

Hi:

I have been asked several times about when you *need* a preheat. First, here is what Cessna has to say:

### **Engine Operation**

When air temperatures are below 20°F (-6°C), use an external preheater and an external power source whenever possible, to obtain positive starting and to reduce wear and abuse to the engine and airplane's electrical system. Preheat will lower the viscosity of the oil trapped in the oil cooler, which may be congealed prior to starting in extreme cold. If the engine does not start during the first few attempts, or if engine firing diminishes in strength, the spark plugs may be frosted over. Preheat must be used before another start is attempted.

It should be noted that during cold weather operations, the oil temperature indicator may not be in the green band prior to takeoff. After a suitable warm up period (2 to 5 minutes at 1000 RPM), accelerate the engine several times to higher engine RPMs. If the engine accelerates smoothly and the oil pressure remains normal and steady, the airplane is ready for takeoff.

While I accept the 20° F as a reasonable point for deciding when to seek a preheat, it has been my experience that preheaters frequently do not work when it's cold. So what do you do then? How low can you go? And why doesn't this apply to your car?

There are two quite independent issues in a cold start: Oil viscosity and fuel vapor pressure. Looking at the two of them should give you a good and simple plan to get the bird running on a cold day in Hell Airport.

**OIL VISCOSITY:** We use a multi-viscosity oil that provides good lubricity from 0° up. The only thing you can do to improve on this is to pull the prop through a few revolutions to move some oil into bearings and onto the cylinder walls. However, I value our members and their limbs more than engine life, so I really do not recommend this activity. That prop is a big meat chopper and you are meat. For the most part, if the engine has been flown in the last 48 hours, there will be enough of a protective film so that a very cold start is not hazardous to the engine.

**FUEL VAPOR PRESSURE:** If you remember the *good old days* when we cavalierly threw our drained gasoline onto the tarmac, on a cold winter day, it could take 5 minutes or more to evaporate. Cold aviation fuel has a low vapor pressure. (In cold climates, auto fuel has volatile components added in the winter to allow easy starting. This is not done with aviation fuel.\*) Only the vapor is combustible. To start the engine, you need a good supply of combustible vapor, so here is how to get it. Before starting your walk-around (but definitely AFTER pulling the prop through, if you choose to do that) prime the engine. With either engine, priming sprays fuel into the manifold. It will wet the cold manifold and start to evaporate. Get back out and do a thorough walk around. That should allow the prime to evaporate, making a nicely combustible mixture of air and fuel vapor. Get back into the plane and prime again. Finish with the primer pulled out. (Both planes have a primer though you seldom use it on the 206.) This second priming is to provide a source of vapor to sustain combustion after the first vapor is exhausted. Now, with throttle cracked and mixture full rich, start the engine. If the engine starts to die, push the primer in at a modest pace. The engine may run rough for up to a minute due both to unequal fuel deliver and also to the possibility of ice forming on a spark plug or two, but as the heat builds up, it will smooth right out and you are on your way.

Obviously, none of this applies to a warm start out of our hangar, but planes do go places and park outside.

-- Jim Feldman, December 21, 2011

\*Since planes can fly from cold climates to warm, the FAA worries that volatile components in the fuel system could cause vapor lock. Accordingly, they have ruled that aviation fuel volatility shall not be adjusted for local climates.

Note from the president: API pays for pre-heat when you are at other airports (just note the cost on your timeslip or send the treasurer an email). So if it is cold, be sure to get a pre-heat if available to save wear on the engines.