

Lycoming Aerobatic Engines:

- How to prime before starting
- How to start
- Avoid an engine fire!

The words in the manual mean exactly what they state.

Anything with a caution you must do exactly as instructed otherwise you may damage the airplane.



CAUTION

An operating procedure, practice or condition, etc. which if not strictly observed, may damage the aircraft or equipment.

The amount of fuel priming will vary with each engine and temperature condition. If the engine is warm, little or no prime is required.

CAUTION

Do not overprime due to the resulting fire hazard.

Priming a fuel-injected Lycoming aerobatic engine is an art so don't expect to get it right by simply counting the same number of seconds every time.

This is from the Super Decathlon Operating Manual:

- 10) Engine Prime (as required)**
- Mixture - FULL RICH.**
 - Throttle - 1/4 to 1/2 inch OPEN.**
 - Electrical Fuel Pump - ON until fuel pressure is indicated, then OFF.**

i.e. look at the fuel pressure as you prime! You are looking for it to get to its peak at about 24 psi. If the engine has not been running that day you should expect that to take 3 to 5 seconds.

Lycoming has good advice in their Key Flyer Operations Reprint:

“The amount of fuel needed to achieve the correct fuel/air mixture for starting a fuel-injected engine is controlled by timing rather than number of primer strokes. With the electric fuel pump on, moving the mixture control to the rich position allows fuel to flow to the cylinders. For cold-weather starting, it may be necessary to keep the mixture control in rich somewhat longer than in warm weather.

The fuel part of the fuel/air mixture may be the part we have the most control over during the engine start, but keep in mind that the amount of throttle opening does have an effect on the air

that is pumped through the engine. Just as we compensate for cold/dense air by adding more fuel for start, it may also be appropriate to reduce the air part of the mixture when the temperature is very cold. For example, if the throttle is normally set open one-half inch for warm weather starting, it may be helpful to reduce this to one-quarter inch in cold weather. Again, it will require some experimentation to determine what is needed to achieve the correct fuel/air mixture for any particular aircraft at any temperature range.”

The Super Decathlon technique is slightly different than the Lycoming manual to better control timing by use of the pump switch rather than moving the mixture knob. Throttle setting is 6 to 13 mm. If you know what you are doing position the throttle somewhere within that range for priming! Otherwise use 10 mm.

Most of the wear experienced by an engine is just after start before oil pressure is achieved. Initial warm-up should be at 1000 RPM. The MT propeller has a low inertia so the RPM will accelerate quickly after start so set the throttle to be **absolutely no more than 10 mm when starting** - check it before pressing the button.

“When an engine does not start easily, it can be frustrating. Of course, this can occur at any time of the year, and it is very tempting to just keep grinding away with the starter in an attempt to get it going. Should this happen to you, RELAX. Take care of that starter, or it may fail. The general rule for starters is that they should only be operated for short periods, and then allowed to cool. If engine start has not occurred after three 10-second periods of operation with a pause between each, a five-minute cooling off period is required. Without this time limit for operation and an adequate cooling off period, the starter will overheat and is likely to be damaged or to fail completely.”

VH-UPG has a newer Sky-Tec starter with these instructions.



As VH-UPG is not usually heavily booked most pilots experience a cold start requiring pretty much the same priming procedure. As Lycoming states, it will be different for every condition. If it was flown the day before it will be different from when it hasn't flown for a week.

If it has flown earlier that day it will be warm. The Operating Manual states “little or no prime”. “Little” means turning the fuel pump on for no more than a second - that will generally work. If you are at a contest doing quick change-overs try to start with no prime first.

If you want to know more about the engine in the Super Decathlon you should read [Lycoming's Aerobatic Engine Operator's Manual](#) - after all, it is written for pilots.

Finally, a good explanation of [What Causes Engine Fires During Start? | Boldmethod](#). In the Super Decathlon excess fuel will pool below the engine in the air scoop box.

The pilot of VH-UPG was very lucky that day. A larger flame from the bottom of the cowl would've ignited the fabric under the pilot's seat. It doesn't take long for such a fire to destroy the whole aeroplane.



I recommend that everyone review:

- **their priming and start techniques**
- **identification of an engine fire and the initial actions to quell it**
- **the final stage of the checklist for an engine fire. Good luck with getting to #5 before there is nothing left of the airplane**

“Assuming the engine has kicked off, check for an indication of oil pressure. Learn the characteristics relative to response of oil pressure indications of your aircraft/engine combination. On most single-engine aircraft, an almost immediate response is noted. On twin-engine aircraft, the response may be much slower. On some twins, the oil pressure may go up, and during warm-up, may drop again for a short period of time, then again rise to normal. All cases mentioned may be normal, but the important thing is to know what to expect from your aircraft/engine combination.

After start, do not idle engine below 1000 RPM. It's not good practice to idle engines below 1000 RPM at any time. This is particularly true during cold weather to prevent lead fouling of spark plugs.”

Some thoughtful pilots ask me for guidance on whether the engine is warm enough to do the run-up as part of the pre-takeoff checks. I generally give a very short answer but here is a longer answer:

- UPG's checklist has the runups after all of the other checks so that it is probably going to be warm enough by then. On a very cold Melbourne winter morning some additional thoughts may be appropriate.
- We want the oil temperature to be “in the green” (100 deg F) before take-off so there is no point in starting to taxi for the holding point unless the oil temperature is at least 85 deg F. Work backwards from there, as some flight schools do, and wait for 75 deg F.
- Another indicator is oil pressure. It won't get into “the green” until it has warmed somewhat.

From data downloaded from the MVP-50P I have seen these examples of operations which must be improved:

- **Excessive engine RPM just after start. 1850 RPM with an oil temp of only 9 deg C and oil pressure still coming up is unacceptable! You must verify the correct throttle position before you start the engine.**
- **Those who simply prime the engine for a count of 5 seconds regardless of the situation. If the engine is warm you can try to start without priming, then try (with the mixture rich) just a blip of the fuel pump switch.**

That last situation, of priming as for a cold start, when the engine is warm is when there is a real risk of an engine fire.

If anyone is interested in looking at the MVP-50P data for their flight let me know and I will send you the spreadsheet.