Multi-Engine Checkride Study Guide
Cessna 310L
N2296F

Pitot static questions

1. Where are the static ports located? *On the side of the fuselage*
2. What instruments are they connected to? *VSI, altimeter, airspeed indicator*
3. If your static ports become clogged inflight, what indication would you get on the instruments? *IAS indicates lower in a climb from point of static blockage, IAS indicates higher descending, VSI stays at 0, and Altimeter freezes at level of blockage*
4. What action would you take to correct that? *Open the alternate static port (or smash the VSI glass cover if Alt-port didn't work)*
5. Where does the alternate static Source get its air from? *Passenger Cabin*
6. What comes on when you activate pitot heat? *Pitot, fuel vents, stall warning vane*
7. If you are flying an ILS to minimums while using alternate static what would your decision height be…Higher or lower? *Higher*
8. If your pitot tube became clogged, what indication would you get on your airspeed indicator while in a climb? *It would act like an altimeter, when you climb indicated airspeed would increase because pitot blocked w lower altitude air and static port air gets less dense*

Environmental

1. How do you turn on the heater? *Heat switch on panel, set reostat and open air duct*
2. What type of heater? *Southwind in nose*
3. Where does it get its fuel from? *Right main, .5gph*
4. Will the heater work on the ground? *Yes*
5. How do you get fresh air into the cabin? *Open vents*
6. Where does it come from? *Outside through the nose*

Ice protection

1. What ice protection do the props have? *Electric pads*
2. How do you activate? *Switch on panel*
3. How do you know they are working? *Dedicated prop ammeter*
4. What would you do if the air filter became clogged with ice in flight? *Open alternate engine air*
5. Where is the alternate air? *Pull handle on right lower side of panel*
6. Does the pitot-static heat work on the ground? *Yes*
7. Do you have windshield Heat? *Defroster only*

Flight controls

1. How are the flight controls connected to the control yoke? *Cables*
2. Do you have aileron trim? *Yes*
3. How do the flaps operate? *Single electric motor under front seats*
4. Is there split flap protection? *Yes. Single motor works both flaps*
5. Is there an oxygen system on board? *Yes, but deactivated.* If so how is it activated?
6. Where is the fire extinguisher located? *None on board*
7. If you find an inoperative component or equipment during your pre-flight how would you go about deferring it? *Label it INOP, enter in mx log. Call a&p to help*

Engines

1. What type of engines does the 310 have? *Continental IO-470-V 260hp*
2. How many cylinders? *6 each*
3. How many spark plugs per engine? *12*
4. Where do the spark plugs get their power from? *2 engine driven Magnetos*
5. If you were to go out to the aircraft and look at the manifold pressure gauge what would it read right now? *Atmospheric 30"*
6. What would the manifold pressure gauge read after you start the engine at idle? *About 14"*
7. When you set take off power? *29". After takeoff you normally pull the throttles back to 25 in for climb power and add throttle as you climb*

8. At what altitude will you be able to add Full Throttle without exceeding 25" manifold? *About 4000'*
9. What are the normal cruise power settings on this airplane? *23/23*
10. What are the power settings on this plane when performing slow flight? *21/23. You'll probably bring MP back to 18 to slow down to 90, but bring it back to 21 to maintain level flight.*
11. What are the max Cruise power settings on this airplane? *24.5MP/24.5RPM*
12. How are the engines cooled? *Air*
13. Do you have cowl flaps? *No*
14. Does this plane have an external power receptacle? *Yes – under the left engine*
15. How do exhaust augmenters work? *All engine compartment air exits through the tubes pulling the exhaust out more efficiently.*
16. What are the engine RPM limitations? *2700rpm*
17. What happens if the auxiliary fuel pump is turned on while the engine is stopped? *If the auxiliary fuel pump is turned on accidentally while the engine is stopped, with the throttle open and mixture rich, solid fuel will collect temporarily in the cylinder intake ports, the quantity depending upon the amount of throttle opening in the length of time that the pump was operating. If this happens, it is advisable to wait a few minutes until the fuel drains away before attempting to start the engine. If the aux pump is on when the engine is running, say takeoff, accidents have occurred where the aux pump thinks the engine driven pumps have failed and then it kicks into HIGH and floods the engine. Very dangerous…which is why aux pumps are NoT turned on during takeoff…basically there haven't been engine driven fuel pump failures, but there have been crashes from aux pumps activating to high and flooding engine to cause a crash*
18. Oil temperature and pressure? *80-225 degrees Fahrenheit / 30-60psi*
19. How much oil do each of these engines hold? *Total of 6 gallons, 3 per engine*
20. Cylinder head temperature? *200-460 degrees Fahrenheit*

