

(Posted: Tuesday, March 01, 2011)

Some notes from the latest Aviation Safety Magazine written by Mike Gugeler, for your information:

Pre-heating: Aircraft engines are made of aluminum and steel, which expand and contract at different rates, it is possible for bearing and piston clearances to be below tolerance, to the point of metal-to-metal contact, when a cold engine is started and runs, until the temperatures are equalized. Engines are built and adjusted at room temperatures, and very cold temperatures can upset the clearances. A piston will heat up quickly, especially at the top where the fire is burning, and expand rapidly while the cylinder wall, made from steel, expands much more slowly. This can cause the parts to run together without room between for the lubricating oil. Preheating is essential to equalize the engine parts again and make them run correctly. Preheating should be done over a period of hours, or overnight in the hangar, since heating something up too quickly from low temperatures itself can cause problems.

Chilled Oil: When oil is cold it is thick. It might not flow through the oil cooler, but through the bypass ports. You will see normal oil pressure. When the oil is warmer, it will flow into the oil cooler and put pressure on the congealed oil already there, which can cause rupture of the cooler. The veratherm is trying to move out the old oil and replace it with warmer oil but sometimes it cycles quickly, never allowing any warm oil to enter the cooler, which remains solid with congealed oil. The cycling of the veratherm can cause damaging pressure spikes, too fast to register on the oil pressure gauge.

Thick Fuel: Avgas can get thick when cold. It does not vaporize as readily. This is one reason cold weather starts are a bear. Liquid fuel does not burn, so wait for a while after priming before attempting a start. You might need to wait three or four minutes. After waiting, fill the primer with fuel and be ready to give the engine another shot when it starts to fire, to allow for stabilized idling. If a fuel injection engine, be ready with the fuel pump. You will need extra priming during cold starts, and there is a danger that too much fuel will be provided, which can lead to a fire during start.

Cold Plugs: It is possible for the spark plugs to be wet with water or ice, in which case they will not fire. If you have done everything else and still cannot start, consider taking the plugs out and drying them in the oven (with appropriate clearances from Maintenance) or thoroughly preheat the engine to a temperature above the condensation point.

Warm up: Warm up the engine and airplane until it is definitely ready to fly. It can take 10-45 minutes or more but an engine that is not ready to run at full power will fail, sometimes catastrophically just after takeoff. Check the oil pressure after start and keep the rpm down until it is under the maximum pressure limits.

Personnel: Crew members do not operate at full efficiency when cold, so take the time to ensure a viable working environment is carried aloft with you.

Here is a checklist for winter operations:

- * Avoid water in fuels. Ice crystals can plug lines and filters. Sump the drains when the temperatures are above freezing.
- * Check for snow blown into controls, especially between the control and the adjacent wing/tail plane. It can freeze solid at altitude and jam the control.
- * Check the breather tube for clearance, and that it is not iced up. A blocked breather can increase crankcase pressures and increase the chance of engine failure.
- * Keep batteries charged. Better starts and less chance of battery freezing.
- * Watch the gauges. Surging oil pressure can indicate congealed oil in the prop, governor or cooler.
- * Check fuel selectors for freedom of movement frequently when flying in cold air. If the selector jams, you lose the fuel in the other tank.
- * Cycle the flight and engine controls during flight. Including the trims and carb heat levers. They can freeze if not moved occasionally. After shutdown, consider leaving the carb heat, throttle and mixture in the start/run position in case they freeze and cannot be set for the next start.
- * Plan a slow descent with power. Watch for shock cooling.
- * Beware of overboost/overspeed due to super cold air or congealed oil in the governors.
- * If you have to feather an engine during flight, don't wait too long. Cooling oil in the governor can prevent feathering. If training, re-start without delay for the same reason.
- * Use the carb heat. Taxi out for takeoff with it full on, set cold for the runup and then move it to hot again until the throttle is opened to full power for the takeoff. Leave the carb heat out for the landing approach and taxi back to parking, set it to cold only when shutting the engine down. Be prepared to lean the mixture when using carb heat. If the ground is cold but not snow covered, consider the surface before following this procedure.
- * Watch for batteries that are not in the engine compartment. Preheating will not help them unless the whole airplane is heated in the hangar. Also true for instruments, such as gyro horizons and DGs, which have bearings that need to be warmed up just as the engine does.
- * Gas-fired airplane heaters and ground-use propane heaters can put too much hot air in too quickly, damaging plastic parts, windscreens and the like. Set the controls low at first.

But the first rule still applies: Have fun.

Glen Morthorpe.