

Airplane Operating Manual

Section 4

NORMAL PROCEDURES

GENERAL

Pilots should familiarize themselves with the procedures in this section to become proficient with the normal operation of the aircraft.

AIRSPEEDS FOR SAFE OPERATION

| | | |
|----------|---|----------|
| V_R | Takeoff Rotate Speed | 55 KIAS |
| V_Y | Best Rate Of Climb Speed | 95 KIAS |
| V_X | Best Angle Of Climb Speed | 80 KIAS |
| | Best Glide Angle | 80 KIAS |
| V_A | Maneuvering Speed | 125 KIAS |
| V_{FE} | Full Flap Extension | 87 KIAS |
| | Half Flap Extension | 96 KIAS |
| | Approach Flaps (first position or approximately 1 inch) | 120 KIAS |
| V_{SO} | Stall Full Flap | 52 KIAS |
| V_S | Stall Flaps Up | 60 KIAS |
| | Final Approach WITH Flaps | 70 KIAS |
| | Final Approach NO Flaps | 80 KIAS |
| | Demonstrated Crosswind Velocity | 15 KNOTS |
| V_{NE} | Never Exceed Speed | 200 KIAS |



STALL



**IMMINENT
STALL**



**BEST ANGLE
BEST RANGE
BEST GLIDE**

ABBREVIATED NORMAL PROCEDURES

See Appendix 1, Laminated Checklist

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EXPANDED NORMAL PROCEDURES

Preflight

Conduct a normal pre-flight inspection. Before beginning, check the status of the annual inspection, oil change interval, VOR log, and GPS databases in the flight log. Check the flight log for open discrepancies.

Open the cowl. Check for leaks, debris and loose items. Check the engine oil level. Close and secure the cowl.

Turn on the battery switch, strobes, lights, and pitot heat. Check these items for function.

CAUTION

The pitot tube can get hot enough to burn you.

Lift the stall warning tab on the left wing leading edge and check for a tone from the cockpit. Turn off the battery and all switches.

Check the fuel vent line under the left wing inboard leading edge for obstructions. Any drips of fuel indicate an open vent (correct condition). If there is evidence of blockage, attach a short length of rubber tubing to the vent line. Blow in the tube and have someone listen for air with the fuel cap removed. Air passage indicates an open vent. If the vent is blocked, it must be repaired before flight or fuel starvation could result.

Check the fuel sump for water.

Ensure the pitot cover is removed if the heat was not checked.

Visually check the left tank fuel level. If fuel is just covering the bottom of the tank under the filler, the fuel level is approximately 6 gallons. Fuel at the first (mid) tab indicates approximately 17 gallons. Fuel at the upper tab indicates approximately 28 gallons. The fuel tank is full when fuel is within $\frac{3}{4}$ " of the filler neck.

Remove the left tie-down and unscrew the ring to remove it for flight.

Check for the presence of a trim tab on the left aileron.

Check security of the left main wheel fairing. Visually check that the tire is properly inflated and in good condition. Remove wheel chocks as necessary.

Check that all baggage is properly secured and that the baggage door is locked.

Check the elevators and rudder for free travel and security. Each surface should strike its stops without interference. The trim tab should be secure. The wiring to the tail lamps should be intact.

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The elevator trim tabs can deflect in opposite directions or deflect unequally up or down.

Check that the tail tie down ring is installed and secure for flight. The ring also serves as a tail skid.

Check the travel of the right aileron. It should move freely until it contacts a firm travel stop. Any roughness or binding should be further inspected. The right aileron does not have a trim tab.

Check the upper and lower AOA ports near the right wing tip. They should be clear. If necessary, drain the upper port by using a thin rod to open the drain inside the lower wing skin. Draining may be necessary after sitting or flying in rain or ice.

Check the right fuel tank quantity in the same way the left tank was checked. Quantity indications are similar.

Remove the right tie-down and unscrew the ring to remove it for flight.

Check security of the right main wheel fairing. Visually check that the tire is properly inflated and in good condition. Remove wheel chocks as necessary.

Check the right fuel sump for water.

Check the fuel vent line under the right wing. See left fuel vent above if further inspection is necessary.

Check the belly for excessive dirt and oil. Check antennas for security.

Check that the induction air inlet is clear.

Check the propeller for deep nicks, damage, and grease or oil leaks.

Check the nose wheel fairing for security. Remove wheel chocks as necessary. Stow the tow bar.

Before Starting

Ensure the baggage key is stowed. A good place for it is in the left back seat, outside pocket. That way it can be reached from outside.