Propellers

1. What type of propellers are on the 310? *Hartzell, 2 blade, 81" diameter, constant speed, fully feathering*
2. During the pre-flight, the props are in low pitch high RPM how are they held in that position? *Internal latches (small pin in the pitch change mechanism)*
3. How do the props maintain constant speed? *Prop governor supplies high pressure engine oil to push the blades to low pitch*
4. What senses the prop speed? *Governor*
5. When you initiate a decent by lowering the nose as the aircraft increases speed during descent, does the pitch of the prop increase or decrease in order to maintain speed? *Increase*
6. Does it require more oil or less oil pressure to do that? *Less*
7. If an engine had a significant oil leak and ran out of oil will a prop go into feather? *Yes*
8. What are the propeller RPM limitations? *2625 rpm*

<u>Landing gear</u>

1. How does the landing gear operate? *Electric motor under the pilot seat*
2. When the gear is retracted what tells the electric motor to turn off? *Squat switch on gearbox*
3. What would you do if it didn't turn off? *Center the gear handle*
4. When the gear is extended how is it locked down? *Overcenter locks on gear legs*
5. What senses that it's locked down and green light? *Squat switches on the gear*
6. Does the step that you use to climb into airplane retract during flight? *Yes – It is actuated by the landing gear switch (step has cable attached to nose gear)*
7. When does the Gear horn activate? *Throttle back to 15" on manifold and gear not down*
8. What would happen if you put the gear handle up while the aircraft is on the ground? *Nothing*
9. How would you manually extend the gear? *Gear handle centered crank under seat*
10. Where is the gear handle placed how many turns? *50 turns*
11. If you need to manually extend landing gear what should you do to the gear handle? *Center it so that in the event it was only stuck, the motor doesn't takeover and bust you in the face with a spinning gear handle*
12. After manually extensive extending if you had one main gear light green light not indicating what action would you take? *Check lights, one down all down*
13. What should you do if one of your landing gears has a flat strut? *DO NOT Taxi*

<u>Fuel System</u>

1. You turn on the Battery and Alternator switches, what is that humming/buzzing sound you are hearing in the CE310L? *The internal tank pump that bathes fuel over the pickup line to ensure fuel supply (pumping it back to front to keep engine pump submerged.*
2. The trapped fuel trick question as it relates to cross feeding aux fuel tanks from the wing of the inoperative engine. *If both an engine-driven fuel pump and an auxiliary fuel pump fail on the same side of the airplane, the failing engine cannot be supplied fuel from the opposite MAIN tank since that auxiliary fuel pump will operate on the low pressure setting as long as the corresponding engine fuel pump is operative. The aux fuel pump will not operate at all unless engine oil*

pressure on that side is at least 20psi. (David's answer is that you can crossfeed the right engine from the left main if the left engine is dead, but your left aux tank is trapped fuel and cannot be accessed)

3. What is the total fuel capacity of this airplane? *2 51 gallon mains (tips) and 2 20.5 gallon aux tanks (wings)*
4. How much of the total fuel is usable? *There are a total of 143 gallons capacity, but only 140 is usable.*
5. How many fuel tanks are on this airplane? *4, 2 main (tip) tanks, and 2 aux (wing) tanks*
6. Which fuel tanks are used during take offs and landings? *BOTH MAINS*
7. Does this fuel system use fuel pumps? If so, how many? *YES. Each Main tank has 3 fuel pumps…and engine driven fuel pump, an auxiliary fuel pump, and a constant bathing fuel pump to keep engine driven pump submerged.*
8. Describe the boost pumps system. *Fuel boost pumps are used in engine start operations to help prime the engine for starts. Timing of boost pumps depends on normal or Hot starts. It's is the aux pumps doing the boosting when you prime the engine.*
9. Describe the fuel selector valve handles and how they work. *There are 2 fuel systems: Left and Right. The Left has OFF, LEFT MAIN, and RIGHT MAIN X. The Right has OFF, RIGHT MAIN, and LEFT MAIN X.*
10. Describe how the fuel flow gauge measures fuel consumption. *The fuel flow gauges don't directly measure the amount of fuel burned. They measure fuel pressure instead, which indirectly provides a very accurate and consistent measure of fuel burn since pressure translates into a consistent rate of burn.*

