda has been circulated and repeated to promote sales of high dollar complex systems.

The large surface high watt oil pan heaters work on the principal that warm air rises and cold air is heavier and falls through the warm air. When the oil and oil sump are warm, the air inside the engine rises and warms the upper engine, cylinders, crankcase, and steel parts. The now cooled internal engine air falls to the oil surface and is reheated. This cycle repeats over and over. After several hours of operation of an oil pan heater the cylinders and crankcase are warm to the touch. Some heater manufactures put preference to heating the individual engine parts and use small, very low wattage oil pan heaters with insulating adhesives. The result is that the engine feels warm and starts great, but the oil is thick and lubrication is delayed after startup.

Extreme engine damage caused by lack of lubrication will happen during cold starts without sufficient preheat of the *oil*. The cylinders and camshaft depend on slung and misted oil from the rotating crankshaft for lubrication. Cold oil is slow to move through the engine lubrication system and it clings to the crankshaft until higher engine speeds are reached.

There is misinformation given by a preheater manufacturer about pistons sticking in the upper choke area of the cylinder barrels during start-up. This is bogus! The engine manufacturers have given ample clearance between the ring areas of the piston that goes into the choke portion of the cylinder such that there will be no interference with temperature differences. Besides, the pistons are aluminum and shrink more than the steel barrels when cold. During the warming process after start, the aluminum cylinder head expands at the same rate as the aluminum piston. This relieves the built in stress on the cylinder barrels and allows them to also grow.

Another piece of propaganda is that the crankcase shrinks to a metal to metal contact with the crankshaft at cold temperatures and that a crankcase heater must be used to keep them separated. There is a theoretical extreme temperature at which this could happen, but it is out of the range of mother earth. Main bearing and crankshaft damage is more likely to occur from lack of lubrication during a cold start. SAFE-HEET™ oil pan heater will warm the crankcase.



Internal moisture can cause corrosion problems inside engines when they are continuously maintained in the preheated condition. This will happen with all types of preheaters when the engine is maintained substantially above the ambient temperature. Water vapor and its associated combustion acids will condense on any cooler surface. Temperature differentials are impossible to eliminate with any heater as the heat dissipation rates vary with metal type and external exposure. Examples would be if you heat the cylinder head it would then be warmer than the cylinder barrels or if you heat the crankcase it would then be warmer than the crankshaft. The problem is amplified with higher preheat temperatures as internal moisture with acid is more aggressive when it is warm. There are several products that circulate warmed air or dehydrated air through the crankcase to reduce the humidity levels of the air inside the engine. These systems work well to prevent corrosion.

We do not recommend that any type of heater be used at full power for extended time periods. Overnight or several days at preheat temperatures between flights generally is not harmful as the engine operation will remove moisture deposits before they cause damage. The SAFE-HEET Temperature Controller allows control of the input voltage and amount of heat produced. We recommend that the engine temperature be kept only somewhat above ambient temperature when continuous operation of a heater is used so the aircraft can be flown on short notice. Final preheat can be accomplished by turning the heater to full power during preflight. Our temperature controller will work with almost any brand of heater.

Preheating is enhanced by using thermal blankets or cowl covers to keep the heat from dissipating.

Installation of the SAFE-HEET is somewhat more technical than other oil pan heaters because of our thermally conductive epoxy adhesive. It is worth the extra time and effort of installing a SAFE-HEET as this special adhesive gives better heat transfer and adhesion as compared to silicone or silicone based Pressure Sensitive Adhesives (PSA's).

High performance SAFE-HEET oil pan heaters will give great preheat performance without the expense of a complex multi-system heater that requires engine modification and a STC. SAFE-HEET heaters are FAA-PMA approved and can be installed with a log book entry only. Since SAFE-HEET does not modify the engine, no FAA Form 337 is required.