Upon entering the cockpit, ensure all switches are off. Turn on the Main Battery, Bus Tie, and Aux Battery. The battery status lights should not be illuminated. If they are on or flashing, see Chapter 8 for recommended actions.

Review the aircraft log to make sure that maintenance items are current and the last flight was recorded. Check the Hobbs meter to see that it agrees with the last time recorded.

If desired, make sure an SD card is inserted in the PFD to record screen shots.

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Brief all passengers. Describe operation of the seat belts and doors. Describe use of the oxygen system. Describe the flight controls and avionics to front seat passengers if they are unfamiliar. Prepare passengers for what to expect. Describe the various warnings they may hear over the audio system: Oil Pressure, Fuel Computer, Terrain, AOA, etc.

Adjust the front seats for proper use of the rudder pedals. Be sure the seat position pins are firmly seated. Adjust the seatback to a comfortable position. Adjust the lumbar support by inflating or deflating as desired.

Buckle the seat belts. Red markers on the shoulder straps go on the left; green markers go on the right. Rear passengers should use the center “anti-submarine” (crotch) strap to prevent slipping under the seat belts in the event of a crash. The front seats do not require crotch straps because the occupants sit more upright.

Set all switches to the right of the aux battery switch to OFF.

Verify all circuit breakers on the right side are engaged. Also check the alternator field breaker on the left next to the aux battery switch and the autopilot breaker.

Verify the alternate static toggle is in the NORMAL position (down).

Turn on the strobe lights to alert outside personnel to the fact that the engine will be starting.

Retract the flaps until they are in the full up position.

Verify that the yellow low voltage light is illuminated. It will remain on until the engine is running, and the alternator is producing current at the proper voltage.

Verify that the PFD has completed its boot-up operation and is displaying as expected.

Verify that the fuel totalizer is in the desired mode, and that it is displaying the correct fuel quantity. See the PFD operating manual for instructions detailing use of the fuel computer.

Place the fuel valve in the desired position for takeoff and climb. Generally, the fuel valve should be on the fullest tank.

Turn the main oxygen valve to OFF by unscrewing it in a counter-clockwise direction.

Starting

NOTE

For instructions to perform starts using an External Power Unit (EPU) or the auxiliary battery, see Appendix A, Abbreviated Procedures Checklist: ALTERNATE STARTS

The aircraft should now be ready for engine start. Procedures for “Cold” and “Hot” starts are the same. To start the engine, fuel is primed into each cylinder with the electric fuel pump, intentionally

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creating an over-rich condition. Then, with no fuel being delivered since the mixture is at cut-off, the starter turns and the engine clears itself of excess fuel. During this process, the ideal mixture ratio is achieved and the engine starts.

Place the red mixture control and the black throttle handle fully forward to enable fuel flow to the engine. The engine will now allow fuel to pass through the fuel injector to the cylinders for priming.

Turn on the boost pump while monitoring fuel pressure on the FUEL CALC page. After a few seconds, the fuel pressure will peak and stop climbing near the white hash mark around mid-scale. Turn off the pump. The pressure will drop back to zero. A quantity of fuel should now have entered the engine. The mixture will initially be too rich to start, but as the engine turns over during start and clears out excess fuel, a suitable fuel-air ratio will develop.

Pull the mixture back to idle cut-off.

Pull the throttle back to the closed position, then open it to approximately the **E** in the **THROTTLE** on the quadrant. Guard the throttle during starting to prevent excessive RPM.

Switch the left and right ignition switches to FLY.

Clear the propeller area by giving a loud warning to outside personnel: CLEAR PROP! Allow a few seconds afterwards to give those nearby enough time to react. Listen for any response before engaging the starter.

NOTE: This aircraft is equipped with a Sky-Tec Flyweight starter. Because it lacks the mass normally associated with a standard starter, it heats rapidly while cranking. To prevent damage to the starter, do not crank for more than 10 seconds. Allow 20 seconds for cool-down between starting attempts. Repeat up to 6 times, then allow the starter to cool for 30 minutes.

Using one hand on the mixture control, push the start switch. Begin a ten second count, then release the start switch if the engine does not begin to fire. See note above. The engine normally starts after a few revolutions.

IF ENGINE STARTS NORMALLY

Once ignition begins, slowly move the mixture control to the full forward position. Move the control slowly and smoothly. It should take about 2 seconds to move from idle cut-off to full rich. There should be no need to move the red mixture control rapidly forward. Adjust idle RPM.