<u>Electrical System</u>

1. What is the purpose of the emergency power switch? *The alternators on this plane will not work unless they are supplied power from the battery. If the battery stops working, the emergency power switch switched to the ON position tricks the alternators into believing there is battery power so they will continue to operate.*
2. What is the purpose of the voltage regulator switch? *This switch has 2 positions: MAIN and STDBY. If the MAIN fails, you can select standby for continue voltage output.*
3. What is the purpose of the overvoltage relay? *It monitors system voltage. If voltage exceeds a predetermined level, the relay opens and shuts down both alternators. Switching it from MAIN to STDBY resets the relay.*
4. What type of circuit breakers are used in this airplane? *All circuit. Breakers are the push-to-reset type except for the alternator field circuit, which is protected by a fuse.*
5. If the battery switch is positioned to off, will the alternators continue operating? *NO. the alternators will shut off. Unless they are energized by the emergency power switch.*
6. Describe why the ammeter is an important instrument for the pilot. *The Ammeter monitors alternator output, and battery charge OR discharge rate. A selector switch labeled Left ALT, Right ALT, and BATTERY lets you position it to monitor alternator amperage.*

<u>Vmca – and the conditions that affect it</u>

1. What is the definition of Vmca? *Vmca is the minimum airspeed at which a multiengine airplane is controllable with an inoperative engine…under a standard set of conditions. NOTE: Vmca is arguably the most important piece of aeronautical knowledge a multiengine pilot must understand!*
2. What set of criteria are required by the FAA of the manufacturer when determining Vmca? *The conditions a manufacturer must have, in no particular order of importance, are:*
    a. *Critical Engine at Idle Power*
    b. *Critical Propeller windmilling*
    c. *Operating engine set at maximum thrust*
    d. *Landing Gear Up*
    e. *Flaps Up*
    f. *Aircraft loaded with Aftmost allowable Center of Gravity*
    g. *Aircraft loaded to Its LIGHTEST possible gross weight*
    h. *Up to 5 degrees of Bank towards the Operating Engine*
    i. *Atmospheric Conditions normalized to standard day at sea level pressure*
3. What does the Manufacturers Vmca Limitation mean (for light twins…those below 6000lbs gross max)?
   The manufacturer guarantees that as long as the airplane is operated legally at an airspeed above Vmca, <u>heading</u> can be maintained. That is the ONLY guarantee. The ability to climb, or even the ability to maintain altitude, is NOT guaranteed, and plays no part in the concept of Vmca. <u>HEADING ONLY!</u> (NOTE: airplanes above 6000lbs must demonstrate ability to climb)

   This means that Vmca is strictly a limitation on the ability to control the airplane around its vertical axis. The only flight control that can control the airplane around its vertical axis is the rudder. Once the rudder is at full deflection toward the operating engine, Vmca has been achieved.

4. To best understand the criteria listed in question 2 above, discuss the "5 Why's" of demonstrating Vmca using those configurations.
    a. *<u>Loss of the Critical Engine</u> – In One Engine Inoperative operations, the left engine's centerline of thrust remains closest to all-engines operative centerline of thrust. This improves yaw stability since moving the centerline of thrust further away increases yaw tendency. Also, propeller slipstream and prop wash effect from the critical engine actually aid in the creation of lift across the rudder, improving its performance. The right engine also has a slipstream and prop wash, but it is too far away from the rudder and elevator to have an effect. Having the critical engine lost in the demonstration of Vmc put the aircraft into its most unfavorable condition…(1) The Critical Engine Idle Power setting INCREASES asymmetrical*

