Engine Management Tips for N3524F
By Lou Rossi

Managing the fuel-injected Lycoming engine in 24F is slightly different than for the carbureted Continental engine in 98N and 733. When reading these tips, I would recommend having the POH handy as I refer to it extensively.

PRIMING and STARTING
First of all, priming and starting the engine is different in that we have an electric fuel pump and hot starts can be a little tricky. Lets start with the normal start procedure. Usually, we prime the engine with the fuel pump on, then mixture FULL RICH until the fuel flow needle just starts to rise. Sometimes, I don't even see the needle move on this airplane, so I'll give it 3 Mississippi and go back to IDLE CUT OFF. When you crank the engine, your right hand should be on the Mixture control and *not* the throttle. When it kicks, *smoothly* advance the mixture to full rich. If the engine is warm, no priming is required. Be careful here using the Cessna checklists. The NOTE about starting a warm engine comes AFTER the priming procedure. So if you are following step-by-step, you would prime a warm engine, and then read the note that tells you not to. Kind of like telling the guy defusing the bomb: “cut the blue wire.....but *FIRST* cut the red wire” oops, too late. But, I digress.

HOT STARTS
Starting a HOT engine can be tricky because the heat causes fuel to vaporize in the system where it is supposed to still be in liquid form. But, there is a procedure on page 4-19 of the POH that I have used and it works pretty well. Basically it says use the normal start procedure (without priming obviously,) except when the engine fires, promptly advance the mixture to 1/3 open, and then smoothly all the way to full rich “as power develops.” I have also found that if you are anticipating a hot start on the next flight (i.e. quick turnaround) it is helpful to shutdown the engine at 1000-1200 RPM instead of at idle. Regardless of what happens, pay attention to the starter duty limits (POH 4-20--10 seconds of cranking, followed by a 20 second cool down, no more than 3 times.) In cold weather, pre-heating the engine is required per HFC policy, so normal starting should always work pretty well. Nothing will kill a battery faster than improper starting procedures, so please be familiar with them.

TAXI and RUNUP
After the engine is started, leaning for ground operations will save a ton of fuel, and will preclude the plugs from getting fouled. The procedure is outlined in the POH p.4-27, but basically it says to set the throttle to 1200 RPM, then lean for peak RPM. I have found that leaving the mixture here even during run-up is fine (the engine will let me know if I have over-leaned.) There is no risk of harming the engine at 1800 rpm if you are leaned too much, the engine will simply hesitate. If you are closer to sea level, then having the mixture full rich for run-up is fine. But at our typical field elevation, it's just not necessary, and, in my opinion, is a waste of fuel.

TAKEOFF
For takeoff, the POH NORMAL TAKEOFF procedure states MIXTURE—RICH (mixture may be leaned to Maximum Power Fuel Flow Placard Value.) I would recommend the latter, parenthetical procedure. Before you call tower ready for takeoff, take a look at the placard (pictured below and also in POH p2-13) and determine what maximum power fuel flow is for your current altitude. (Hint: the interpolation shouldn't require a calculator—a WAG is fine.) Then look at the fuel flow gauge and scope out where the needle should be after you apply full throttle. When you take the runway and apply full throttle, adjust the mixture until the fuel flow reaches this value. I realize this is a busy time, so this should only take a few seconds. The question is, why wouldn't you want Maximum Power for every takeoff?

INITIAL CLIMB
For climb, I normally leave the throttle wide open (WOT) and reduce engine RPM at 1,000 feet AGL (or when I finally remember,) to about 2300 RPM to quiet things down a bit. “Wait!” you say “Shouldn't you pull the throttle back before you reduce RPM?” There is an old wives tale out there that somehow your manifold pressure (MP) X 100 should never exceed your rpm, or else it will damage your engine. This is utterly false, but don't take my word for it. One look at the Cruise Performance charts in the POH should convince you. This engine can cruise continuously at 80% power. If you

look at the chart on page 5-24, lets say you want to cruise at 2100 RPM at 76% power. Your Manifold pressure is 25” with 2100 RPM. This chart is for 2000' pressure altitude, so we will likely never use that chart at our cruise altitudes, but you get the idea. A gentleman named Mike Bush has written extensively about this on AvWeb—a Google search will bring up many good articles on the subject. He is a maintenance guru, an A&P, and owns a Cessna 310 that he routinely flys well past TBO. Most of his writing is based on data that his company collects from engine monitoring systems (like the EDM.)