Check the oil pressure gauge. Oil pressure may be low but should be rising to the normal range. The oil pressure can be zero or very low for up to 30 seconds. If oil pressure does not start to rise, or remains in the red zone, stop the engine and investigate.

If the engine stumbles, runs rough, or runs very slow, adjust the throttle. Generally, opening the throttle will improve initial idling. The most common cause of rough initial idling is vapor in the fuel lines that provides insufficient fuel to the engine.

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If the engine stops running immediately or does not start at all, a re-prime is usually necessary. Re-prime the engine and begin the procedure again.

FOR A FLOODED ENGINE

If the engine still does not start, assume the engine is “flooded”; that is, it has far too much fuel in the cylinders to ignite. Fuel dripping from the cowlings is a sure sign of flooding, and is a fire hazard. Move the airplane away from puddled fuel before starting.

To clear a flooded engine, move the red mixture control to idle cut-off.

Turn off both ignition switches.

Open the throttle fully.

NOTE

Be sure both ignitions are OFF. If the engine fires at full throttle, the engine may be damaged.

Engage the starter switch and count for 12 propeller blades to pass.

Pull the throttle back to the closed position, then open it approximately one-quarter inch. Guard the throttle during starting to prevent excessive RPM.

Switch the left and right ignition switches to FLY.

Using one hand on the mixture control, push the start switch. Begin a ten second count, then release the start switch if the engine does not begin to fire. See NOTE above.

If the engine starts, return to **“IF ENGINE STARTS NORMALLY”**, above.

Check the other engine gauges to make sure they are all within normal operating range. The oil temperature will normally remain near ambient for several minutes before moving to the normal operating range. It is safe to proceed with taxi and run-up with the oil temperature below the operating range.

Ensure that the alternator low voltage warning light is off. The alternator should now be producing current in the high-to-normal operating range.

Adjust the headsets and intercom, and prepare for taxi.

Before Taxi

From an idle, lean the mixture control for ground operations by moving the mixture control aft until the RPM peaks, then forward about ¼ inch. The mixture control will be at about half travel. Leaning the mixture for taxiing and idling helps keep the oil and spark plugs clean, and uses less fuel.

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Turn on the TRIM switch. Set ailerons and elevator to takeoff positions. The white hash marks are the neutral trim position, for reference. Different settings may be needed for a smooth takeoff depending on conditions. Rudder trim should be set at full right.

Check that flaps are fully retracted, then lower the flaps for one second. The trailing edge of the flaps should stop about 1 inch below neutral ailerons. This position is alternately described as "zero flaps" or "in trail flaps".

Since braking is required for steering, check that the brakes will hold. Apply taxi power with the brakes held. The plane should not move. ***If you can not keep the plane from moving, do not taxi—reduce power and shut down.*** Briskly release and reapply each brake separately to make sure each brake is functioning. You should feel each wheel move slightly as you release the brake, and stop somewhat suddenly as you reapply braking pressure.

Before takeoff

Taxi to the run-up area. If taxiing parallel to a runway, verify the correct runway heading on the PFD, SFD, and magnetic compass.

Select a suitable area with the nose of the airplane into the wind for best cooling and flight control checks.

Check the fuel gauges to see that they agree with the visual indications from the pre-flight inspection. Due to sensor limitations, the fuel gauges do not indicate higher than about twenty gallons. If more than twenty gallons is in either tank, the left gauge will display "23" and the right gauge will display "20". When the fuel level has been reduced to less than 20 gallons, the green bar will shrink and the correct quantity will be displayed. Take time now to ask yourself: Is this enough fuel for this flight? Is there an adequate reserve? If the answer is unclear, get more fuel now!

Check that the fuel calculator is in the correct mode. It has several modes which can appear similar yet function very differently. Verify that "Fuel Used" and "Fuel Remaining" values agree with the preflight inspection. See the PFD operating manual for instructions detailing use of the fuel computer.

Make sure the cabin doors are securely latched. The small silver button on each handle should protrude from the handle, and the handle should be pointing forward. Press on each door near the forward and aft pins. It should feel tight. Make sure the "CHECK DOORS" warning on the PFD is not displayed.

Ensure all occupants' seat belts are tight. Small children tend to inadvertently unfasten their belts. Rear passengers should use the center strap. Make sure the front belts are secure and free of the flight controls if not in use.

Set the autopilot as desired. At a minimum, set the heading bug, altitude bug, and vertical speed rate to the desired values. The autopilot annunciator should not be illuminated until you are ready to use the autopilot.