THRUST; (2) The Critical Propeller Wind milling INCREASES asymmetrical DRAG; and (3) The Operating Engine at Maximum Thrust setting INCREASES asymmetrical THRUST

b. *Critical Propeller Windmilling – A wind milling propeller can be one of the greatest sources of drag in OEI operations, creating the equivalent drag of a plywood disc the same size as the propeller blade disc diameter. This creates the most unfavorable characteristic to demonstrate Vmca.*
c. *Operative Engine at Maximum Thrust – Maximum thrust on the operative engine INCREASES asymmetrical THRUST, creating the most unfavorable characteristics*
d. *Landing Gear Up - Flying with landing gear extended greatly improves the yaw stability of aircraft. Having gear up during Vmc demonstration helps to provide the most unfavorable yaw stability characteristics*
e. *Flaps Up - Flying with flaps extended does increase drag and lower stall speed, but it also improves yaw stability because what is done to the left wing is equally done to the right. Having flaps up during Vmc demonstration helps to provide the most unfavorable yaw stability characteristics*
f. *Aftmost Center of Gravity (CG) - Rudder effectiveness is a key component of Vmc demonstrations and yaw stability. The distance between the rudder and the point of CG (Center of Gravity) on the airplane impacts rudder effectiveness on the same mechanical principals as a lever and fulcrum. Having the Aft-most CG used in determining Vmc creates the most unfavorable position characteristics for rudder effectiveness.*
g. *Gross Weight – (LIGHTEST POSSIBLE IS MOST UNFAVORABLE FOR Vmca)*
h. *5 Degrees Bank Towards Operative Engine – Banking up to 5 degrees into the operative engine will allow the pilot to align relative wind with the longitudinal axis of the airplane. This DECREASES drag that would otherwise occur from the uncoordinated flight.*
i. *Sea Level Altitude - Sea level atmospheric conditions enhance asymmetrical thrust and drag to their most unfavorable conditions. At higher altitude, the conditions are minimized due to lesser atmospheric pressures. Determining Vmca at sea level gives you a higher Vmca. While Vs stall speeds remain constant with altitude, Vmca decreases with altitude, and can at some point actually be below Vs (stall).*

5. What are the steps associated with a Vmca Demonstration in N2296F (C310L)? *These steps are specific to the noted airplane and may vary with other aircraft. They are as follows:*
    a. *Vmca demonstrations must be completed above 3,000' AGL (enter at 3500-4000)*
    b. *No Engine Pulls will occur below Vsse (Safe Single Engine Speed - 90)*
    c. *Gear UP*
    d. *Flaps UP*
    e. *Props FULL FORWARD*
    f. *Left Throttle to IDLE*
    g. *Right Throttle to FULL (Max Thrust)*
    h. *Raise Nose – Slow down slowly*
    i. *AT LOSS OF CONTROL/STALL:*
    j. *REDUCE POWER on Right Engine*
    k. *LOWER Nose – Recover to Blue Line (Vyse 119MPH)*
    l. *POWER UP Right Engine*
6.

Aircraft performance Specifications and Limitations

What are the adverse effects of exceeding the following limitations:

1. Departing over gross weight? *Increased TO roll, reduced climb rate, reduced SE performance*
2. CGI out of limits? *Reduced pitch stability*
3. Exceeding maneuver speed in rough air? *Overstress on aircraft*
4. Discuss the effect of Spiraling Slip Stream from each engine on the CE310L
5. Discuss the Prop Wash effect on the CE310L
6. Determine the following based on today's flight:
    a. Weight and Balance Calculation
    b. Accelerate stop distance
    c. accelerate go distance
    d. takeoff distance
    e. climb performance on two engines
    f. climb performance on one engine
    g. service ceiling on two engines and on one engine
    h. Cruise power setting
    i. Fuel consumption range and endurance
    j. Decent performance
    k. Landing distance

Keel Effect

CE 310 peformance cheat sheet

Emergency Speeds

Vmca-85mph

Vsse-90

Vxse-108

Vyse(Blue Line)-119

Vglide-138

Emergency Decent-160

Normal Speeds

Vs-75mph

Vx-97

Vy-124

Vfe-180 1st notch, 160 for remainder

Vle-160

Va-170

Vne-257

Approach-120 (short field-105)

Performance Specs and weights

Empty Weight 3378, Max gross 5200, Payload 1822, Payload with full fuel 962, Service Ceiling 19,900ft. SE ceiling 6850 (increases 425ft for each 30 minutes flown), Typical cruise speed/ff 200mph/26gph Max range 1300 miles. 6 seats.

6T's – TIME, TURN, TWIST, THROTTLES, TRACK, TALK