ENROUTE CLIMB

The ENROUTE CLIMB and CRUISE sections of the POH (starting on p.4-24) have some great information regarding engine management, too. The first paragraph under the ENROUTE CLIMB section talks about setting 23 in Hg. MP or FULL Throttle (whichever is less) and 2400 RPM for the best combination of performance, visibility and engine cooling. The typical altitudes at which we fly, full throttle will usually be less. I personally like it a little quieter in the cockpit, so I will reduce RPM to 2300, leave the throttle wide open, and set the mixture as recommended to 15 GPH. Don't Forget to monitor the CHT gauge during climbout for signs that the engine is getting too warm. If necessary, adjust airspeed, rpm, or mixture (or all three) to keep the CHT normal. The maximum CHT on this engine is 500°F. I think trying to keep it under 400°F will help us to extend this engine's life and save us money in the long run. Keep in mind, this CHT gauge only monitors one out of the 6 cylinders, and oddly enough, it is number 1 (front, right) probably the coolest running cylinder of all of them. So it would be prudent to assume that most of the other cylinders are running hotter.

CRUISE

With this engine, you can cruise at 80% power continuously. At our typical cruise altitudes in the mountains, we normally won't achieve 80%, so exceeding 80% is not usually a concern. Using the CRUISE PERFORMANCE charts, the CONDITIONS say the charts are based on Recommended Lean Mixture (see Figure 4-4 on Page 4-27.) Recommended Lean Mixture is 50° Rich of Peak. Since I am paying for the gas, I usually follow NOTE 2 on the top of the cruise performance charts which states “For best economy, operate at peak EGT.” Notably absent is the caveat that requires operation at 65% power or less to run at peak EGT. That caution only applies to the Continental Engines in our other 182s. So, using the CRUISE checklist, set the power (don't be in a hurry here, First let the airplane accelerate while still in climb power,) re-adjust your trim, Lean the mixture, and close the cowl flaps to keep the engine warm if necessary (monitor you CHT gauge.)

DESCENT

For the descent, set the throttle as necessary (I usually leave it set at cruise power as long as the air is smooth enough to let the airspeed build up.) It is not necessary to touch the prop control until the BEFORE LANDING checklist, when we push it full in. And the Mixture is managed by enrichening as required--I will normally just give it a couple of clockwise twists every thousand feet (or when I remember) as required. Also pay attention to your CHTs (keep the cowl flaps CLOSED.) Unfortunately we can't monitor the cooling rate like we can with the EDM equipped aircraft, so just do your best to keep the engine warm by not pulling the power off too abruptly until you are ready to land. A good rule of thumb to prevent shock cooling is to only reduce power as necessary to control airspeed (keep airspeed in the green arc if bumpy) but at most one or two inches of MP per thousand feet of descent.

LANDING

And finally for landing, don't forget your GUMPS Check. Specifically, the MP part. While the mixture doesn't necessarily have to be full rich at our home field elevation, It should probably be about where it was for takeoff from the same elevation. Full rich also works fine. In the event of a go-around, if your engine hesitates, it may be because you forgot to enrichen the mixture during the descent phase (ask me how I know.) If that happens, just go full rich on the mixture, make sure the prop is high RPM and add full throttle (if it's not already there.)

AFTER LANDING

After landing, don't forget to lean the mixture for taxi. Again, the POH recommends leaning for all ground ops (p4-27) but fails to remind you on the AFTER LANDING checklist. I usually pull the mixture knob out just a couple of inches, unless the engine faulters, then I push it back in a bit. This procedure doesn't need to be precise since you can't do any damage by over-leaning an engine at typical taxi-in RPMs.

I hope this takes some of the mystery out of engine management for you. I believe that experience is the best teacher, so get out there and fly!

Happy Flying,
Lou Rossi