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Verify that weather is as expected along your route, destination, and alternate.

Set COM 1 to the desired active and standby frequencies. Test volumes and check that all passengers are able to communicate comfortably.

Check that the PFD and transponder are communicating via Bluetooth with the tablet. The PFD will appear in the Bluetooth menu as "G3X PFD". The transponder will appear as "GTX ADS-B".

Make sure the avionics have the desired information input and displayed: frequencies, flight plans, altitudes, etc. Setup and use of the avionics is described in detail in the G3X and GTN user manuals.

Turn the pitot heat on if the OAT is below 10°C. Look for a corresponding amperage rise. The pitot heater is unregulated and will become quite hot if left unattended. It normally draws about 10 amps from the bus.

Set the PFD to the EFIS/ENGINE page by touching the engine field. The screen should split to show an EFIS on the right and engine monitor functions on the left. Compare the PFD with the MFD. They should match very closely for horizon, heading, altimeter, airspeed, and vertical speed. For IFR or night operations, abort the flight and determine the cause if the PFD and SFD don't agree. Double check that heading and altitude bugs are set as desired.

Set the mechanical altimeter to the correct barometric setting, or field elevation. It should agree closely to the other altimeters. Wind and set the clock.

Engine check

Perform the engine run-up. Move the mixture control to the full rich position, unless the run-up is taking place at a very high elevation. Then, adjust as necessary.

Increase throttle to 1500 RPM.

Switch the left ignition to TEST. There should be no discernible difference in engine operation. The left ignition should be running on its internal alternator. Turn the left ignition to OFF. The engine should run smoothly, and RPM should drop by no more than 175. All EGTs should rise. If no change is noted, it could mean that the left ignition is not functioning. If the engine stops suddenly, it usually means that the right ignition is not functioning. **If the engine stops, DO NOT turn the ignition back on.** Allow the engine to stop running, then attempt a normal restart. Turning the ignition back on can cause engine damage and fire.

Repeat the procedure with the right ignition. The RPM drop between the right and left ignitions should be less than 50 RPM. Example: Left ignition off, RPM drops from 1500 to 1450. The right ignition drops from 1500 to 1410. The difference between 1450 and 1410 is less than 50, so the test result is acceptable.

With the engine still at 1500 RPM, test the governor linkage by pulling the blue propeller control until

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a noticeable RPM drop is noted. A single check is all that is required. Do not allow the RPM to drop more than 100-200. Loading the engine at low power settings can be detrimental to the engine, and is not necessary to test the propeller control.

Check the engine instruments. Each bar should be in the normal range. It is normal for oil temperature to be in the lower yellow range during cool weather. As long as the temperature appears to be rising and the other parameters are normal, takeoff is acceptable. Return the throttle to normal idle.

Re-check that the autopilot and yaw damp annunciators are off. Set the flight director to vertical speed or off.

Move the control stick throughout its range. The controls should contact a firm stop at each full position. It should be possible to feel elevator and rudder effectiveness, even at idle power settings. Ailerons can be visually checked for operation in the correct direction. There should be no lost motion or binding in the controls.

Turn on the boost pump. This engine requires high fuel pressure to operate. Without adequate fuel pressure, the engine will stop running almost immediately. Therefore, fuel pressure is supplied by two independent sources: an engine-driven mechanical fuel pump and the electric boost pump. Either pump will provide sufficient pressure. The boost pump should be on for takeoff, landing, and low altitude operations during which a loss of engine power could cause an especially critical situation.

Select ALT on the transponder. The transponder senses altitude and groundspeed and does not transmit to Air Traffic Control until it senses that it is at flying speed and has begun climbing. However it will still annunciate the ALT setting. The transponder section of the PFD will disagree with the transponder by indicating GND until the transponder is actually communicating with ATC. This generally occurs during the takeoff roll or shortly after liftoff.

Set the lights as required. FLASH is recommended near airports for visibility.

Double check that the passengers are ready for takeoff.

Takeoff

For a normal takeoff, apply full throttle and accelerate normally with the control stick neutral. Rotate at 55 KIAS. Accelerate to 80 KIAS before climbing, then climb normally at 100 to 110 KIAS. Use 80 KIAS for Best Angle and 95 KIAS for Best Rate. Adjust climb speed as necessary. In hot weather it may be necessary to reduce RPM and/or increase airspeed to keep oil and cylinder head temperatures within the operating limits.

Engage the autopilot if desired. See the PFD operating manual for instructions detailing use of the autopilot.

High density altitude power settings may require leaning before takeoff. If the engine exhibits any abnormal roughness or low RPM, and the power output is below 75%, lean the mixture for smooth

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operation. See the Engine Operator's Manual for additional information on high density altitude operation.

After stabilizing the climb, turn the fuel pump off. Continue to monitor temperatures and fuel flow.

Cruise

Upon reaching the desired altitude, raise the flaps and trim for cruise flight. Elevator and aileron trim will automatically operate slower but will be similarly effective due to higher aerodynamic pressures at cruise speeds. The aircraft trims each axis automatically when the autopilot is engaged. If any trim switch is activated, the autopilot will intentionally disconnect.

Set the desired power level. Several useful power settings are available in Appendix 1. The Engine Operating Handbook and Checklist also have convenient power settings. Using full throttle provides the least restrictive and most efficient air path into the engine and the best economy. Cruise RPM should be between 2100 and 2500. Higher RPM results in higher airspeed but also higher fuel flow, oil consumption, operating temperatures, and engine wear. Use the lowest comfortable RPM. With experience, a "best compromise" power setting be recognized.

If operating below 75% power, lean for best economy by pulling the mixture control aft until a reduction in power is noted and engine roughness ensues. Then richen the mixture until the desired smoothness and fuel flow is achieved. In general, slight roughness is not problematic and is a result of lean mixtures. If smoother operation is desired, richen the mixture. Higher fuel flow will provide somewhat higher airspeeds.

Switch tanks to keep the fuel levels similar in each tank. It is not necessary to turn on the fuel pump when switching tanks, but doing so is not detrimental. Chances of fuel valve malfunction are slightly higher when switching tanks, so be prepared for engine roughness or fuel starvation. Have a landing spot in mind.

Check with passengers periodically to make sure they are comfortable and at ease. Periodically check weather conditions at the destination. If able, monitor 121.5 for ELT signals.

Descent

Set the altimeter to the destination pressure. If desired, set the minimum altitude bug for an appropriate arrival altitude reminder.

Reduce power and increase mixture as necessary.

Select the fullest tank for landing and a possible go-around.

Turn off music and passenger intercoms if necessary. Brief the passengers for descent and landing.

Before Landing

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Before landing, brief the acronym **GMPPF**:

Gas: select the fullest tank.

Mixture: move the mixture to full rich in preparation for a full power go-around.

Prop: move the propeller control full forward to the high RPM position

Pump: turn on the boost pump

Flaps: Select the desired flap setting. The AOA indicator is calibrated for full flap deployment. The first flap setting can be deployed at 120 KIAS (approach flaps or zero flaps). The second position can be deployed at 96 KIAS. Full flaps can be deployed at 87 KIAS.

Check all seat belts and shoulder harnesses.

Turn on landing and taxi lights as desired. The landing and taxi lights flash alternatively when the flasher switch is on and the light switches are off. Turning on either switch will light the corresponding lamp without flashing.

Airspeed should be 70-80 knots. The ideal approach speed by the AOA is indicated by:



The center circle is green when the flaps are down, and black when the flaps are up. The AOA will announce “ANGLE ANGLE PUSH” very close to touchdown as the landing stall is approached.

After touchdown, brake as necessary. Raise the nose to improve braking and reduce nose wheel forces and shimmy.

Go Around

Add full power and arrest the descent. Avoid obstacles or other aircraft. Raise the flap switch. Accelerate to 90 KIAS and climb. Brief for landing.

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Clean Up

After clearing the runway, clean up the airplane. Turn off the boost pump, autopilot, and trim. Raise the flaps.

Adjust lighting as necessary. Be mindful of strobes near other taxiing aircraft, especially at night.

Turn off the pitot heat. Confirm that XPNDR GND is indicated on PFD 1.

Note

The screen on the panel mounted transponder will indicate ALT on the ground.

Taxi as required.

Shutdown

After taxiing, allow the engine to idle until the cylinder temperatures have dropped a noticeable amount. This allows the engine to cool slowly instead of being cooled faster by premature shutdown.

Turn off all lights except the strobes.

Set idle to 1000 RPM. MIXTURE-MAGS-MASTER: Pull the mixture control to idle cut-off. Turn off both ignition switches. Turn off the AUX, BUS TIE and MASTER switches. Setting the RPM to higher than idle usually provides a cleaner and more abrupt shut-off.

Turn off all switches. Fill out the flight log.

See Section 8 Service and Handling for instructions on securing the aircraft after shutdown.

END OF SECTION